more representative sample. We have not attempted to fit these curves using the Bayesian methodology discussed above.

Summarizing, we can be fairly convinced that once a spill has occurred, the U.S. tanker spill is most likely smaller than the flag-of-convenience spill and perhaps the western-developed spill. U.S. tankers can also be expected to have fewer spills than their foreign counterparts, although the magnitude of the difference is still somewhat in question. It is also worth a second look at Figure 5 to imprint the generally small size of these spills, whether they are from U.S. or foreign tankers. When we calculate that the U.S. fleet will have about 100 spills in a year, these are by no means all blockbusters. Most will be fairly small.

Offshore platform spill incidence model

Although the PIRS data is demonstrably deficient in its classification of platform and pipeline spill incidents, it was our most automated spill incidence source and so our first attempts at analysis of the platform problem were made with this data. The relationship of spill incidence with production was investigated using the PIRS and LPR10 data, and the effects of weather were investigated using the environmental information included in the PIRS report. Preparing the LPR10 and PIRS data for this comparison was rather time-consuming. A major difficulty was encountered in classifying the PIRS spill incidents by area and block numbers (or equivalently, lease numbers). The revised

PIRS code calls for the spill location to be specified by latitude and longitude. This meant that we had to generate a table to cross-reference area and block numbers with latitude and longitude. This was not a simple task, because the transformation between the two surveying systems is extremely irregular. Appendix A discusses this problem more fully.

The simplest results came from the environmental factors analysis. The baseline data for this comparison came from the Environmental Data Services compendium, Environmental Conditions Within Specified Geographical Regions. For the offshore production areas in the Gulf of Mexico this data comes mainly from TDF-11 ship weather reports. As in the tanker investigation, we limited this study to a comparison of mean values conditional on a spill occurring versus the unconditional mean values. Presumably, if spills are caused by bad weather, then the conditional mean will be in excess of the unconditional mean, at least with respect to wind and current speeds and wave heights. We were unable to find baseline data on current speed, so our comparison is limited to wind speed and wave height. An examination of the PIRS data showed that 68% of the pipeline/platform records contained wind speed data, 47% had wave height data, but only .5% had current speed data. Thus, the absence of comparative baseline current speed values was of no consequence, since little could be learned from the limited number of incidents available. Table 16

TABLE 16
ENVIRONMENTAL FACTORS IN SPILL INCIDENCE AT OFFSHORE PRODUCTION PLATFORMS AND PIPELINES

	Wind Speed (Knots)		Wave Height (Feet)	
Percentile	PIRS (conditional, 1781 records)	Baseline (unconditional)	PIRS (conditional, 1199 records)	Baseline (unconditional)
01	1	0	0	0
05	3	2	0	0
25	5	6	0	1
50	10	12	1	3
75	16	17	3	5
95	25	24	6	8
99	30	32	10	11
Max	45	48	20	32
Average	11	12	4.2	3.6
	$x^2 = 275,889$ $\bar{x} = 10.77$ $N_o = 1,781$		$x^2 = 11,703$ $\bar{x} = 2.42$ $N_o = 1,199$	

shows the annual percentiles and averages for wind speed and wave height for both the PIRS data and the unconditional baseline for the nearshore Gulf of Mexico data. Note that the wind speed and wave height are smaller for equivalent percentiles for the PIRS data (the conditional distribution) than for the ambient levels as seen by ships in the region. The differences are insufficient to make a case that spills occur only in good weather, but they do suggest that bad weather has little to do with a spill event, at least with respect to large aggregates of data such as the combined 1973-1975 PIRS offshore production and pipeline records. The results of the calculation for the PIRS data are shown to two digits because it is our belief that the data does not warrant the implicit claim to higher accuracy that would accompany the inclusion of more decimal points.

We also looked at the time at which the spill incident was reported to have occurred. As in the tanker spill case, the daylight hours had the bulk of the spills. Nearly 90% of the spills were reported between the hours of 7 a.m. and 4 p.m. The average time of spill occurrence was 10:40 a.m. The standard deviation was 3 hours and 20 minutes. We recalculated these values for spills over 99 gallons with the result that the average was 10:50 a.m. and the standard deviation was 4 hours and 50 minutes. This result suggests that spill volume is not linked with a tendency toward timeliness in reporting a spill incident. We speculate that either nighttime spills are not reported, or that most spills actually do occur during the day, or that the reports are routinely not forwarded to the Coast Guard until the following morning. Since the Coast Guard receives most of its offshore production platform spill notifications through the Geological Survey, the last explanation seems worthy of further investigation.

The results of the linear regression between a lease's annual oil and condensate production and the number of PIRS spill incidents are shown in Table 17. For the purpose of this regression, only leases with both production and one or more spill incidents were included. This screening should enhance any linearity evident in the data. The data is classified by year as well as aggregated over all years, and is further classified by spill volume. These sortings were made to ensure that trends or reporting thresholds associated with spill volumes would not distort the results of the linear regression. Note that the largest correlation coefficient was .34, and that the interpretation that can be applied to all the regression results is that no correlation is evidenced by the data. This is the case, even though we have artificially removed all leases that produced oil but had no spills. Had these individuals been included, the apparent correlation would have been smaller still, and the likelihood that there is no correlation between production and spill incidence as seen in the PIRS data would have increased.

TABLE 17
LINEAR REGRESSION OF NUMBER OF PIRS SPILL INCIDENTS ON ANNUAL OIL AND CONDENSATE PRODUCTION FOR FEDERAL OCS LEASES IN THE GULF OF MEXICO

	All Spills		Spills Greater Than 99 Gallons	
Year	Correlation Coefficient	Significance	Correlation Coefficient	Significance
1973	-.06	(T = .65, N = 117) No correlation likely	-.13	(T = -.90, N = 44) No correlation likely
1974	-.03	(T = -.35, N = 131) No correlation likely	-.25	(T = -1.48, N = 35) No correlation likely
1975	.15	(T = 1.70, N = 133) No correlation likely	.34	(T = 1.8, N = 26) No correlation likely
All Years	.04	(T = .58, N = 190) No correlation likely	-.13	(T = -1.11, N = 77) No correlation likely

We performed similar regressions for leases owned by three of the more active offshore producers. The results were much the same as those reported above. Spill reports tended to be strongly clustered in the hours of 6 a.m. (versus 7 a.m. for the aggregated sample) to 4 p.m. for all three companies. No correlations were observed between lease production volume and number of spills. Wind speed, wave height, and current speed were all reported with like regularity and with similar distribution. In short, nothing very useful was learned from this classification.

These negative results led us to consider the USGS Event file for its listing of spill incidents. A random sample was drawn from the LPR10 list of active offshore leases. For each lease, we determined a typical water depth, the distance from shore, the number of structures built prior to 1965, the number of structures built in 1965 and after, the number of PIRS spill incidents in 1973 to 1975, the number of USGS spills in the same period, and the total oil and condensate production from 1973 to 1975. Twenty-eight leases were included in this sample.

The four regressions between water depth and distance from shore and the number of USGS and PIRS spill incidents showed no correlation between spill number and either of the proposed explanatory variables. Therefore, we have not considered these parameters further. The remaining three explanatory variables are, thus, the number of old platforms (where "old" is prior to 1965), the number of new platforms, and the total oil and condensate production for 1973 to 1975. Table 18 shows the twenty-eight samples.

One result that is readily obtained from this table is that the number of PIRS incidents is only weakly correlated to the number of USGS incidents, the correlation coefficient being .414. This means that results obtained for the PIRS data do not carry over to the USGS data. Thus, our earlier conclusions regarding the lack of correlation between the PIRS data and the 1973 to 1975 LPR10 lease production data do not speak to the correlations that might exist between the USGS spill numbers and lease production.

This lack of correlation between the two spill data sources may be partially attributable to the difficulties we encountered in cross-referencing the PIRS data's latitude and longitude with area and block numbers. Further, we should not expect a perfect correlation, since the USGS data includes only those spills over 42 gallons (1 BBL), while the Coast Guard's PIRS data appears to contain all spills of all sizes. This means that the number of spills in the USGS data should (ideally) always be less than the number in the PIRS data; and this number should be binomially distributed. The observed behavior, however, is worse than this model would predict. In thirteen cases the PIRS data shows an equal or greater number of spills, but in the five remaining cases where a lease had one or more spills, the USGS data shows a greater number of spills. Further, there is little indication of binomial behavior in the thirteen properly behaved cases.

TABLE 18
RANDOM SAMPLE FOR PRELIMINARY OFFSHORE PRODUCTION PLATFORM SPILL INCIDENCE REGRESSIONS*

	No. Spills		Production '73-'75, MMBBL	No. Structures	
Area/Block	PIRS	USGS		Pre-'65	'65 & After
V 179	0	0	.915	1	0
EI 172	1	0	.002	2	2
SM 140	4	0	1.37	2	1
EI 193	0	0	.342	1	1
EI 215	14	10	.281	2	6
WC 180	2	0	1.12	4	4
EC 48	0	0	.222	2	2
SM 22	0	0	.006	2	0
EI 219	1	0	.214	0	1
SS 219	26	10	6.53	0	5
SM 135	0	0	.006	5	0
EI 275	0	0	1.67	1	0
SS 99	1	0	.551	1	1
WD 35	28	2	1.22	0	4
V 190	0	0	.124	0	1
SM 16	2	0	.008	1	0
EI 158	0	6	10.8	1	5
SP 62	0	9	19.6	0	1
MP 142	4	0	1.94	0	1
EC 14/9	14	3	2.90	0	6
WD 42	1	1	2.47	0	2
SS 207	0	5	15.8	0	9
SP 54	0	0	.471	0	1
MP 144	21	1	12.9	0	2
EI 258	1	1	3.03	0	2
EI 295	0	0	1.57	0	2
EC 321	0	4	2.82	0	1
WD 35/36	0	2	.006	0	6

* It has been brought to our attention that a number of the structures identified above are single or dual well satellites with no production equipment. Further, some of the platforms may not have been producing continuously in the 1973-1975 period, while others have no wells or are producing gas. However, each member of the sample did produce some oil or condensate over this period, and so we conclude they are a suitable basis for a preliminary analysis.

If we consider only the USGS data and the three proposed explanatory variables, we obtain the covariance/correlation matrix shown in Table 19. This table shows a strong correlation between number of spills and both production volume and the number of new platforms. Rather remarkably, the matrix also suggests a negative linear relationship between the number of old platforms and the number of spills. However, the correlation coefficient is not large enough to be significant.

The partial correlation coefficients for both the production volume and the number of new platforms remain significant at about .48. That is, the slight colinearity evidenced by the .353 correlation between production volume and number of new platforms does not account for the high correlation evidenced by the correlation coefficients in the first row of the matrix.

These results suggest that a simple spill incidence model could be developed on the basis of either number of platforms or production volume. We chose the former alternative for two reasons. First, the selection of 1965 as the cutoff year between old and new platforms was not entirely arbitrary. A preliminary examination of the data had revealed some strong platform age effects. A more thorough investigation of this phenomenon is warranted. Second, this approach is analogous with the ship spillage incidence model developed above. Such a model not only has a reasonably simple physical interpretation, but might also be of value from the standpoint of supervisory requirements.

TABLE 19
COVARIANCE/CORRELATION MATRIX

	x_1	x_2	x_3	x_4
Number of USGS Spills (x_1)	10.25	.576	.568	-.192
Production (MMBBL) (x_2)	9.55	26.82	.353	-.316
Number of New Platforms (x_3)	4.26	4.29	5.50	-.171
Number of Old Platforms (x_4)	-.792	-2.11	-.517	1.66

Note: Both the covariance and the correlation matrices are symmetric. Further, all diagonal elements in the correlation matrix are unity. Thus, the table above, with variances on the diagonal and covariances to lower left, contains all the data required to recreate the covariance and correlation matrices.

As a first step in the platform-specific analysis, we calculated the ratio of the number of spills and the number of platforms for the years 1971-1975 for four age groups, each age group encompassing five years. This ratio is an estimate of the rate constant for a Poisson model based on platform years as the exposure variable. The results of this calculation are shown in Table 20. It suffices for our purposes to note that there is a rather substantial difference between years in any given age group, with the general trend being towards fewer spills per platform as we approach 1975. Note also that within the 1973 to 1975 period, the number of spills per platform year decreases with platform age. This is as we expected, based on the negative correlation seen in our preliminary investigations, above. In 1971 and 1972 this was not the case. In those years, the oldest platforms accounted for a disproportionate share of the number of spills. Danenberger (1976, page 15) attributes this to an overly hasty implementation of OCS Order No. 8 which required extensive additions to on board equipment, much of which had to be replaced later, due to poor installation and design. Note also that in recent years, the rate constant is such that we should anticipate only one spill (over 1 BBL) per year for every 50 or so platforms. If we calculate an equivalent figure from the linear regression that accompanied Tables 18 and 19, we would find that this random sampling of the total population had about one spill for every five platform years. Such a large departure from the population mean demonstrates the hazards of relying too heavily on small samples, even when great care is taken in constructing the sample.

TABLE 20
SPILLS PER PLATFORM-YEAR BY AGE GROUP. USGS SPILL DATA, 1971-1975

	1971	1972	1973	1974	1975
0-4	.08	.05	.05	.02	.05
5-9	.09	.06	.05	.03	.02
10-14	.08	.02	.04	.01	.01
15+	.16	.12	.03	.01	.003
All ages	.09	.05	.04	.02	.02

Table 21 shows the number of platforms having 0, 1, 2, etc. spills in 1973 to 1975. We have classified the platforms by age, ten years being the cutoff between the old and new groups. This classification is consistent with the variation of rate constants shown in Table 20 for the years 1974 and 1975. There is some uncertainty in this classification procedure, as not all platforms listed in the USGS Event file were found in the structures file. However, we made our best guess in these cases based on the lease date or the initial production date in the LPR10 file. In 1973 these guesses could influence the comparison between old and new platforms. In 1974 and 1975, the age of only seven and six structures respectively had to be estimated (none of which involved more than two spills), so this would not affect the ordering. (Table 20 was created using only those structures with known age.) The fit of this data to a Poisson model is not as good as that shown above for tankers. In fact, both the Chi Square test and the dispersion test suggest substantial heterogeneity in all but the old structures in 1974 and 1975.

This problem is associated with the relatively large number of new platforms that had 2, 3, and even 4 spills in any given year. Since this problem isn't evident in the old platform spill records for 1974-1975, we immediately suspected some kind of run-in problem with new platforms. To investigate this possibility, we tabulated the date of construction, number of spills, and identity of all structures having

TABLE 21
NUMBER OF PLATFORMS REPORTING 0,1,2, ETC. SPILLS FOR STRUCTURES IN THE GULF OF MEXICO FEDERAL OCS REGION

		Number of Spills Reported by Platform Annually					Observed Rate Constant (Spills per Platform-Year)	χ^2 (2DF)	Fisher's Test of Dispersion		
		0	1	2	3	4			χ^2	DF	Approximate Normal Value
1973	New[a]	1057	44	6	2	1	.059	25.27	1649.45	1109	10.35
	Old[b]	661	29	3	1	0	.055	10.61	1057.79	693	8.78
1974	New	1016	25	3	0	0	.030	15.26	1215.06	1043	3.63
	Old	784	13	0	0	0	.016	(1DF) .00	784.00	796	-.29
1975	New	989	23	4	0	2	.038	43.88	1814.32	1017	15.15
	Old	880	11	0	0	0	.012	(1DF) .00	880	890	-.22

[a] New = 0-9 years old

[b] Old = 10^+ years old

three or more spills in 1971 to 1975. This is shown in Table 22. Danenberger's speculation about the hasty implementation of OCS Order No. 8 may well explain the nine old structures that had multiple spills in 1971 and 1972, and SS-158A in 1973. With the exception of SS-158A, no old structure has had more than two spills per year since 1973; and, without exception, no old structure had more than one spill per year since 1974 (Table 21). In those new platforms having multiple spills in 1973-1975, all spills were caused by the repeated failure of the same item or class of items. The four spills at EC 371A in 1975, for example, were all associated with a sump overflow. SS-168B in the same year had two spills from a sump overflow and two from high-level shutoff failure. Both the 1971-1972 history and the problems encountered by the new platforms recently are consistent with the idea of randomly encountered run-in problems.

This suggests that the spill incidence model be based on the idea that we estimate both the number of platforms that will have run-in problems (and thus the number of spills during run-in) and the number of spills generated by platforms beyond the run-in stage. We will assume that it takes five years to iron out all the initial, miscellaneous equipment and design problems. Table 22 shows four platforms with an unusual number of problems in 1973-1975. In the same period there were 1,543 platform-years of exposure of new platforms. We can use the ratio of these numbers as an estimate of the probability that any new structure will have three or four spills in any given year over its first five years of operation. Following

TABLE 22
STRUCTURES HAVING THREE OR MORE SPILLS, 1971 TO 1975

1971	1972	1973	1974	1975
			None	(4)--EC321A--(1972)
	(3)--EI158B--(1964)			
(4)--EI188A--(1958)				
		(3)--EI215B--(1968)		
	(4)--MP296A--(1970)			
(3)--SM23D --(1963)				
(4)--SP55A --(1970)				
		(4)--SS158A--(1960)		
				(4)--SS168B--(1973)
	(3)--SS208F--(1964)			
(5)--SS209B--(1961)				
(3)--SS253A--(1962)				
(4)--SS219A--(1969)	(4)--SS219A--(1969)	(4)--SS219A--(1969)		
(4)--WD73A --(1963)	(3)--WD73A --(1963)			
	(4)--WD305 --(1956)			
	(3)--WD73C --(?)			
	(3)--WD90A --(1964)			

(Number of Spills)--Structure Code--(Date Constructed) this break-in period, we may assume that all platforms exhibit a spill rate comparable to that shown by the old structures of Table 21 for 1974 and 1975. We will also assume that structures not having run-in problems exhibit the same spill rate during their first five years as during their later life. The idea is implemented as follows. We first determine the total number of platform years required in a development. We also determine the number of platform-years spent in the run-in stage, the first five years. The expected number of structures having anomalous break-in problems is then readily calculated. Each structure is assumed to have four spills during the year it experiences its problems. The number of spills from those structures not experiencing run-in problems is then calculated from the Bayesian algorithm using a historical exposure of 1,688 platform-years and 24 spills (the old structure data from Table 21). The two results may then be summed.

One aspect of spillage from offshore production activities that is not addressed by this aggregated data is the blowout problem. A blowout is defined to be the loss of control over the flow in a well. It is usually occasioned by a breach in the well line above the sea floor compounded by a failure of the subsurface control valve. An exception was the Santa Barbara blowout, in which the installation of the production casing was mishandled. Large volumes of oil can be spilled in such incidents, provided only that the reservoir pressure is sufficient to overcome the hydrostatic pressure exerted by the oil and gas mixture standing in the well. Measures to restore well control vary from pinching off the well immediately below the breach, to drilling relief wells into the reservoir in the vicinity of the runaway well.

The USGS lists 56 petroleum blowout incidents for the Gulf of Mexico in Table 2 of their report "Accidents Connected with Federal Oil and Gas Operations in the OCS" (July 1976). The remaining blowout incident of Table A involved a spill of saline water from a sulphur mine. Eight of the 56 incidents resulted in the spillage of a known amount of oil. Eight other incidents involved the spillage of a small but unknown ("minimal") quantity of oil. Forty-three of the 56 incidents occurred during drilling or reworking operations. Twelve of the remaining incidents were caused by rammings by ships or severe storms. Three spills of known volume and six spills of minimal volume occurred during the drilling or reworking operation. Four of the remaining spills of known volume and the two spills of minimal volume were associated with hurricanes or unexpected shifting of the drilling rig. The remaining blowout was caused by an explosion of unknown origin. In addition to these incidents, there were two other blowout incidents of considerable importance. They were the Santa Barbara oil spill of January 28, 1969 (mentioned above) and the fire and spill at Chevron's Platform C in Main Pass 41 on February 10, 1970. It is not clear why the latter incident is not considered a blowout by the USGS.

Table 23 lists the location, date, cause and volume spilled for the ten blowouts in which known volumes of oil

TABLE 23
BLOWOUT INCIDENTS RESULTING IN KNOWN QUANTITIES OF OIL SPILLAGE ON FEDERAL OCS LEASES, 1964-1975

Location	Date	Cause	Volume (Gallons)
WD 117; A-5	1-20-64	Fire	4,200
EI 208; A,C,D	10-03-64	Hurricane	217,560
SS39; No. 7	7-19-65	Unknown	70,896
S. B. Calif; Union A	1-28-69	Mishandled Completion	3,250,000
SS72; No. 3	3-16-69	Rig Shifted	105,000
MP41; C	2-10-70	Fire While Reworking	2,730,000*
ST26; B	12-01-70	Wire Line Work	2,226,000
EI215; B	10-16-71	Explosion and Fire	18,900
SPEL 20; 13	9-07-74	Hurricane	3,150
SPEL 19; 12	12-22-74	Attempt to Repair Hurricane Damage	8,400

*Based on McAuliffe 1975. USCG lists this spill at 1281000 Gallons (30,500 BBL) were spilled. Because the number of blowouts for any particular cause is so small, objective techniques for comparing spill incidence models with the data are largely inapplicable in this problem. The alternative is, therefore, to postulate a reasonable model on subjective grounds with coefficients determinable from the data.

A reasonable supposition is that the number of blowouts incurred during drilling and reworking operations or during routine operation will be Poisson distributed with the exposure measured in well years. Our analysis of the tanker and platform data basis showed that there were sharp declines in the number of spills between 1973 and 1975. This was even more pronounced for platforms in the comparison of 1971-1972 to 1974-1975. While it is reasonable to expect a similar decline in the incidence of blowouts over the same period, there is no way to determine the magnitude of this effect. Rather than guess this number, we will simply use the historical data of Table 23 which dates back to 1964 with the understanding that it probably predicts too many blowouts. In most circumstances this should correspond to a conservative estimate since it will overstate the oil-spill-related disbenefits of OCS petroleum developments. With these provisos, the probabilities of the number of blowouts occurring during drilling and reworking operations or during routine operations unmarked by severe storms or seismic activity can be estimated using the Offshore

Risk Analysis Group's Bayesian algorithm and the historical data of 7 spills in 4.91×10^4 well years. Estimates of the anticipated number of well years involved in a candidate development will require information on reservoir properties in addition to total reserves.

The other three blowouts were caused directly or indirectly by hurricanes. In our previous report, "Monte Carlo Platform Failure/Oil Spill Model", we discussed the means by which estimates of the number of blowouts accompanying natural events like earthquakes or hurricanes may be calculated. The information required for such calculations include storm track and path width statistics, frequency of occurrence of the survival-threatening event, and the seismic properties of a region. The reader is referred to that report for further details.

Volume distributions for production platform spills

Figure 6 shows the observed cumulative histogram for the non-blowout production platform spills in 1973-1975. It is based on 264 incidents, the largest being a 417,270 gallon (9935 BBL) spill from West Delta Block 79 on 9 January 1973. Also shown is the posterior cumulative based on the Bayesian methodology developed for this report. The functional form of the volume distribution was the inverse gamma based on the posterior probability statistic. Unlike the ship spill volume distributions, Figures 3 and 4, the observed histogram is quite different from the analytical form. The analytical posterior distribution is too low in the range 42-420 gallons (1-10 BBL) and too high above 1000 gallons (23.8 BBL). As an example of the differences in the low range, the probability that a non-blowout platform spill will be less than 100 gallons is about .5 based on the observed histogram and .28 based on the posterior distribution.

This discrepancy appears to be due to the censoring* of the USGS data from which the cumulative histogram and the posterior distributions were derived. Whereas the Coast Guard PIRS data retains all spills over 1 gallon, the USGS Event file retains only those 1 BBL and larger. This affects not only the sufficient statistics required for the Bayesian analysis, but it also affects the shape of histogram. Based on Danenberger (1976), approximately 89% of all OCS spills were less than 1 BBL, for example, and so the cumulative

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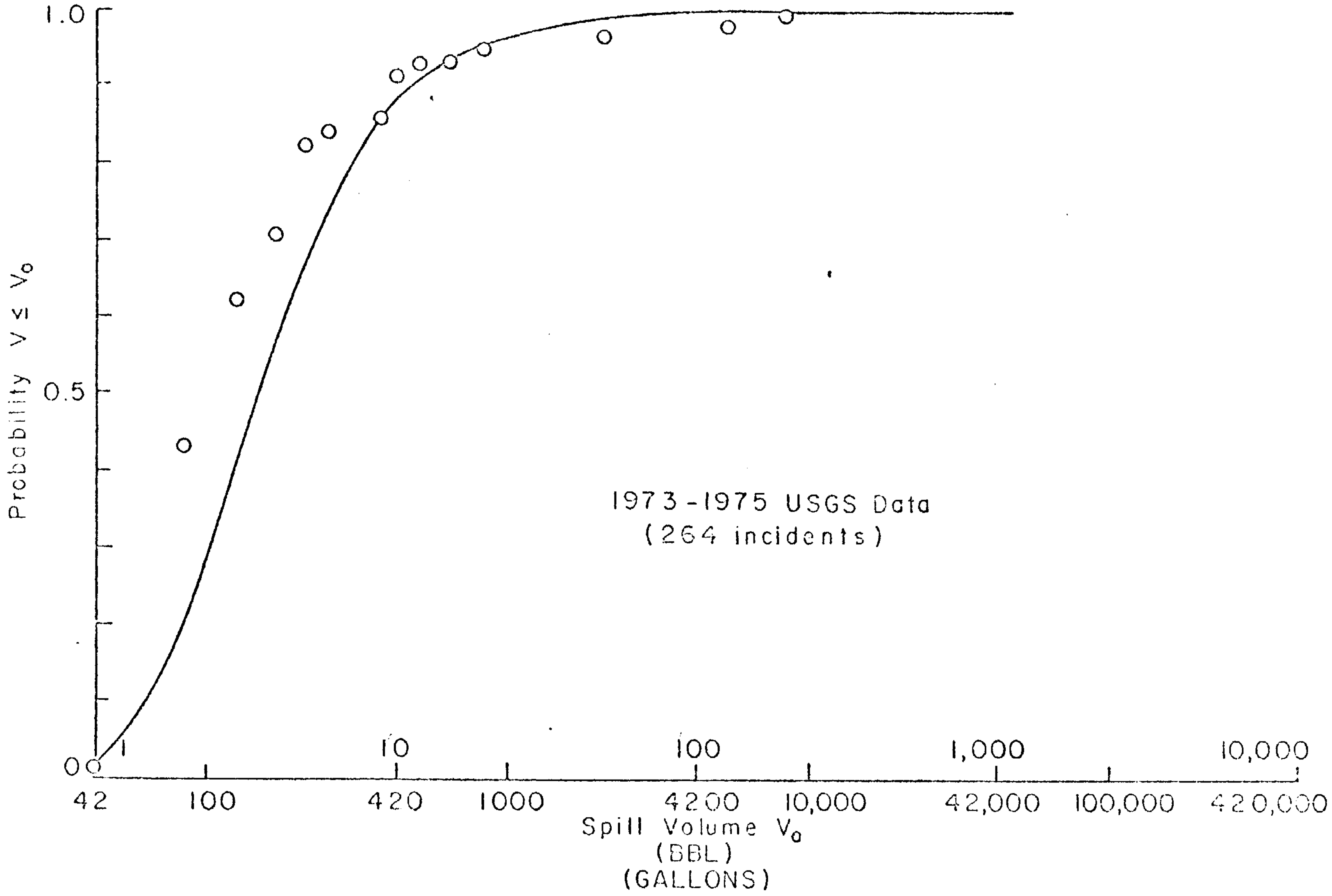
*Censoring is used here in the statitical sense, that is, it means that all data values below (above) some threshold are discarded.

FIGURE 6
POSTERIOR CUMULATIVE PRODUCTION PLATFORM SPILL VOLUME DISTRIBUTION



histogram for the uncensored data would have a value of .89 at 1 BBL versus the .02 shown.*

Figure 7 shows the volume distribution for blowouts based on the ten values of Table 23. No attempt was made to account for the eight blowouts in which a "minimal" volume of oil was reported spilled. Thus, this data might also be considered censored, but the discrepancy between the observed and analytical distributions is not so large as to indicate that this is an important consideration.

It is readily seen that this class of spill is far and away the largest of the various classes considered. In the ten blowouts underlying this table, three were over one million gallons. In comparison, the three largest U.S. tanker spills in 1973-1975 were 7,350 gallons, 32,110 gallons, and 196,100 gallons. Blowouts, of course, are much more uncommon than tanker spills.

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* In an effort to upgrade the spill volume distribution for platforms, we attempted an extreme value analysis of platform spills in the period 1963-1976. The results of this analysis were negative. See Appendix D for further details.

FIGURE 7
POSTERIOR CUMULATIVE DENSITY FUNCTION
PLATFORM BLOWOUTS