HSE
Health & Safety Executive

OFFSHORE TECHNOLOGY REPORT - OTO 95 959

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

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Health and Safety Executive

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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 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 1992. Records are based on incidents reported under the OIR9A reporting scheme. The database contained details of some 1160 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 likeihood of an incident on a 'per installation year' basis. Whilst a coarse measure than 'per crane lift' it was nevertheless considered capable of yielding useful indcative 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]. However, due to a change in format the 'Brown Book' does not give equivalent figures for 1991 and 1992 and estimates have had to be made for these years.

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. Some typical incidents are outlined in Table 2. 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 twelve 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 12 years.

12. The results indicate an overall average installation impact frequency of 0.073 (installation yr)$^{-1}$, an average frequency of drops into the sea of 0.032 (installation yr)$^{-1}$ and frequency of impacts onto supply vessels of 0.023 (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 there 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 no clear trend from 1985 onwards. 1988 was a poor year in terms of crane safety as in terms of general safety.

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.

TABLE 1

SOME RECORDED INCIDENTS CLASSED AS 'SERIOUS'

1. An 8 ton load struck the accommodation module and fell into the sea.

2. A 500 tone 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 ton 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. A 8.5 ton load became in freefall due to failure of a crane clutch. The load landed on a catwalk.

TABLE 1
SERIOUS DROPPED OBJECTS & SWINGING LOADS INCIDENTS

(Includes Fixed Installations, Jackups, Semi-subs.)

YEAR	INST'N YEARS	MAIN CRANES						DERRICK CRANE				OTHER FIXED DEVICE				PORTABLE DEVICES				TOTAL INCIDENTS	AVGE. FREQ /YR
		IMPACT ON INST'N	FREQ./YR	FALL TO SEA	FREQ./YR	IMPACT ON VESSEL	FREQ./YR	FALL TO SEA	FREQ./YR	IMPACT ON INST'N	FREQ./YR	FALL TO SEA	FREQ./YR	IMPACT ON INST'N	FREQ./YR	FALL TO SEA	FREQ./YR	IMPACT ON INST'N	FREQ./YR		
81	89	6	0.067	6	0.067	4	0.045			1	0.011			3	0.034			1	0.011	21	0.236
82	97	6	0.061	9	0.093	4	0.041	5	0.051			1	0.010					3	0.031	28	0.289
83	108	7	0.065	3	0.028	2	0.018	1	0.009	2	0.018			1	0.009	1	0.009	5	0.046	22	0.204
84	133	11	0.082	4	0.030	10	0.075							1	0.007			3	0.022	29	0.218
85	140	5	0.036	3	0.021	3	0.021	1	0.007											12	0.086
86	145	4	0.027	5	0.034	3	0.020			2	0.014							1	0.007	15	0.103
87	138	9	0.065	2	0.014	3	0.022	1	0.007	2	0.013							1	0.007	18	0.130
88	182	6	0.033	3	0.016	2	0.011			4	0.022			3	0.016			5	0.027	23	0.280
89	191	6	0.031	3	0.016	3	0.016	1	0.005	1	0.005							1	0.005	15	0.078
90	200	4	0.019	1	0.005	3	0.015			3	0.015							1	0.005	16	0.059
91	EST.200	10	0.050	2	0.010	1	0.005			2	0.010			1	0.005					16	0.080
92	*EST.150	5	0.033	3	0.020	3	0.020	1	0.007					3	0.020			1	0.007	16	0.107
SUM	1777	79	0.044	44	0.025	41	0.023	10	0.006	17	0.010	1	n/a	12	0.007	1	n/a	22	0.012	227	0.128

* TO THE END OF SEPTEMBER 92

TOTAL TO INSTALLATION = 130 AVGE. FRQ. = 0.073

TOTAL TO SEA = 58 AVGE. FRQ. = 0.032

TOTAL TO VESSEL = 41 AVGE. FRQ. = 0.023

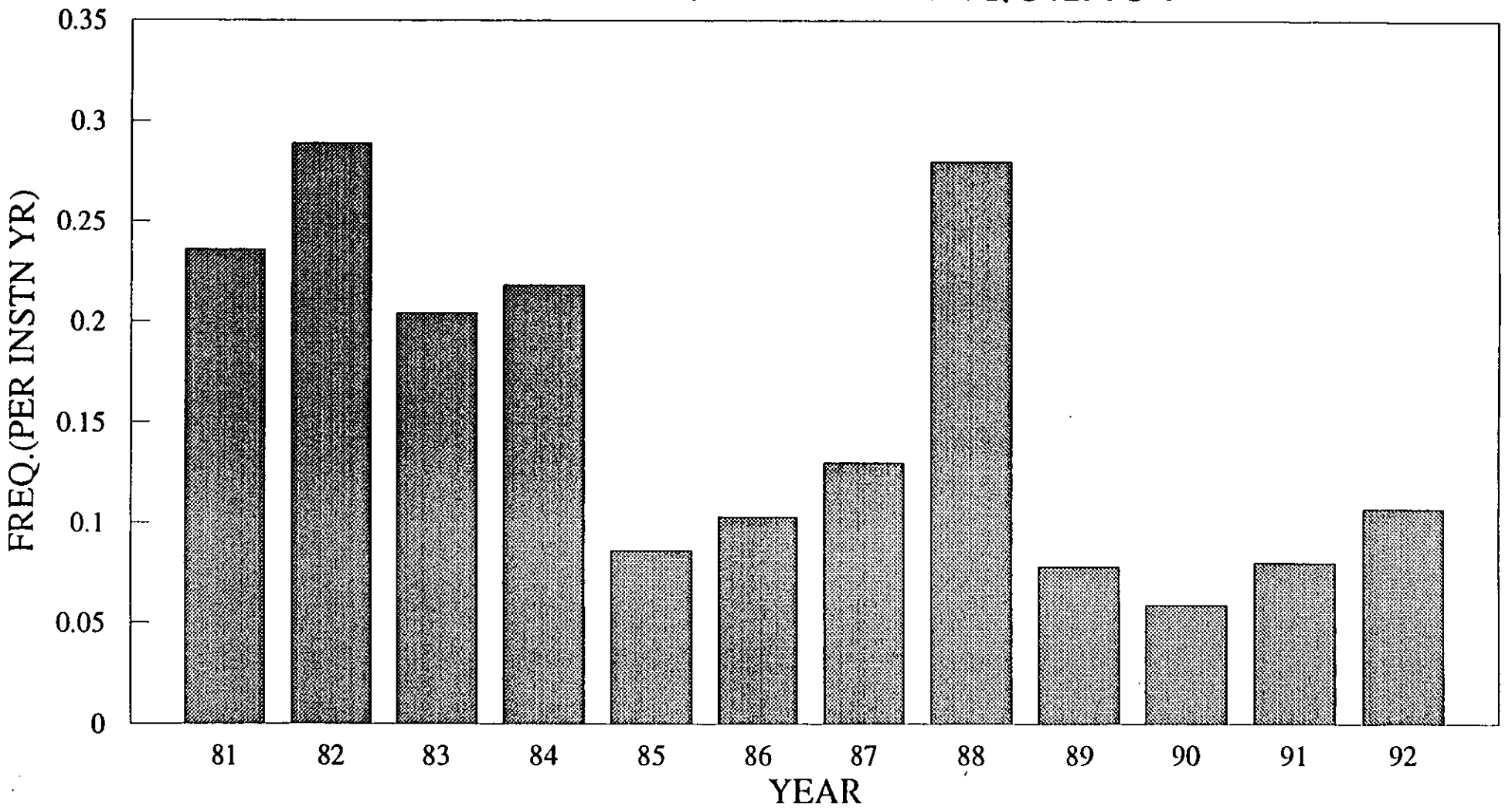
CRANE INCIDENT FREQUENCY
FREQ.(PER INSTN YR)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
81
82
83
84
85
86
87
88
89
90
91
92
YEAR

FIGURE 1