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		Design Authority N/A			
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1	1	Cog. Eng. T. B. Powers TBPowers 11/22/99 R3-26			
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XX TB Powers 12/6/99 Signature of EDT Originator / Date	XX [signature] 12/9/99 Authorized Representative for Receiving Organization / Date	XX [signature] 12/9/99 Design Authority Cognizant Manager / Date	Ctrl. No. [ ] Approved [ ] Approved w/comments [ ] Disapproved w/comments

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Potential Multi-Canister Overpack Cask Drop in the K West Basin South Loadout Pit

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Abstract: This calculation note documents the probabilistic calculation of a potential drop of a multi-canister overpack (MCO) cask or MCO cask and immersion pail at the K West Basin south loadout pit. The calculations are in support of the cask loading system (CLS) subproject alignment of CLS equipment in the K West Basin south loadout pit.

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POTENTIAL MULTI-CANISTER OVERPACK CASK DROP IN THE K WEST BASIN SOUTH LOADOUT PIT

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Technical checker's name (printed and signed) Date

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POTENTIAL MULTI-CANISTER OVERPACK CASK DROP IN THE K WEST BASIN SOUTH LOADOUT PIT

PURPOSE AND OBJECTIVES

The purpose of this calculation note is to document the probabilistic calculation of a potential drop of a multi-canister overpack (MCO) cask or MCO cask and immersion pail on a per lift basis at the K West Basin south loadout pit. The Cask Loading System (CLS) subproject needs to align CLS equipment in the K West Basin south loadout pit. To perform this equipment alignment, an MCO cask or an MCO cask mockup needs to be used for four different lifts. The use of an existing MCO cask is desired because of availability. A probabilistic calculation of the potential for a drop will be used as part of the basis for seeking U.S. Department of Energy approval to use an MCO cask for the four lifts required for CLS equipment alignment.

With some minor changes, the probabilistic calculation for the CLS equipment alignment also can be used to complete a frequency calculation for operations at the K West Basin south loadout pit over 2 to 3 years. The recalculation raises the final drop probability per lift from 1.5×10^{-5}/lift to 1.75×10^{-5}/lift, which is not a significant change. This recalculated probability can be used to calculate frequencies to support the analysis of design basis accidents presented in the K Basins Final Safety Analysis Report.

SUMMARY OF FINAL RESULTS AND CONCLUSIONS

The point estimate value calculated for the probability of potential drop per lift in the south loadout pit is 1.5×10^{-5}/lift. The probability of 1.5×10^{-5}/lift is about a factor of 2 times smaller than the midpoint of the crane load drop failure data provided in NUREG-0612, *Control of Heavy Loads at Nuclear Power Plants*. The point estimate value for the frequency of potential drops in the south loadout pit is 7.05×10^{-3}/yr.

METHODOLOGY

Fault tree analysis is used to calculate the probability of a potential MCO cask drop in the K West Basin south loadout pit. The fault tree logic represents the failures required before a potential drop by the transfer bay crane could occur in the K West Basin south loadout pit.

ASSUMPTIONS

The following assumptions are represented by the fault tree logic and failure probabilities developed for this calculation note.

1. The basic human error probability (BHEP) used in the fault tree to represent an operator error is 0.03. This value is documented in NUREG/CR-4772, *Accident*

Sequence Evaluation Program Human Reliability Analysis Procedure (step 6 in Table 4-1, page 4-3).

2. It is assumed that the controller that manages the load cell signals for overload protection can fail such that no overload signal is sent to the 110% alarm or no overload signal is sent to shut off power to hoisting at 125% of normal load.

3. It is assumed that a single failure of an MCO cask lifting attachment or a crane hook or a crane cable will result in a drop of the MCO cask.

4. It is assumed that three of the four rigging lines (each comprising an upper hook, sling, and lower hook) on the immersion pail would have to fail to allow an immersion pail to drop.

5. For crane bridge failure, material defect, damage, and/or fatigue is assumed to be a probability of 1.0×10^{-7}.

6. For crane trolley failure, material defect, damage, and/or fatigue is assumed to be a probability of 1.0×10^{-7}.

7. Loss of electrical power failure is based on Hanford Site specific loss of power data of 1.22/yr (WHC-EP-0811).

8. The limit switches and brakes are assumed to be tested before each lift for the CLS cask alignment activity. The limit switches and brakes are assumed to be tested every year for normal operations.

INPUT DATA

The following paragraphs describe the failure data used in the fault tree logic that is described in the section entitled "Calculations" and presented graphically in Figure 1.

Event KWOP1 is the operator error that leads to "two-blocking" the transfer bay crane with a load attached. As mentioned in the assumptions above, the BHEP used for this operator error is 0.03.

Event KWLSW1 is the failure of the first limit switch to stop transfer bay crane hoisting to prevent two-blocking. Since the limit switches are assumed to be tested before each lift performed for CLS alignment, the failure of these limit switches over time will be detected before a lift is performed. Thus the dominant failure mode of the limit switch is a failure to open or close on demand. The probability of a limit switch failing to open or close on demand is 3.0×10^{-5}/demand based on EGG-SSRE-8875, *Generic Component Failure Data Base for Light Water and Liquid Sodium Reactor PRAs* (page 22). For normal operations, the limit switches as assumed to be tested once a year, and thus the failure of these limit switches over time will dominate the failure to open or close on demand. The probability of a limit switch failing over time is 1×10^{-6}/h (EGG-SSRE-8875, page 22). Conservatively assuming 10,000 hours per year, the failure probability of the limit switches is $(1 \times 10^{-6}/\text{h})$ (10,000 hours) $= 1 \times 10^{-2}$.

Event KWLSW2 is the failure of the second or "high" limit switch to stop transfer bay crane hoisting to prevent two-blocking. The discussion for KWLSW1 above applies to KWLSW2. Thus the dominant failure probability for KWLSW2 is 3.0×10^{-5}/demand for CLS alignment. The dominant failure probability for KWLSW2 for ongoing operations is 1×10^{-2}.

Event KWOP2 is the operator error that leads to "load hang-up" of the transfer bay crane with a load attached. As mentioned in the assumptions above, the BHEP used for this operator error is 0.03.

Event KWLCA is the random failure of the 110% overload alarm given a load hang-up has occurred. Alarms randomly fail about 1.0×10^{-6}/h (EGG-SSRE-8875, page 21). Conservatively assuming 10,000 h/yr, a mission time over which the alarm could fail is 10,000 hours; thus the alarm would fail (1.0×10^{-6}/h) (10,000 h) = 1.0×10^{-2}. Thus the probability that the alarm will not function given a load hang-up that produces a 110% overload is calculated to be about 1.0×10^{-2}. This assumes that once a year the 110% overload circuit and alarm are tested to verify the alarm works as desired.

Event KWOP3 is the operator error of failing to stop hoisting once the 110% overload alarm has sounded given a load hang-up of the transfer bay crane with a load attached. As mentioned in the assumptions above, the BHEP used for this operator error is 0.03.

Event KWLCPOW is the random failure of the overload protection controller to send a signal to stop hoisting given a 125% overload. A controller failure is assumed to be equivalent to microcircuit failure (INSPEC, page 92), which has a failure rate of about 1.0×10^{-8}/h. Conservatively assuming 10,000 h/yr, a mission time over which the alarm could fail is 10,000 hours; thus the controller would fail (1.0×10^{-8}/h) (10,000 h) = 1.0×10^{-4}. Thus the probability of the controller failing to send a signal when there is a 125% overload is calculated to be 1.0×10^{-4}. This assumes that once a year the 125% overload circuit in the controller is tested to verify the 125% overload shutdown signal works as desired.

Event KWOP4MIS is the operator error of incorrectly resetting both load cell set points so they trip at higher loads than desired for the 110% and 125% overload protection. This operator error would thus fail both the 110% overload alarm and the 125% overload power shutdown. As mentioned in the assumptions above, the BHEP used for this operator error is 0.03. The BHEP is multiplied by an additional 0.01 to take credit for procedural steps that require a work package be developed to reset the load cell set points and a requirement to get a key from the shift manager for access to the controller to execute the work package. Thus the probability of event KWOP4MIS is 3.0×10^{-4}.

Events KWCLA, KWCRH, KWCCA, and KWCDR are failures of the cask lifting attachment, crane hook, crane cable, and crane drum, respectively. These are mechanical component failures. Navy crane failure data from NUREG-0612 indicate a low end failure probability per lift of 2.5×10^{-5}/lift (NUREG-0612, page 4-3). NUREG-0612 also indicates that about 17% of the drops are related to crane component failures based on the Navy data (NUREG-0612, page 4-4). Thus (2.5×10^{-5}/lift) (0.17) = 4.3×10^{-6}/lift. Given that there are four components that could lead to the drop, the probability of each one failing could be considered to be about one-fourth of the value 4.3×10^{-6}/lift, or about 1.0×10^{-6}/lift.

Events KWLB, KWLS1UH, KWLS1S, KWLS1LH, KWLS2UH, KWLS2S, KWLS2LH, KWLS3UH, KWLS3S, KWLS3LH, KWLS4UH, KWLS4S, and KWLS4LH are failures of the immersion pail lift beam, upper hook, lifting sling, and lower hook of each of the four lifting rigging lines, respectively. Similar logic was used for the failure probability of each of these components as was used for events KWCLA, KWCRH, KWCCA, and KWCDR in the previous paragraph. Since there are more than four components, the failure probability per component would be less than 1.0×10^{-6}/lift per component but for simplicity and conservatism 1.0×10^{-6}/lift is assigned to each of the these component failure probabilities.

Event KWHG is a failure of the drum hoist gear. Failure data on gear failures in a Savannah River failure data compilation (DP-1633, page 17) range from 5.0×10^{-8}/h to 1.0×10^{-5}/h. For conservatism, 1.0×10^{-5}/h is chosen as the failure rate for drum hoist gear failure. Assuming a 1-hour lift, the failure probability is 1.0×10^{-5}.

Event KWDISSEN is a failure of a discontinuity sensor associated with the hoist drum gears such that a signal is not sent to the programmable logic controller and then on to the drum brake to apply the drum brake. Failure data for sensors indicate 1.0×10^{-6} failures/h (EGG-SSRE-8875, page 23). Conservatively assuming 10,000 h/yr, a mission time over which the alarm could fail is 10,000 hours; thus the sensor would fail with a probability of $(1.0 \times 10^{-6}/h)$ $(10{,}000\ h) = 1.0 \times 10^{-2}$.

Event KWSHB is a failure of a solenoid hoist brake to operate on demand. The failure probability for a solenoid hoist brake is assumed to be represented by the failure probability of a solenoid valve to open on demand, which is 1.0×10^{-3}/demand (DP-1633, page 38).

Event KWRG is a failure of a reducer gear. Failure data on gear failures in a Savannah River failure data compilation (DP-1633, page 17) range from 5.0×10^{-8}/h to 1.0×10^{-5}/h. For conservatism, 1.0×10^{-5}/h is chosen as the failure rate for reducer gear failure. Assuming a 1-hour lift, the failure probability is 1.0×10^{-5}.

Event KWMLB is a failure of a mechanical load brake to operate on demand. Brake failure data from the Savannah River failure data compilation (DP-1633, page 11) range from 4.0×10^{-6}/h to 1.0×10^{-5}/h. Conservatively assuming 10,000 h/yr, a mission time over which the alarm could fail is 10,000 hours; thus the brakes would fail with an upper probability of $(1.0 \times 10^{-5}/h)\ (10{,}000\ h) = 1.0 \times 10^{-1}$. Assuming the brakes were applied 100 times per year, the demand failure would be $1.0 \times 10^{-1}/100$ demands $= 1.0 \times 10^{-3}$/demand. This value compares well with the solenoid brake failure probability on demand, so 1.0×10^{-3} is used to represent the failure probability of the mechanical load brake per demand.

Event LOEP is a loss of electrical power as represented by losses of power in the 200 Area over a 20-year period. Based on WHC-EP-0811, *Analysis of Power Loss Data for the 200 Area Tank Farms in Support of K Basin SAR Work*, a loss of electrical power occurs about 1.22/yr in the 200 Areas. This can be judged to be representative of power losses in the

100 K Area because the Hanford Site grid supplies all areas on the Hanford Site. The yearly average power loss can be represented as an hourly power loss of 1.4×10^{-4}/h. Thus for a 1-hour operation period per lift, the probability of loss of power per lift is 1.4×10^{-4}.

Event KWEM is the electric hoist motor fails to continue running. Based on failure data for motor-driven pumps failing to run (EGG-SSRE-8875), the failure rate applied to an electric motor failing to run is 3.0×10^{-5}/h. Thus for a 1-hour operation period per lift, the probability of electric hoist motor failing to run is 3.0×10^{-5}.

CALCULATIONS

The logic to calculate the probability of a drop per lift is modeled as a fault tree in Figure 1. The solution of the fault tree in Figure 1 yields a list of minimal cutsets based on Boolean logic. A minimal cutset is the minimum number of failure events that will result in the top event. The failure probabilities discussed in the input data section above were used to quantify the solution of the fault tree in Figure 1. The computer software code CAFTA, version 2.1, was used to yield the minimal cutsets and quantify the top event of the fault tree in Figure 1. CAFTA, version 2.1, has been validated as reported in WHC-SD-MP-SWD-0004, *CAFTA Computer Program Testing and Acceptance Report*, and the results generated for this calculation note have been randomly spot checked by the technical reviewer to ensure the calculations were performed correctly. Table 1 is a listing of the minimal cutsets and their quantification for logic in Figure 1 using the input data discussed above.

An example quantification calculation of the following set of failures (cutset) that lead to a load drop due to a hang-up scenario involves the multiplication of the probabilities for events KWLCA, KWLCPLC, and KWOP2. This is cutset number 13 in Table 1:

$$(1.0 \times 10^{-2}\ [\text{KWLCA}])\ (1.0 \times 10^{-4}\ [\text{KWLCPOW}])\ (0.03\ [\text{KWOP2}]) = 3.0 \times 10^{-8}\ .$$

To calculate the frequency of MCO cask drops in the south loadout pit during normal operations, the probability of a drop per lift is multiplied by the expected number of lifts per year. For the frequency of MCO drops in the south loadout pit caused by a seismic event, the frequency calculated for drops during normal operations is added to the frequency of the design basis seismic event multiplied by a conservative fraction of a year that MCO casks are being lifted over the south loadout pit.

RESULTS

Solving the logic in the fault tree in Figure 1 results in a listing of 124 minimal cutsets, as listed in Table 1. The quantification of the minimal cutsets resulting from solving the logic in the fault tree in Figure 1 is also represented by the numbers on the far right hand side of Table 1 for each minimal cutset. The total probability of a potential load drop per lift is 1.45×10^{-5}, which is shown in the upper right hand corner of Table 1 under the column heading "MOD./CS. PROB.". This number represents a point estimate value for the probability of potential drop per lift in the south loadout pit (1.5×10^{-5}/lift) during CLS alignment.

In representing normal operations, minimal cutset number 16 would change because the probability of limit switches failing during normal operations is different than the probability of their failing during CLS alignment. For normal operations, minimal cutset number 16 (KWLSW1, KWLSW2, and KWOP1) has a probability of (1×10^{-2}) (1×10^{-2}) $(0.03) = 3 \times 10^{-6}$. Thus the point estimate value for the probability of a potential drop per lift in the south loadout pit for normal operations would be 1.75×10^{-5}/lift. Assuming 400 lifts per year, the frequency of drops caused by crane failures (other than those involving seismic events) is $(1.75 \times 10^{-5}$/lift) (400 lifts/yr) = 7×10^{-3}/yr. The frequency of a design basis seismic event is 4×10^{-4}/yr at the K Basins. It is conservatively assumed that MCO casks will be lifted over the south loadout pit 1,000 hours in a year (a normal lift is probably less than 1 hour per lift). Thus the frequency at which an MCO cask is vulnerable to a drop over the south loadout pit because of a design basis seismic event is $(4 \times 10^{-4}$/yr) [(1,000 h)/(8,760 h)] = 4.6×10^{-5}/yr. Thus the total frequency of drops is the sum of 7×10^{-3}/yr and 4.6×10^{-5}/yr or 7.046×10^{-3}/yr.

CONCLUSIONS

The probability of 1.5×10^{-5}/lift is about a factor of 2 times smaller than the value used in WHC-SD-WM-SAR-062, *K Basins Final Safety Evaluation Report* (page 3A-3), for cask–MCO drops $(2.7 \times 10^{-5}$/lift). The value of 2.7×10^{-5}/lift is the midpoint of the frequency range for crane load drops described in NUREG-0612. The upper end of the frequency range for crane load drops described in NUREG-0612 is 3.0×10^{-4}/lift.

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Figure 1. Multi-Canister Overpack Cask Drop in K West South Loadout Pit during Cask Loading System Alignment. (sheet 1 of 8)

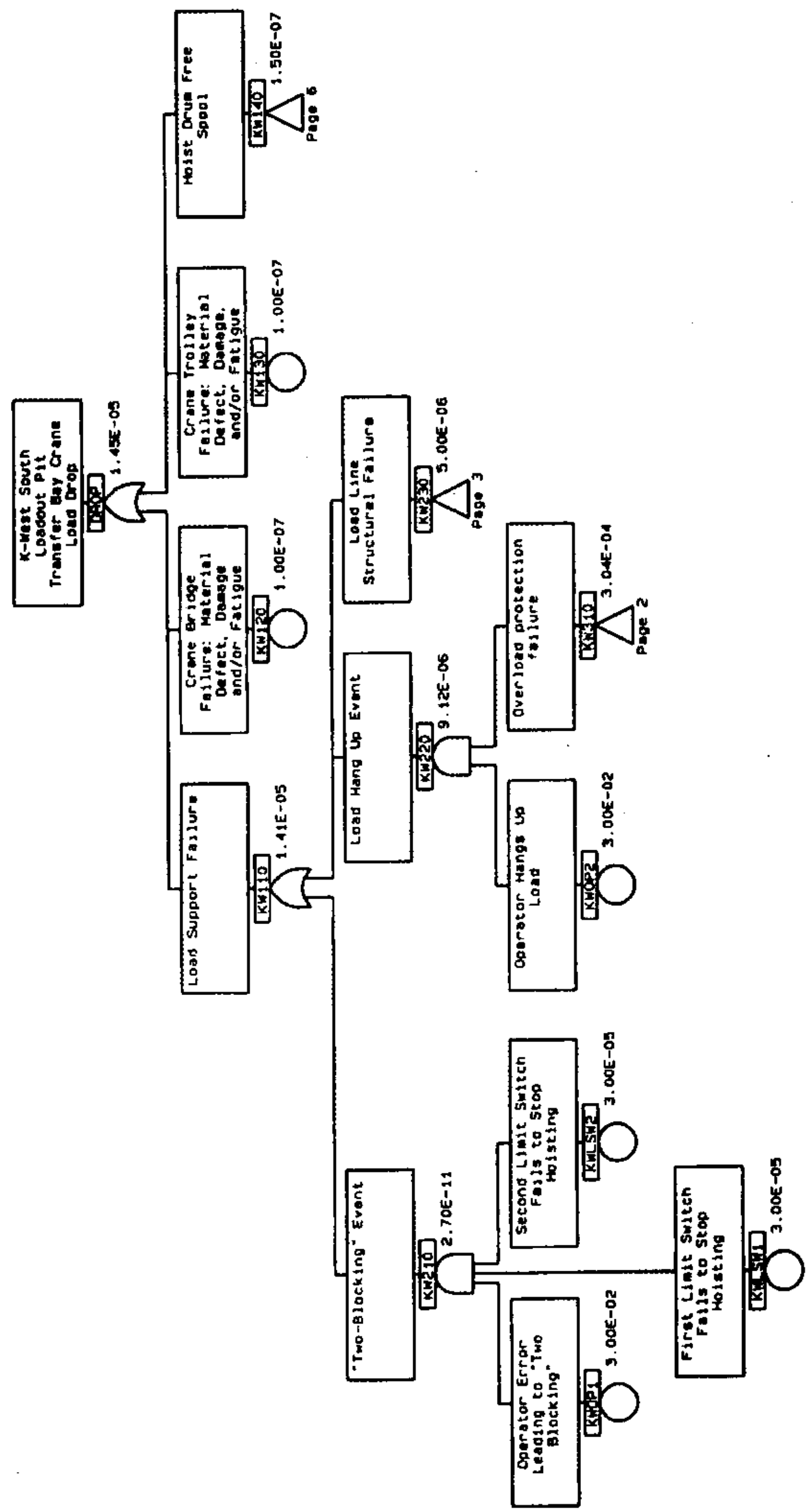

Figure 1. Multi-Canister Overpack Cask Drop in K West South Loadout Pit during Cask Loading System Alignment. (sheet 2 of 8)

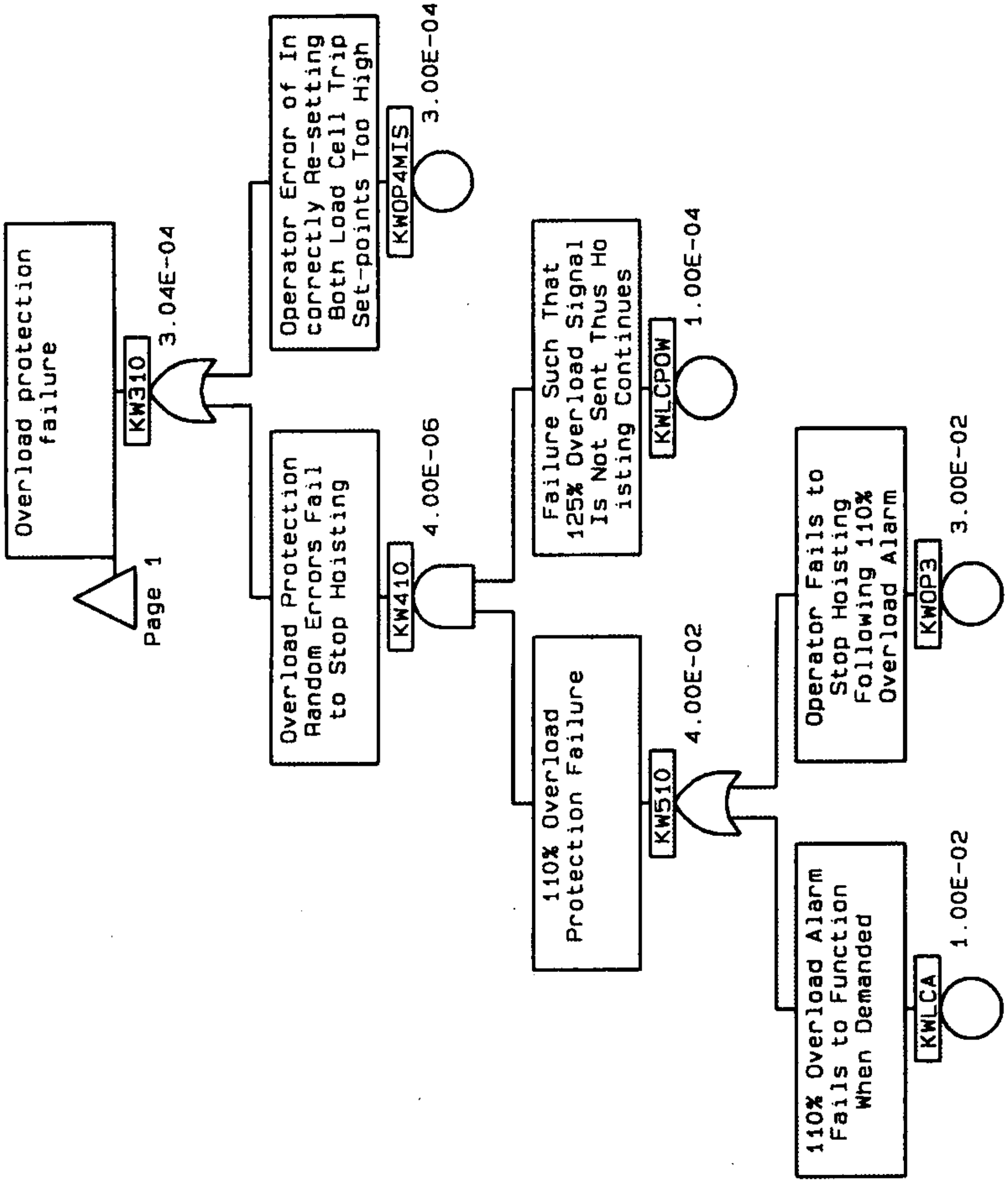

Figure 1. Multi-Canister Overpack Cask Drop in K West South Loadout Pit during Cask Loading System Alignment. (sheet 3 of 8)

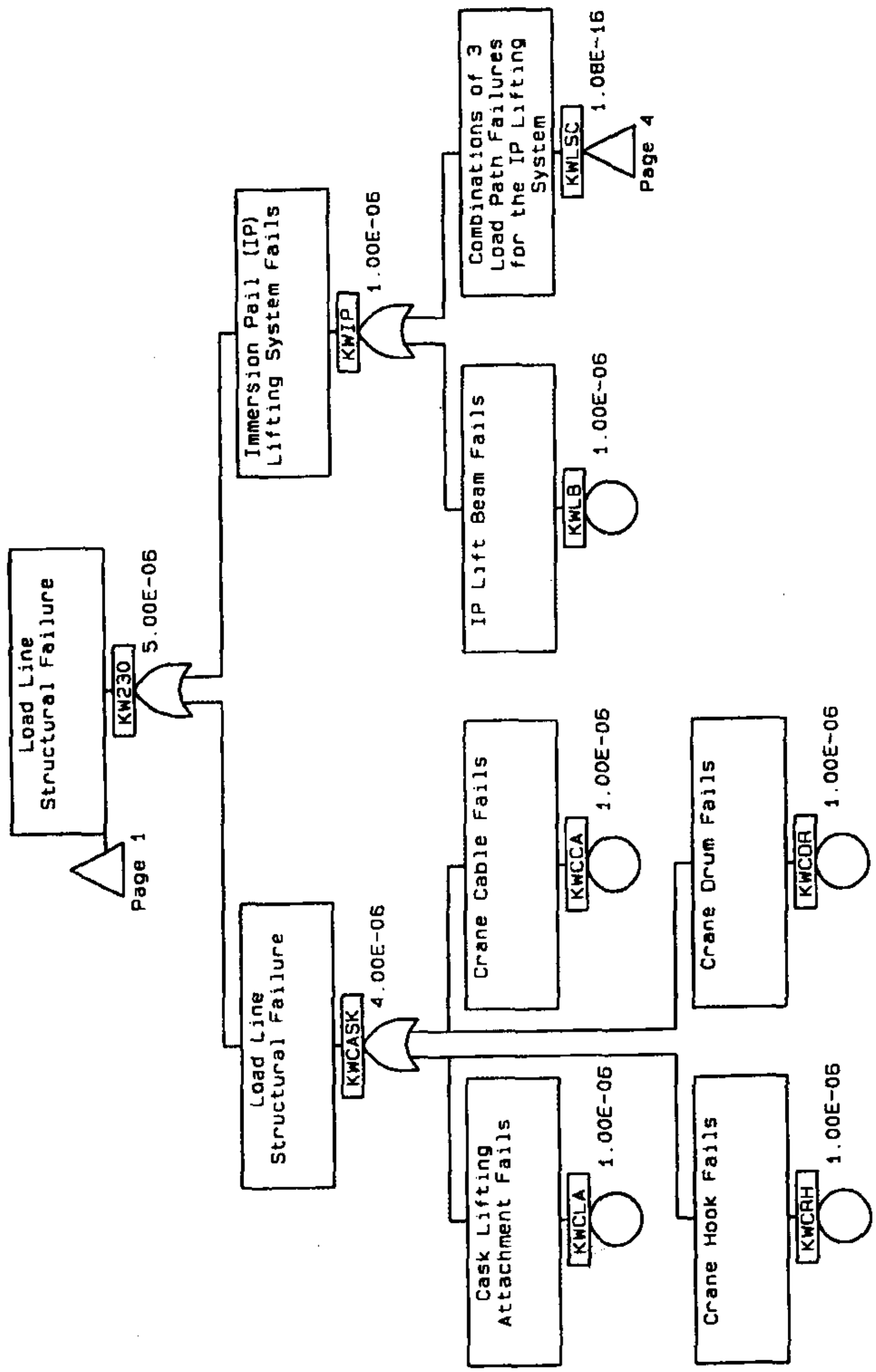

Figure 1. Multi-Canister Overpack Cask Drop in K West South Loadout Pit during Cask Loading System Alignment. (sheet 4 of 8)

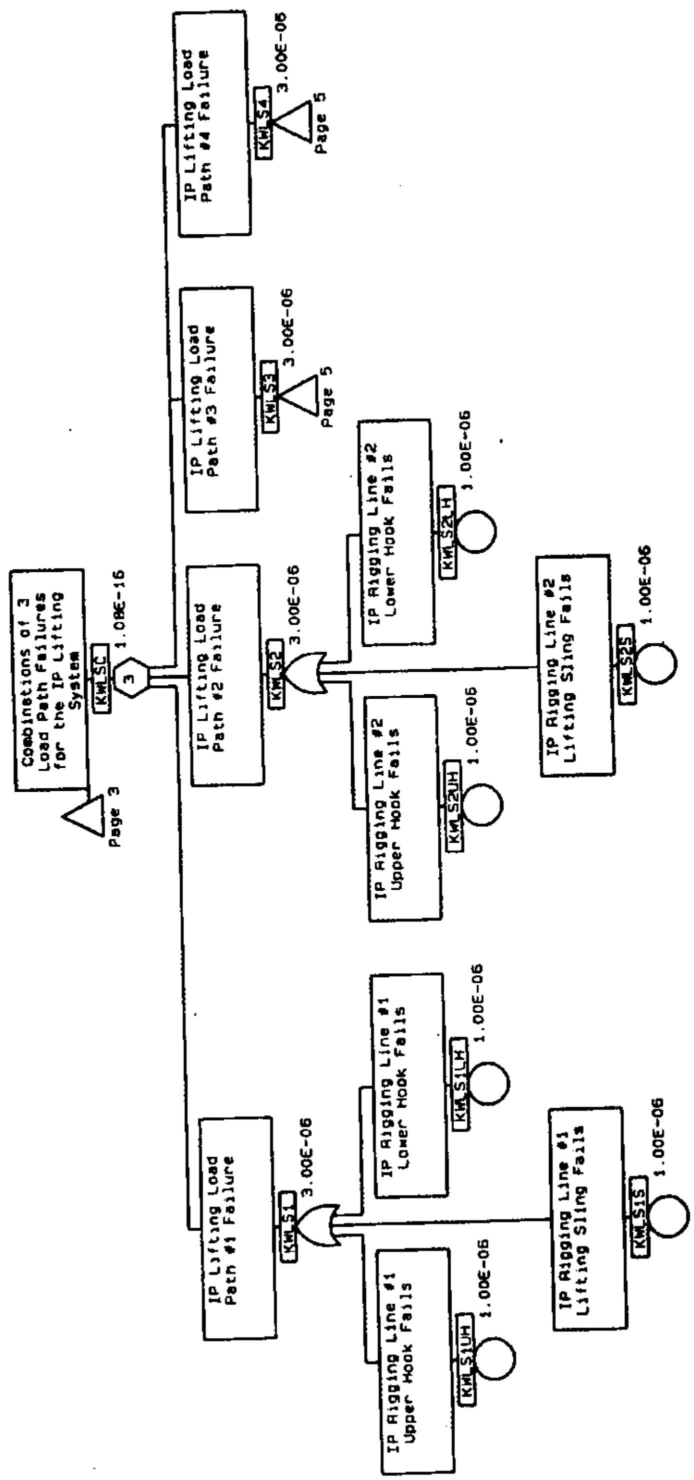

Figure 1. Multi-Canister Overpack Cask Drop in K West South Loadout Pit during Cask Loading System Alignment. (sheet 5 of 8)

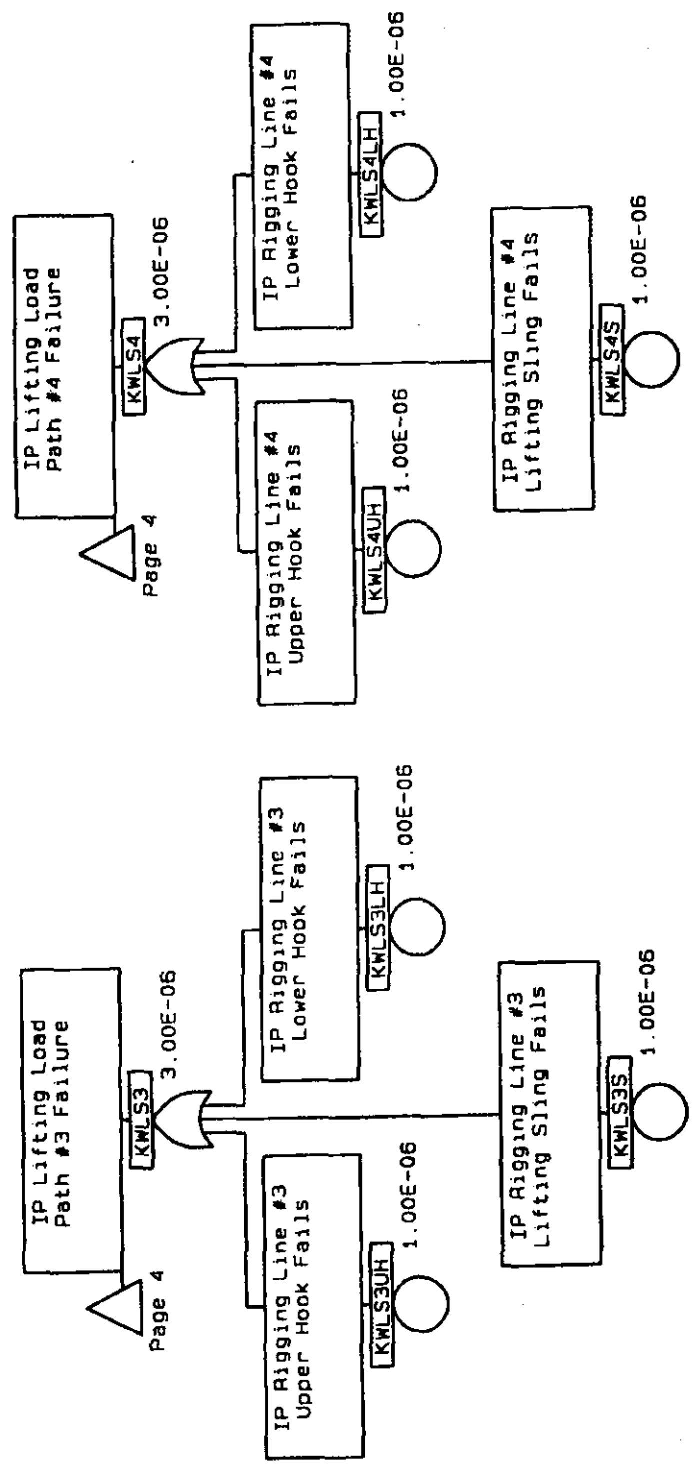

Figure 1. Multi-Canister Overpack Cask Drop in K West South Loadout Pit during Cask Loading System Alignment. (sheet 6 of 8)

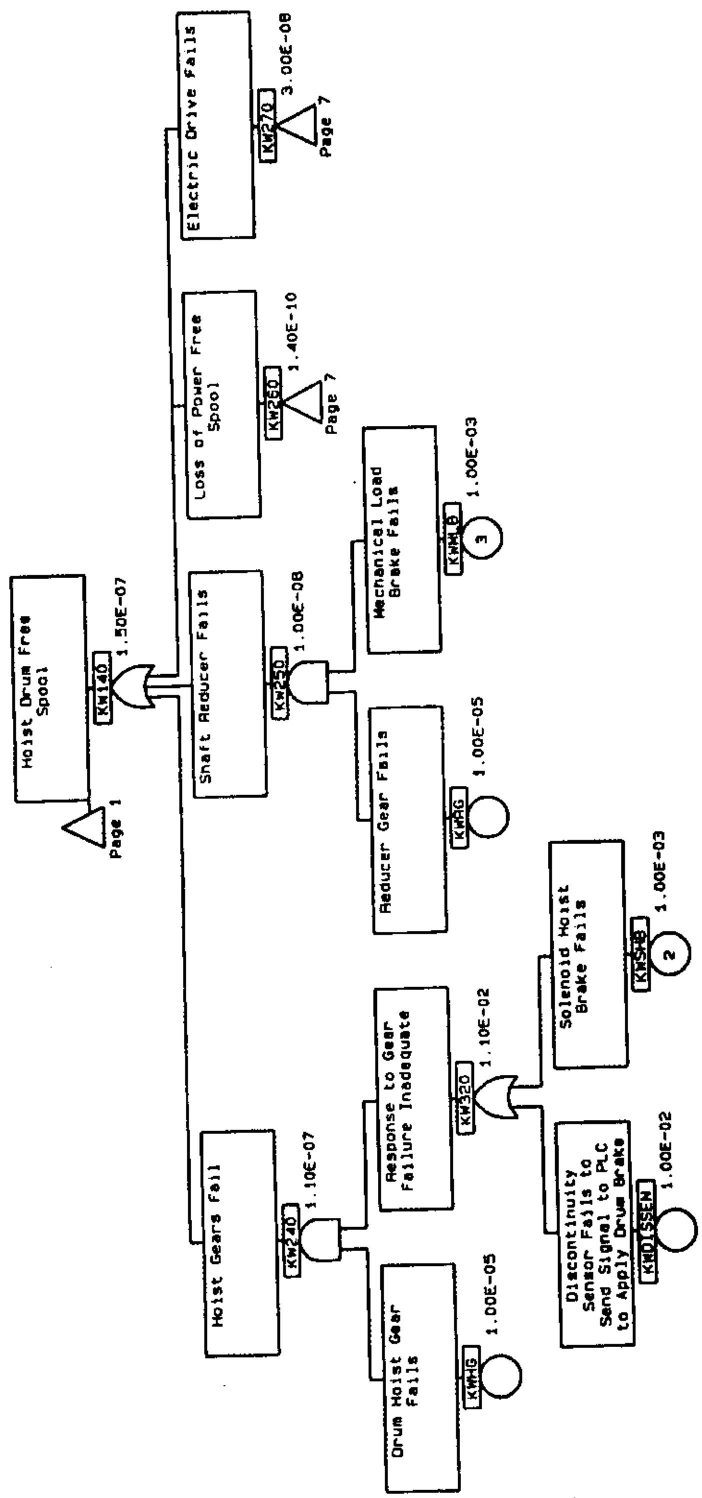

Figure 1. Multi-Canister Overpack Cask Drop in K West South Loadout Pit during Cask Loading System Alignment. (sheet 7 of 8)

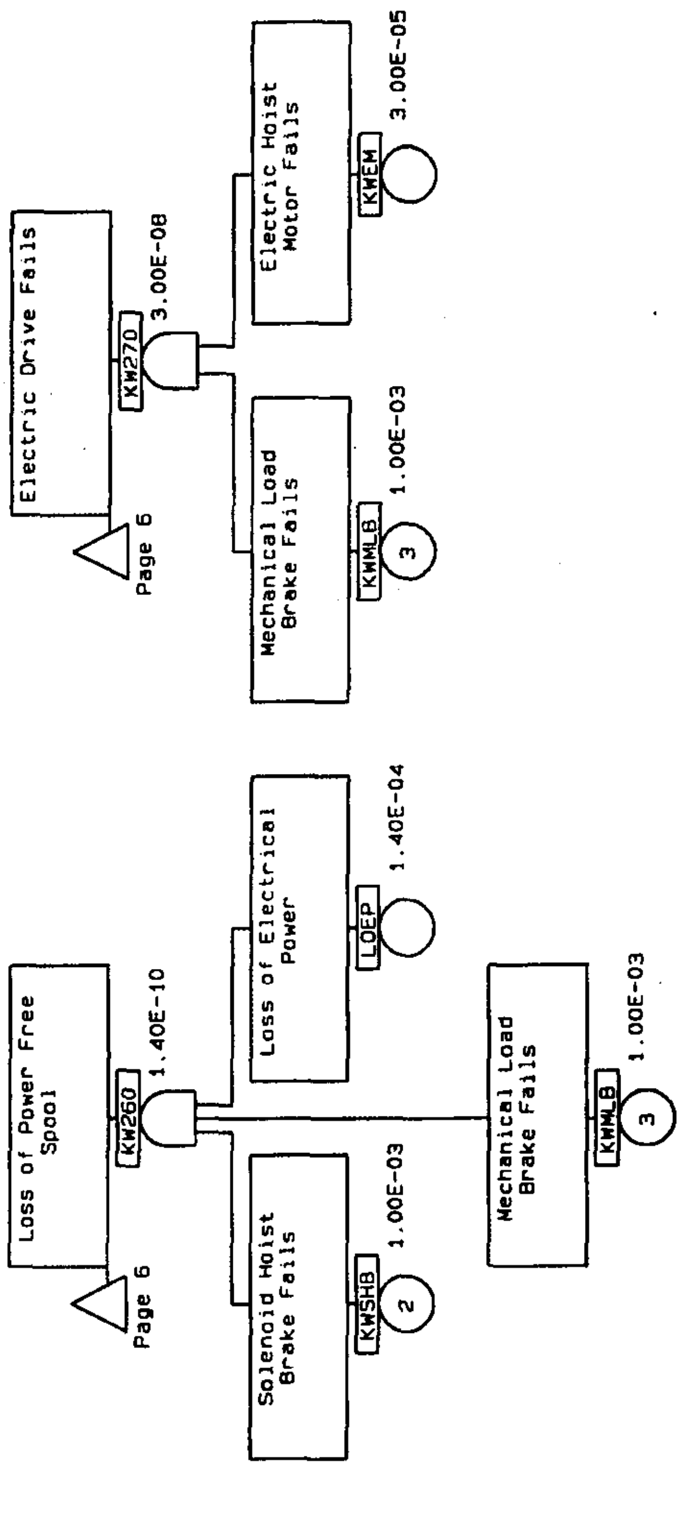

Figure 1. Multi-Canister Overpack Cask Drop in K West South Loadout Pit during Cask Loading System Alignment. (sheet 8 of 8)

ate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone	Gate/Event Name	Page	Zone
ROP	1	5	KWLS4	4	6						
W110	1	3	KWLS4	5	3						
W120	1	4	KWLS4LH	5	4						
W130	1	5	KWLS4S	5	3						
W140	1	6	KWLS4UH	5	3						
W140	6	3	KWLSC	3	4						
W210	1	2	KWLSC	4	3						
.W220	1	4	KWLSW1	1	2						
.W230	1	5	KWLSW2	1	2						
.W230	3	2	KWMLB	6	4						
:W240	6	2	KWMLB	7	1						
:W250	6	4	KWMLB	7	3						
:W260	6	5	KWOP1	1	1						
:W260	7	1	KWOP2	1	3						
<W270	6	6	KWOP3	2	2						
<W270	7	3	KWOP4MIS	2	3						
<W310	1	4	KWRG	6	3						
<W310	2	2	KWSHB	6	3						
<W320	6	2	KWSHB	7	1						
<W410	2	2	LOEP	7	2						
<W510	2	1									
<WCASK	3	1									
<WCCA	3	2									
<WCDR	3	2									
<WCLA	3	1									
<WCRH	3	1									
KWDISSEN	6	2									
KWEM	7	4									
KWHG	6	1									
KWIP	3	3									
KWLB	3	3									
KWLCA	2	1									
KWLCPOW	2	2									
KWLS1	4	2									
KWLS1LH	4	2									
KWLS1S	4	2									
KWLS1UH	4	1									
KWLS2	4	4									
KWLS2LH	4	4									
KWLS2S	4	4									
KWLS2UH	4	3									
KWLS3	4	5									
KWLS3	5	1									
KWLS3LH	5	2									
KWLS3S	5	1									
KWLS3UH	5	1									

MCO Cask Drop in KW SLOP during CLS alig	KWSLOP-D.CAF	11-15-99	Page 8

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CLSDROP.CUT              CUTSET REPORT                  11-15-99  10:59  Page   1
Filter: 'ALL'      Truncation Limit:  1.00E-30
                                                               B.E.      MOD./CS.
MODULE/EVENT NAME   DESCRIPTION                                PROB.     PROB.
-----------------   -----------                                -----     --------

  1) DROP                                                                *1.45E-05
     1) KWOP2       Operator Hangs Up Load                     3.00E-02  9.00E-06
        KWOP4MIS    Operator Error of Incorrectly Re-setting   3.00E-04
     2) KWCCA       Crane Cable Fails                          1.00E-06  1.00E-06
     3) KWCDR       Crane Drum Fails                           1.00E-06  1.00E-06
     4) KWCRH       Crane Hook Fails                           1.00E-06  1.00E-06
     5) KWCLA       Cask Lifting Attachment Fails              1.00E-06  1.00E-06
     6) KWLB        IP Lift Beam Fails                         1.00E-06  1.00E-06
     7) KW130       Crane Trolley Failure: Material Defect,    1.00E-07  1.00E-07
     8) KW120       Crane Bridge Failure: Material Defect, D   1.00E-07  1.00E-07
     9) KWDISSEN    Discontinuity Sensor Fails to Send Signa   1.00E-02  1.00E-07
        KWHG        Drum Hoist Gear Fails                      1.00E-05
    10) KWLCPOW     Failure Such That 125% Overload Signal I   1.00E-04  9.00E-08
        KWOP2       Operator Hangs Up Load                     3.00E-02
        KWOP3       Operator Fails to Stop Hoisting Followin   3.00E-02
    11) KWLCA       110% Overload Alarm Fails to Function Wh   1.00E-02  3.00E-08
        KWLCPOW     Failure Such That 125% Overload Signal I   1.00E-04
        KWOP2       Operator Hangs Up Load                     3.00E-02
    12) KWEM        Electric Hoist Motor Fails                 3.00E-05  3.00E-08
        KWMLB       Mechanical Load Brake Fails                1.00E-03
    13) KWMLB       Mechanical Load Brake Fails                1.00E-03  1.00E-08
        KWRG        Reducer Gear Fails                         1.00E-05
    14) KWHG        Drum Hoist Gear Fails                      1.00E-05  1.00E-08
        KWSHB       Solenoid Hoist Brake Fails                 1.00E-03
    15) KWMLB       Mechanical Load Brake Fails                1.00E-03  1.40E-10
        KWSHB       Solenoid Hoist Brake Fails                 1.00E-03
        LOEP        Loss of Electrical Power                   1.40E-04
    16) KWLSW1      First Limit Switch Fails to Stop Hoistin   3.00E-05  2.70E-11
        KWLSW2      Second Limit Switch Fails to Stop Hoisti   3.00E-05
        KWOP1       Operator Error Leading to "Two Blocking"   3.00E-02
    17) KWLS1UH     IP Rigging Line #1 Upper Hook Fails        1.00E-06  1.00E-18
        KWLS3LH     IP Rigging Line #3 Lower Hook Fails        1.00E-06
        KWLS4UH     IP Rigging Line #4 Upper Hook Fails        1.00E-06
    18) KWLS1LH     IP Rigging Line #1 Lower Hook Fails        1.00E-06  1.00E-18
        KWLS3LH     IP Rigging Line #3 Lower Hook Fails        1.00E-06
        KWLS4S      IP Rigging Line #4 Lifting Sling Fails     1.00E-06
    19) KWLS1UH     IP Rigging Line #1 Upper Hook Fails        1.00E-06  1.00E-18
        KWLS3S      IP Rigging Line #3 Lifting Sling Fails     1.00E-06
        KWLS4UH     IP Rigging Line #4 Upper Hook Fails        1.00E-06
    20) KWLS1S      IP Rigging Line #1 Lifting Sling Fails     1.00E-06  1.00E-18
        KWLS3LH     IP Rigging Line #3 Lower Hook Fails        1.00E-06
        KWLS4S      IP Rigging Line #4 Lifting Sling Fails     1.00E-06
    21) KWLS1LH     IP Rigging Line #1 Lower Hook Fails        1.00E-06  1.00E-18
        KWLS2UH     IP Rigging Line #2 Upper Hook Fails        1.00E-06
        KWLS4S      IP Rigging Line #4 Lifting Sling Fails     1.00E-06
    22) KWLS1S      IP Rigging Line #1 Lifting Sling Fails     1.00E-06  1.00E-18
        KWLS2S      IP Rigging Line #2 Lifting Sling Fails     1.00E-06
        KWLS3LH     IP Rigging Line #3 Lower Hook Fails        1.00E-06
    23) KWLS1S      IP Rigging Line #1 Lifting Sling Fails     1.00E-06  1.00E-18
        KWLS3LH     IP Rigging Line #3 Lower Hook Fails        1.00E-06
        KWLS4UH     IP Rigging Line #4 Upper Hook Fails        1.00E-06
    24) KWLS1LH     IP Rigging Line #1 Lower Hook Fails        1.00E-06  1.00E-18
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                                                                B.E.     MOD./CS.
MODULE/EVENT NAME      DESCRIPTION                              PROB.    PROB.
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         KWLS2S     IP Rigging Line #2 Lifting Sling Fails     1.00E-06
         KWLS3LH    IP Rigging Line #3 Lower Hook Fails        1.00E-06
     25) KWLS1UH    IP Rigging Line #1 Upper Hook Fails        1.00E-06  1.00E-18
         KWLS3LH    IP Rigging Line #3 Lower Hook Fails        1.00E-06
         KWLS4S     IP Rigging Line #4 Lifting Sling Fails     1.00E-06
     26) KWLS1LH    IP Rigging Line #1 Lower Hook Fails        1.00E-06  1.00E-18
         KWLS2LH    IP Rigging Line #2 Lower Hook Fails        1.00E-06
         KWLS3S     IP Rigging Line #3 Lifting Sling Fails     1.00E-06
     27) KWLS1UH    IP Rigging Line #1 Upper Hook Fails        1.00E-06  1.00E-18
         KWLS2LH    IP Rigging Line #2 Lower Hook Fails        1.00E-06
         KWLS3LH    IP Rigging Line #3 Lower Hook Fails        1.00E-06
     28) KWLS1UH    IP Rigging Line #1 Upper Hook Fails        1.00E-06  1.00E-18
         KWLS3LH    IP Rigging Line #3 Lower Hook Fails        1.00E-06
         KWLS4LH    IP Rigging Line #4 Lower Hook Fails        1.00E-06
     29) KWLS1S     IP Rigging Line #1 Lifting Sling Fails     1.00E-06  1.00E-18
         KWLS3LH    IP Rigging Line #3 Lower Hook Fails        1.00E-06
         KWLS4LH    IP Rigging Line #4 Lower Hook Fails        1.00E-06
     30) KWLS1LH    IP Rigging Line #1 Lower Hook Fails        1.00E-06  1.00E-18
         KWLS3UH    IP Rigging Line #3 Upper Hook Fails        1.00E-06
         KWLS4LH    IP Rigging Line #4 Lower Hook Fails        1.00E-06
     31) KWLS1UH    IP Rigging Line #1 Upper Hook Fails        1.00E-06  1.00E-18
         KWLS2S     IP Rigging Line #2 Lifting Sling Fails     1.00E-06
         KWLS3LH    IP Rigging Line #3 Lower Hook Fails        1.00E-06
     32) KWLS2UH    IP Rigging Line #2 Upper Hook Fails        1.00E-06  1.00E-18
         KWLS3S     IP Rigging Line #3 Lifting Sling Fails     1.00E-06
         KWLS4UH    IP Rigging Line #4 Upper Hook Fails        1.00E-06
     33) KWLS1LH    IP Rigging Line #1 Lower Hook Fails        1.00E-06  1.00E-18
         KWLS3S     IP Rigging Line #3 Lifting Sling Fails     1.00E-06
         KWLS4LH    IP Rigging Line #4 Lower Hook Fails        1.00E-06
     34) KWLS1S     IP Rigging Line #1 Lifting Sling Fails     1.00E-06  1.00E-18
         KWLS3S     IP Rigging Line #3 Lifting Sling Fails     1.00E-06
         KWLS4LH    IP Rigging Line #4 Lower Hook Fails        1.00E-06
     35) KWLS1UH    IP Rigging Line #1 Upper Hook Fails        1.00E-06  1.00E-18
         KWLS2S     IP Rigging Line #2 Lifting Sling Fails     1.00E-06
         KWLS3UH    IP Rigging Line #3 Upper Hook Fails        1.00E-06
     36) KWLS1UH    IP Rigging Line #1 Upper Hook Fails        1.00E-06  1.00E-18
         KWLS2LH    IP Rigging Line #2 Lower Hook Fails        1.00E-06
         KWLS4S     IP Rigging Line #4 Lifting Sling Fails     1.00E-06
     37) KWLS1LH    IP Rigging Line #1 Lower Hook Fails        1.00E-06  1.00E-18
         KWLS2UH    IP Rigging Line #2 Upper Hook Fails        1.00E-06
         KWLS3LH    IP Rigging Line #3 Lower Hook Fails        1.00E-06
     38) KWLS1LH    IP Rigging Line #1 Lower Hook Fails        1.00E-06  1.00E-18
         KWLS3S     IP Rigging Line #3 Lifting Sling Fails     1.00E-06
         KWLS4S     IP Rigging Line #4 Lifting Sling Fails     1.00E-06
     39) KWLS1LH    IP Rigging Line #1 Lower Hook Fails        1.00E-06  1.00E-18
         KWLS3LH    IP Rigging Line #3 Lower Hook Fails        1.00E-06
         KWLS4UH    IP Rigging Line #4 Upper Hook Fails        1.00E-06
     40) KWLS1S     IP Rigging Line #1 Lifting Sling Fails     1.00E-06  1.00E-18
         KWLS2LH    IP Rigging Line #2 Lower Hook Fails        1.00E-06
         KWLS4S     IP Rigging Line #4 Lifting Sling Fails     1.00E-06
     41) KWLS1S     IP Rigging Line #1 Lifting Sling Fails     1.00E-06  1.00E-18
         KWLS2S     IP Rigging Line #2 Lifting Sling Fails     1.00E-06
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MODULE/EVENT NAME	DESCRIPTION	B.E. PROB.	MOD./CS. PROB.
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
42) KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
43) KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
KWLS3S	IP Rigging Line #3 Lifting Sling Fails	1.00E-06	
44) KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
KWLS3S	IP Rigging Line #3 Lifting Sling Fails	1.00E-06	
45) KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
KWLS3S	IP Rigging Line #3 Lifting Sling Fails	1.00E-06	
46) KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS3S	IP Rigging Line #3 Lifting Sling Fails	1.00E-06	
KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
47) KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
KWLS3S	IP Rigging Line #3 Lifting Sling Fails	1.00E-06	
KWLS4S	IP Rigging Line #4 Lifting Sling Fails	1.00E-06	
48) KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	1.00E-18
KWLS3S	IP Rigging Line #3 Lifting Sling Fails	1.00E-06	
KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
49) KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
50) KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
51) KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
52) KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS3S	IP Rigging Line #3 Lifting Sling Fails	1.00E-06	
53) KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS3S	IP Rigging Line #3 Lifting Sling Fails	1.00E-06	
54) KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS3LH	IP Rigging Line #3 Lower Hook Fails	1.00E-06	
KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
55) KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	1.00E-18
KWLS3LH	IP Rigging Line #3 Lower Hook Fails	1.00E-06	
KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
56) KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS3LH	IP Rigging Line #3 Lower Hook Fails	1.00E-06	
57) KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS3LH	IP Rigging Line #3 Lower Hook Fails	1.00E-06	
58) KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	
KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	

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MODULE/EVENT NAME		DESCRIPTION	B.E. PROB.	MOD./CS. PROB.
59)	KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
	KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	
	KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
60)	KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
	KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	
	KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
61)	KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
	KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	
	KWLS4S	IP Rigging Line #4 Lifting Sling Fails	1.00E-06	
62)	KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
	KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	
	KWLS3S	IP Rigging Line #3 Lifting Sling Fails	1.00E-06	
63)	KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
	KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
	KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
64)	KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
	KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	
	KWLS3LH	IP Rigging Line #3 Lower Hook Fails	1.00E-06	
65)	KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
	KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	
	KWLS3LH	IP Rigging Line #3 Lower Hook Fails	1.00E-06	
66)	KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
	KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	
	KWLS3S	IP Rigging Line #3 Lifting Sling Fails	1.00E-06	
67)	KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
	KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
	KWLS4S	IP Rigging Line #4 Lifting Sling Fails	1.00E-06	
68)	KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
	KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
	KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
69)	KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
	KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
	KWLS4S	IP Rigging Line #4 Lifting Sling Fails	1.00E-06	
70)	KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
	KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
	KWLS4S	IP Rigging Line #4 Lifting Sling Fails	1.00E-06	
71)	KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
	KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
	KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
72)	KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
	KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
	KWLS4S	IP Rigging Line #4 Lifting Sling Fails	1.00E-06	
73)	KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
	KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
	KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
74)	KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
	KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
	KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
75)	KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
	KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	
	KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
76)	KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18

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MODULE/EVENT NAME	DESCRIPTION	B.E. PROB.	MOD./CS. PROB.
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
77) KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
78) KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	
KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
79) KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
80) KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
81) KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS4S	IP Rigging Line #4 Lifting Sling Fails	1.00E-06	
82) KWLS1UH	IP Rigging Line #1 Upper Hook Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
83) KWLS1S	IP Rigging Line #1 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
84) KWLS1LH	IP Rigging Line #1 Lower Hook Fails	1.00E-06	1.00E-18
KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	
KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
85) KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	1.00E-18
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
86) KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
87) KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	1.00E-18
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
KWLS4UH	IP Rigging Line #4 Upper Hook Fails	1.00E-06	
88) KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	1.00E-18
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
KWLS4S	IP Rigging Line #4 Lifting Sling Fails	1.00E-06	
89) KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
KWLS4S	IP Rigging Line #4 Lifting Sling Fails	1.00E-06	
90) KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	1.00E-18
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
KWLS4S	IP Rigging Line #4 Lifting Sling Fails	1.00E-06	
91) KWLS2UH	IP Rigging Line #2 Upper Hook Fails	1.00E-06	1.00E-18
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
92) KWLS2S	IP Rigging Line #2 Lifting Sling Fails	1.00E-06	1.00E-18
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	
KWLS4LH	IP Rigging Line #4 Lower Hook Fails	1.00E-06	
93) KWLS2LH	IP Rigging Line #2 Lower Hook Fails	1.00E-06	1.00E-18
KWLS3UH	IP Rigging Line #3 Upper Hook Fails	1.00E-06	

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                                                              B.E.      MOD./CS.
MODULE/EVENT NAME    DESCRIPTION                              PROB.     PROB.
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         KWLS4LH     IP Rigging Line #4 Lower Hook Fails      1.00E-06
     94) KWLS1UH     IP Rigging Line #1 Upper Hook Fails      1.00E-06  1.00E-18
         KWLS2UH     IP Rigging Line #2 Upper Hook Fails      1.00E-06
         KWLS3UH     IP Rigging Line #3 Upper Hook Fails      1.00E-06
     95) KWLS1S      IP Rigging Line #1 Lifting Sling Fails   1.00E-06  1.00E-18
         KWLS2S      IP Rigging Line #2 Lifting Sling Fails   1.00E-06
         KWLS4UH     IP Rigging Line #4 Upper Hook Fails      1.00E-06
     96) KWLS1LH     IP Rigging Line #1 Lower Hook Fails      1.00E-06  1.00E-18
         KWLS2UH     IP Rigging Line #2 Upper Hook Fails      1.00E-06
         KWLS3UH     IP Rigging Line #3 Upper Hook Fails      1.00E-06
     97) KWLS2UH     IP Rigging Line #2 Upper Hook Fails      1.00E-06  1.00E-18
         KWLS3S      IP Rigging Line #3 Lifting Sling Fails   1.00E-06
         KWLS4S      IP Rigging Line #4 Lifting Sling Fails   1.00E-06
     98) KWLS2S      IP Rigging Line #2 Lifting Sling Fails   1.00E-06  1.00E-18
         KWLS3S      IP Rigging Line #3 Lifting Sling Fails   1.00E-06
         KWLS4S      IP Rigging Line #4 Lifting Sling Fails   1.00E-06
     99) KWLS2LH     IP Rigging Line #2 Lower Hook Fails      1.00E-06  1.00E-18
         KWLS3S      IP Rigging Line #3 Lifting Sling Fails   1.00E-06
         KWLS4S      IP Rigging Line #4 Lifting Sling Fails   1.00E-06
    100) KWLS2UH     IP Rigging Line #2 Upper Hook Fails      1.00E-06  1.00E-18
         KWLS3S      IP Rigging Line #3 Lifting Sling Fails   1.00E-06
         KWLS4LH     IP Rigging Line #4 Lower Hook Fails      1.00E-06
    101) KWLS2S      IP Rigging Line #2 Lifting Sling Fails   1.00E-06  1.00E-18
         KWLS3S      IP Rigging Line #3 Lifting Sling Fails   1.00E-06
         KWLS4LH     IP Rigging Line #4 Lower Hook Fails      1.00E-06
    102) KWLS2LH     IP Rigging Line #2 Lower Hook Fails      1.00E-06  1.00E-18
         KWLS3S      IP Rigging Line #3 Lifting Sling Fails   1.00E-06
         KWLS4LH     IP Rigging Line #4 Lower Hook Fails      1.00E-06
    103) KWLS2UH     IP Rigging Line #2 Upper Hook Fails      1.00E-06  1.00E-18
         KWLS3LH     IP Rigging Line #3 Lower Hook Fails      1.00E-06
         KWLS4UH     IP Rigging Line #4 Upper Hook Fails      1.00E-06
    104) KWLS2S      IP Rigging Line #2 Lifting Sling Fails   1.00E-06  1.00E-18
         KWLS3LH     IP Rigging Line #3 Lower Hook Fails      1.00E-06
         KWLS4UH     IP Rigging Line #4 Upper Hook Fails      1.00E-06
    105) KWLS2LH     IP Rigging Line #2 Lower Hook Fails      1.00E-06  1.00E-18
         KWLS3LH     IP Rigging Line #3 Lower Hook Fails      1.00E-06
         KWLS4UH     IP Rigging Line #4 Upper Hook Fails      1.00E-06
    106) KWLS2UH     IP Rigging Line #2 Upper Hook Fails      1.00E-06  1.00E-18
         KWLS3LH     IP Rigging Line #3 Lower Hook Fails      1.00E-06
         KWLS4S      IP Rigging Line #4 Lifting Sling Fails   1.00E-06
    107) KWLS2S      IP Rigging Line #2 Lifting Sling Fails   1.00E-06  1.00E-18
         KWLS3LH     IP Rigging Line #3 Lower Hook Fails      1.00E-06
         KWLS4S      IP Rigging Line #4 Lifting Sling Fails   1.00E-06
    108) KWLS2LH     IP Rigging Line #2 Lower Hook Fails      1.00E-06  1.00E-18
         KWLS3LH     IP Rigging Line #3 Lower Hook Fails      1.00E-06
         KWLS4S      IP Rigging Line #4 Lifting Sling Fails   1.00E-06
    109) KWLS2UH     IP Rigging Line #2 Upper Hook Fails      1.00E-06  1.00E-18
         KWLS3LH     IP Rigging Line #3 Lower Hook Fails      1.00E-06
         KWLS4LH     IP Rigging Line #4 Lower Hook Fails      1.00E-06
    110) KWLS1S      IP Rigging Line #1 Lifting Sling Fails   1.00E-06  1.00E-18
         KWLS2UH     IP Rigging Line #2 Upper Hook Fails      1.00E-06
         KWLS4S      IP Rigging Line #4 Lifting Sling Fails   1.00E-06
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CLSDROP.CUT              CUTSET REPORT            11-15-99  10:59  Page   7
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                                                              B.E.     MOD./CS.
MODULE/EVENT NAME   DESCRIPTION                               PROB.    PROB.
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     111) KWLS1S    IP Rigging Line #1 Lifting Sling Fails    1.00E-06  1.00E-18
          KWLS3S    IP Rigging Line #3 Lifting Sling Fails    1.00E-06
          KWLS4S    IP Rigging Line #4 Lifting Sling Fails    1.00E-06
     112) KWLS1UH   IP Rigging Line #1 Upper Hook Fails       1.00E-06  1.00E-18
          KWLS3UH   IP Rigging Line #3 Upper Hook Fails       1.00E-06
          KWLS4UH   IP Rigging Line #4 Upper Hook Fails       1.00E-06
     113) KWLS1S    IP Rigging Line #1 Lifting Sling Fails    1.00E-06  1.00E-18
          KWLS3UH   IP Rigging Line #3 Upper Hook Fails       1.00E-06
          KWLS4UH   IP Rigging Line #4 Upper Hook Fails       1.00E-06
     114) KWLS1S    IP Rigging Line #1 Lifting Sling Fails    1.00E-06  1.00E-18
          KWLS3UH   IP Rigging Line #3 Upper Hook Fails       1.00E-06
          KWLS4S    IP Rigging Line #4 Lifting Sling Fails    1.00E-06
     115) KWLS1LH   IP Rigging Line #1 Lower Hook Fails       1.00E-06  1.00E-18
          KWLS3LH   IP Rigging Line #3 Lower Hook Fails       1.00E-06
          KWLS4LH   IP Rigging Line #4 Lower Hook Fails       1.00E-06
     116) KWLS1S    IP Rigging Line #1 Lifting Sling Fails    1.00E-06  1.00E-18
          KWLS3S    IP Rigging Line #3 Lifting Sling Fails    1.00E-06
          KWLS4UH   IP Rigging Line #4 Upper Hook Fails       1.00E-06
     117) KWLS1LH   IP Rigging Line #1 Lower Hook Fails       1.00E-06  1.00E-18
          KWLS3UH   IP Rigging Line #3 Upper Hook Fails       1.00E-06
          KWLS4UH   IP Rigging Line #4 Upper Hook Fails       1.00E-06
     118) KWLS1LH   IP Rigging Line #1 Lower Hook Fails       1.00E-06  1.00E-18
          KWLS3S    IP Rigging Line #3 Lifting Sling Fails    1.00E-06
          KWLS4UH   IP Rigging Line #4 Upper Hook Fails       1.00E-06
     119) KWLS1S    IP Rigging Line #1 Lifting Sling Fails    1.00E-06  1.00E-18
          KWLS3UH   IP Rigging Line #3 Upper Hook Fails       1.00E-06
          KWLS4LH   IP Rigging Line #4 Lower Hook Fails       1.00E-06
     120) KWLS1UH   IP Rigging Line #1 Upper Hook Fails       1.00E-06  1.00E-18
          KWLS3UH   IP Rigging Line #3 Upper Hook Fails       1.00E-06
          KWLS4S    IP Rigging Line #4 Lifting Sling Fails    1.00E-06
     121) KWLS1S    IP Rigging Line #1 Lifting Sling Fails    1.00E-06  1.00E-18
          KWLS2UH   IP Rigging Line #2 Upper Hook Fails       1.00E-06
          KWLS4LH   IP Rigging Line #4 Lower Hook Fails       1.00E-06
     122) KWLS1UH   IP Rigging Line #1 Upper Hook Fails       1.00E-06  1.00E-18
          KWLS2UH   IP Rigging Line #2 Upper Hook Fails       1.00E-06
          KWLS4LH   IP Rigging Line #4 Lower Hook Fails       1.00E-06
     123) KWLS1UH   IP Rigging Line #1 Upper Hook Fails       1.00E-06  1.00E-18
          KWLS3S    IP Rigging Line #3 Lifting Sling Fails    1.00E-06
          KWLS4LH   IP Rigging Line #4 Lower Hook Fails       1.00E-06
     124) KWLS1S    IP Rigging Line #1 Lifting Sling Fails    1.00E-06  1.00E-18
          KWLS2UH   IP Rigging Line #2 Upper Hook Fails       1.00E-06
          KWLS3S    IP Rigging Line #3 Lifting Sling Fails    1.00E-06
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PEER REVIEW CHECKLIST

Document Title: SNF-5413, *Probability of Potential MCO Cask Drop in the K-West Basin South Loadout Pit*
Document Author: Tom Powers
Document Date: December 1999
Scope of Review:

Yes	No	NA	
[ ]	[ ]	[✓]	Previous reviews complete and cover analysis, up to scope of this review, with no gaps.
[✓]	[ ]	[ ]	Problem completely defined.
[✓]	[ ]	[ ]	Accident scenarios developed in a clear and logical manner.
[✓]	[ ]	[ ]	Necessary assumptions explicitly stated and supported.
[✓]	[ ]	[ ]	Computer codes and data files documented.
[✓]	[ ]	[ ]	Data used in calculations explicitly stated in document.
[✓]	[ ]	[ ]	Data checked for consistency with original source information as applicable.
[✓]	[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
[✓]	[ ]	[ ]	Models appropriate and used within range of validity or use outside range of established validity justified.
[✓]	[ ]	[ ]	Hand calculations checked for errors. Spreadsheet results should be treated exactly the same as hand calculations.
[✓]	[ ]	[ ]	Software input correct and consistent with document reviewed.
[✓]	[ ]	[ ]	Software output consistent with input and with results reported in document reviewed.
[ ]	[ ]	[✓]	Limits/criteria/guidelines applied to analysis results are appropriate and referenced. Limits/criteria/guidelines checked against references.
[ ]	[ ]	[✓]	Safety margins consistent with good engineering practices.
[ ]	[ ]	[✓]	Conclusions consistent with analytical results and applicable limits.
[ ]	[ ]	[✓]	Results and conclusions address all points required in the problem statement.
[ ]	[ ]	[✓]	Format consistent with appropriate NRC Regulatory Guide or other standards
[ ]	[✓]	[ ]	Review calculations, comments, and/or notes are attached.
[✓]	[ ]	[ ]	**Document approved.**

Yih Justin Liu [signature] 12/2/99
Reviewer (Printed Name and Signature) Date

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