



**OFFSHORE TECHNOLOGY
REPORT - OTO 96 951**

**AN EXAMINATION OF THE NUMBER AND FREQUENCY
OF SERIOUS DROPPED OBJECT AND SWINGING LOAD
INCIDENTS INVOLVING CRANES AND LIFTING
DEVICES ON OFFSHORE INSTALLATIONS
FOR THE PERIOD
1981-1995**

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INTRODUCTION

1. A class of accident scenario that normally needs to be considered within a safety case for an offshore installation is that involving impacts by dropped or swinging loads during lifts by cranes and similar devices. The impact could be with hydrocarbon containing equipment (either on the installation itself or subsea) leading to a release of hydrocarbon or could be directly onto a sensitive facility such as the accommodation block or groups of personnel.
2. 'Good practice' should reduce the likelihood of occurrence of such events in that consideration should have been given at the design stage to avoiding lifts over potentially vulnerable areas or to providing protection for equipment where the possibility of interaction cannot be totally avoided. However, 'good practice' may not have been fully applied or have been possible in all cases and hence a formal assessment of the accident mechanism will normally be required.
3. In trying to assess the possibility of such an event occurring on a given installation, an important input is the historical frequency with which loads have been dropped or allowed to swing on offshore installations. This data would be modified and refined to reflect the particular circumstances (type of equipment, procedures etc) on the installation concerned and combined with other factors such as the probability of a sensitive item being impacted and the probability of hydrocarbon release or severe structural damage, to produce an estimate of the overall accident frequency. This note analyses the frequency with which dropped or swinging load incidents have occurred over the period 1981 to 1995 and provides an update to an earlier report⁽³⁾ which considered incidents for the period 1981 to 1992.

DATA SOURCES

4. Data has been obtained from the Department of Energy/HSE 'Safety' database on all recorded incidents involving cranes over the period 1981 to 1995. Records are based on incidents reported under the OIR9A reporting scheme. The database contained details of some 2600 incidents.
5. Ideally, it would be desirable to calculate incident probabilities on a 'per crane lift' basis, with perhaps discrimination between different types of lifting device. However, initial enquiries indicated that data on the number of lifts involved was most unlikely to be easily obtained and was certainly not available to HSE. Consequently it was decided to express the likelihood of an incident on a 'per installation year' basis. Whilst a coarser measure than 'per crane lift' it was nevertheless considered capable of yielding useful indicative data.
6. In order to calculate incident frequencies on a per installation year basis, details of the number of installations (fixed and mobile) operating in each of the years was also required. Information for the years 1981 to 1990 were taken from the Department of Energy 'Brown Book'⁽¹⁾. It is noted that a change of reporting standards occurred in 1992. Data from 1992 onwards has been extracted from the HSE (OSD's) Accident Incident Database.

DATA INTERPRETATION

7. Inspection of the incident data revealed that:-
 - a. none of the incidents had actually led to any significant hydrocarbon release or damage to a sensitive facility,
 - b. many of the incidents were of a relatively minor nature with extremely limited possibility of escalation into a more serious event. For example, a number of the incidents referred to falls by personnel while climbing into or out of crane cabs.

Consequently the data was analysed to identify more 'serious' incidents where it was believed that the potential existed for escalation into a significant event involving death or serious injury to a number of platform personnel had circumstances been slightly different. For example, this included the dropping of heavy loads which would have almost certainly resulted in release of hydrocarbon had equipment containing hydrocarbon been impacted.

8. Inevitably, the data analysis involved a degree of subjectivity as to which incidents had the potential to escalate but in many cases the issue was fairly clear-cut. In assessing incidents involving the derrick crane, account was taken of the reduced lifting area and hence some incidents classed as serious for the main cranes were not classed as such for the derrick crane.

9. Incidents classed as 'serious' were further sub-divided into incidents where:-
 - a. impact was on the installation itself;
 - b. the dropped object fell into the sea (and hence could have impacted subsea equipment);
 - c. the impact occurred on a supply vessel.

10. Incidents were further sub-divided by the type of lifting device involved. The types considered were:-

- a. installation main cranes (pedestal cranes);
- b. derrick cranes;
- c. other fixed lifting devices eg lifting beams (including trolley cranes/hoists);
- d. portable lifting devices (eg chain blocks/slings etc).

RESULTS

11. The results are shown in Table 1. This gives for each of the crane types:-
 - a. the total number of serious incidents in each of the fifteen years;

- b. the number of installation years over the period;
- c. the split of incidents between the different areas of potential impact;
- d. incident frequencies, expressed on a per installation year basis, both for individual years and also averaged over the 15 years.

12. The results indicate an overall average installation impact frequency of 0.065 (installation yr)⁻¹, an average frequency of drops into the sea of 0.024 (installation yr)⁻¹ and frequency of impacts onto supply vessels of 0.020 (installation yr)⁻¹. The figures indicate that whilst serious dropped loads are not a particularly common occurrence, they are not at a sufficiently low level where their effect could be discounted within a safety case without some form of more detailed analysis.

13. The trend of total serious incident frequencies over the period is shown in Figure 1. This indicates a reduction in the high incident frequencies seen in the early years, but with a slight peak of incidents in 1987 and 1988. From 1989 onwards there is a generally steady incident rate at about half the frequencies recorded in the early 1980's. Table 1 contains some examples of serious dropped loads.

APPLICATION

14. The figures derived in this note relate to historical incident frequencies averaged over a large number of different installations. As such they will not exactly reflect the competencies, practices or equipment relevant to specific installations and hence care is needed if applying them to a particular installation. Two different areas of application are foreseen:-

- a. as crude initial frequency inputs into dropped load analyses to determine whether this could be a significant source of accidents and whether procedural changes are required.
- b. as rough comparators when assessing the general validity of frequencies used in detailed dropped load analyses produced in support of safety cases.

REFERENCES

1. Development of the Oil and Gas Resources of the United Kingdom - Department of Energy 1991.
2. HSE (OSD) Accident Incident Database.
3. An examination of the number and frequency of serious dropped object and swinging load incidents involving cranes and lifting devices on offshore installations for the period 1981-1992. HSE Report OTO 95-959.

TABLE 1

SOME RECORDED INCIDENTS CLASSED AS 'SERIOUS'

1. An 8 tonne load struck the accommodation module and fell into the sea.
2. A 500 tonne elevator tilted during lifting causing one side to fall 3ft on to the deck. A 12 inch cut in the deck plating resulted.
3. A 3.5 tonne load was being transferred by crane when the load fell 8 feet on to the deck. No failure of the slings or line was involved.
4. A crane boom fell across a pipe deck lifting a sea water surge tank and an LP flare line. Both were badly dented.
5. An 8.5 tonne load became in freefall due to failure of a crane clutch. The load landed on a catwalk.
6. A 2.75 tonne compactor dropped 3m onto the pipe deck causing a small penetration.
7. A 45 gallon drum of oil fell 25 feet.
8. A main hoist wire parted that was holding a 28 tonne "concrete mattress" 2-3 feet off a DSV deck, with a 60 tonne rated crane. No reason recorded as to why the wire broke.
9. A pipeline support trestle was being lowered subsea when it became detached and fell 30 feet to the seabed. A diver was above 5 feet from the trestle when it landed.
10. Two 45 gallon drums of lube oil carried in a cargo net snagged a protruding light fitting out of sight of the crane operator. Both drums fell about 60 feet onto a module roof, with one drum bursting on impact.
11. A pumping unit of 10.5 tonnes was being backloaded onto a supply vessel using a single part hoist line. When the load was at D-deck level it could no longer be controlled by the brake and fell into the sea.
12. A bulk loading hose was being returned to the loading station when the 2 tonne sling holding the hose parted and fell 30 metres to a production deck walkway.

Table 2

Serious Dropped Objects & Swinging Loads Incidents

Year	Installation Years	Main Cranes			Derrick Crane			Other Fixed Devices			Portable Devices			Total Incidents	Average Frequency/Year				
		Impact on Installation	Freq Per Year	Fall Int Sea	Freq Per Year	Fall Int Sea	Freq Per Year	Fall Int Sea	Freq Per Year	Fall Int Sea	Freq Per Year	Fall Int Sea	Freq Per Year			Fall Int Sea			
1981	89	6	0.067	6	0.067	4	0.045	0.000	1	0.011	0.000	3	0.034	0.000	1	0.011	21	0.238	
1982	97	6	0.062	9	0.093	4	0.041	0.052	1	0.000	0.010	0.000	0.000	0.000	3	0.031	28	0.289	
1983	108	7	0.065	3	0.028	2	0.019	0.009	2	0.019	0.000	1	0.009	0.000	5	0.048	22	0.204	
1984	133	11	0.083	4	0.030	10	0.075	0.000	1	0.000	0.000	1	0.008	0.000	3	0.023	29	0.218	
1985	140	5	0.036	3	0.021	3	0.021	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	12	0.086	
1986	145	4	0.028	5	0.034	3	0.021	0.000	2	0.014	0.000	0.000	0.000	0.000	1	0.007	15	0.103	
1987	138	9	0.065	2	0.014	3	0.022	0.007	2	0.014	0.000	0.000	0.000	0.000	1	0.007	18	0.130	
1988	182	6	0.033	3	0.016	2	0.011	0.000	4	0.022	0.000	3	0.018	0.000	5	0.027	23	0.128	
1989	181	6	0.031	3	0.016	3	0.016	0.005	1	0.005	0.000	0.000	0.000	0.000	1	0.005	15	0.079	
1990	200	4	0.020	1	0.005	3	0.015	0.000	3	0.015	0.000	0.000	0.000	0.000	1	0.005	12	0.060	
1991	209	10	0.048	2	0.010	1	0.005	0.000	2	0.010	0.000	0.000	0.000	0.000	0.000	0.000	15	0.072	
1992	227	9	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4	0.018	0.000	1	0.004	14	0.082	
1993	245	8	0.024	1	0.004	3	0.012	0.000	2	0.008	0.000	0.000	0.000	0.000	0.000	0.000	12	0.049	
1994	249	11	0.044	2	0.008	9	0.036	0.000	0.000	0.000	1	0.004	0.016	0.004	1	0.004	28	0.116	
1995	249	9	0.036	5	0.020	1	0.004	0.000	0.000	0.000	1	0.004	0.008	0.000	0.000	0.000	18	0.072	
SUM	2602	109	0.045	49	0.024	51	0.023	9	0.005	19	0.008	3	0.007	2	0.001	23	0.011	283	0.127

Total Impacts onto Installations = 189 AVGE. FREQ. = 0.065
 Total to Sea = 63 AVGE. FREQ. = 0.024
 Total to Vessel = 51 AVGE. FREQ. = 0.020

*** Data from 1992 onwards analysed by Broad Incident Type (BIT) from OIR/BA reporting form. BIT = 6 & 8, Falling Objects & Lifting/Crane Operations respectively. Data cross check carried out as a review of "Other" categories under OPERATIONS, ACTIVITIES LEADING TO INCIDENTS and BROAD INCIDENT TYPE, REPORTED ON OIR/BA FORMS

Figure 1 - CRANE INCIDENT FREQUENCY

