3. SUMMARY AND CRITIQUE OF U.S. OIL SPILL DATA RESOURCES

Pipelines and tankers have markedly different cost structures. Tankers can be acquired either by chartering for a fixed period or by being purchased outright. In either case, the real cost of owning and operating the tanker is determined by the going rate on the world tanker charter market. At present, these costs work out to about 10^{-3} dollars/ton mile. (Historically charter rates have been higher, sometimes much higher, but reasonable estimates of long-term average should fall within a factor of two or three of this number.) Pipelines, on the other hand, are constructed for an application; and they have high initial costs, but lower operating costs. Tankers are readily bought and sold and the use to which they are put is highly flexible. Pipelines are obviously of use only for carrying oil between two predetermined, fixed points.

Because of these differences, tankers and pipelines are not in general equivalent transportation modes, and there is no meaningful way of comparing tankers and pipelines in a generic fashion. The idea that one mode is always to be preferred to the other without regard to the application is therefore incorrect. Obviously, if we wanted to transport 100,000 tons of oil a distance of 1000 miles on a one-time-only basis, it would be foolish to build a pipeline when tanker transport could be had for $100,000.

However, in any given application, it is possible to construct a number of scenarios and compare those pipeline and tanker transport systems providing equivalent services. The definition of "equivalent" is, however, complicated by the economies of operating the alternative systems. For example, if a very large oil field were discovered close off the shore of a region that had a modest refining capacity that was supported entirely by local crude production, the economies offered by pipeline transport might make expansion of the existing refinery an attractive alternative, particularly if the other option were long-distance tanker transport. In this case the "equivalent" options would be a short pipeline and a long tanker route.

Assuming that such alternatives can be constructed in a meaningful way, we need only evaluate the spillage accompanying the operation of the various subsystems to determine the oil spillage portion of the tanker/pipeline comparison. The pipeline system will be made up of the pipeline; its pumping stations; and associated equipment like surge tanks. The tanker system will be composed of a loading facility, including storage tanks and an SBM of some type; the tanker fleet and the route to port; and an offloading facility. It is important to determine the spillage for each subsystem in this fashion because the location of a spill determines to a large extent the nature of the environmental impact of the spill.

U.S. oil spill data bases are <u>in principle</u> sufficiently comprehensive to allow us to address most of the important questions regarding the subsystems. The single exception to this generalization is the offshore tanker loading facility for which there is no example within the waters covered by the various U.S. data bases. An important question is how reliable is this data as it relates to the other subsystems given our requirements.

Offshore pipeline spill data is compiled by the U.S. Geological Survey (Department of the Interior), the U.S. Coast Guard (DOT), and (for common carrier or trunk lines) the Office of Pipeline Safety and Operation (DOT). The Geological Survey data applies to the federally controlled OCS region. It is therefore a subset of the total (state waters have historically accounted for about one-third of all offshore oil and condensate production). The OPSO data applies only to offshore pipelines that carry oil produced and owned by entities other than the pipeline operator. The pipeline operator is merely given custody of the oil while it is within the pipeline system. As such, this is again but a subset of the total, although in this case spills in state waters will be reported. The Coast Guard's Pollution Incident Reporting System should contain all spills (from pipelines or whatever) out to three miles irrespective of size. Beyond three miles, spills must be reported in writing to both the Coast Guard and the Environmental Protection Agency if they exceed fifty barrels (2100 gallons). Thus, the PIRS data should encompass all the OPSO data, and the larger spills in the USGS data. The reader is referred to Leotta and Wallace, Frankel and Hathaway, and Snider et al. for more complete discussions of the various data collection arrangements.

By far and away the most useful of the data resources is the Coast Guard's PIRS data because it is more nearly a complete compilation of pipeline spills, at least in theory. However, in this business discrepancies between theory and practice seem to be the rule rather than the exception.

Even if we assume, for example, that all spills are reported to the Coast Guard, there is still the problem of verifying that the incident is properly analyzed and encoded within the PIRS format. This requires considerable discretion and experience on the part of the encoder, particularly in distinguishing transportation-related pipeline spills from spills occurring at offshore production facilities.

One method for investigating this problem is to compare the different data bases. In particular, the OPSO data applies only to transportation-related pipelines, and so an interesting question is how are the incidents in the OPSO file recorded in the Coast Guard and Geological Survey files. Through the courtesy of Mr. Frank Fulton of OPSO we have obtained copies of all the offshore oil spill reports received by OPSO. In the period 1973 through 1975, the following spill incidents were reported (this period was selected as it is covered by the revised and expanded PIRS data).

TABLE 3.1
SUMMARY OF ALL SPILLS IN THE OFFICE OF
PIPELINE SAFETY AND OPERATIONS DATA (1973-1975)

Ref. No.	Date	Name of Carrier	Vol. Spilled (BBLS)	Location
1.	11-3-73	Gulf Refining Co.	75	Barataria Bay La.
2.	5-21-74	Shell Oil Co.	65	Eugene Island Block 331
3.	8-1-74	Shell Pipe Line Corp.	250	Quarantine Bay, LA, near Brenton Sound Block 35
4.	9-10-74	Shell Oil Co.	1500-3500	Main Pass Block 73

If we cross-reference these spills to those within the Coast Guard's reporting system we find the following information on these spills in the PIRS data.

TABLE 3.2
SPILLS AS REPORTED IN THE U.S. COAST GUARD DATA (1973-1975)

Ref. No.	Date	Operator	Source	Quantity Spilled (Gallons)	Location
1.	11-3-73	(Petroleum Refiner)	Transport Pipeline	3,150	29°08'N 90°44'W
2.	5-21-74	Shell Oil Co.	Platform	2,730	EI331
3.	8-1-74	Shell Oil Co.	Platform	6,300	29°24'N 89°30'W
4.	9-16-74	(Crude Petroleum Producer)	Platform	16,800	(Bay or Sound)

The spills having reference numbers 2 and 3 are almost certainly the same incidents. Spills 1 and 4 may be improperly identified, although the choice seems to be the best one possible. Notice that the trunk line spills are improperly attributed to production platforms in three out of the four cases. Also notice that the operator is mistakenly identified as Shell Oil Co. in spill number 3.

We can also look for some of these spills in the data kept by the Geological Survey. In this case only those spills that occur in the Federal OCS region are likely to be reported. Consequently, the Barataria Bay spill and the Quarantine Bay spill are not to be found.

TABLE 3.3
SPILLS AS REPORTED IN THE U.S. GEOLOGICAL SURVEY DATA (1973-1975)

Ref. No.	Date	Lessee	Volume Spilled (BBLS)	Location
1	11-3-73	State Waters		
2	5-21-74	Shell Oil Co.	100	EI-331 (Structure A)
3	8-1-74	State Waters		
4	9-9-74	Shell Oil Co.	2213	MP -73 (Cobia Pipeline)

This data is in good agreement with the O.P.S.O. data. In fact, by conjoining the three data sources we can determine a great deal about the four spill events. Unfortunately, if we use only the Coast Guard's data we would be grossly in error in assessing the spillage from common carrier pipelines.

Another problem of considerable interest is how complete is the Coast Guard data for the larger spills occurring in federal waters--those that would be contained in the Geological Survey's records. Snider et al. maintain that only three of fourteen spill events listed in the Geological Survey's records are to be found in the PIRS data. This is lower than our experience with the two files would suggest, and so we attempted to cross-reference the USGS and USCG spill records. The USGS data was taken from Table D of the July 1976 summary, "Accidents Connected with Federal Oil and Gas Operations in the Outer Continental Shelf." A total of fifteen events were identified in the period 1973-1975, one more than Snider's fourteen. (Snider pparently threw out a barge spill.) Of these, we identified eight in the PIRS data. There were substantial discrepancies in the volume spilled, and some minor variations in the date of the incident. The search was performed by a visual examination of the PIRS records and there is some chance that one or two of the incidents we could not find are actually in the PIRS list, awaiting discovery. The spill events may be cross-referenced between the data sources by using Table 3.4 below. The incident number on the left is the number of the spill in Table D of the USGS report. The numbers on the right-hand side correspond to the District Number (e.g. Coast Guard District No. 8 encompasses the Gulf of Mexico OCS area) and the yearly sequence number of the spill incident for that district.

TABLE 3.4

COMPARISON OF USGS 50+ BBL SPILLS
WITH USCG PIRS DATA

Year	USGS Table D Incident Number	PIRS Data, District and Incident Sequence Number
1973	40	8-97
	41	Not Found
	42	Not Found
	43	8-2024
1974	44	Not Found
	45	8-1536
	46	Not Found
	47	Not Found
	48	8-3663
	49	8-3919
	50	8-3503 or 8-3510 (?)
	51	8-4442
1975	52	Not Found
	53	Not Found
	54	8-3346
TOTAL	15	TOTAL 8

Of the two errors we have so far discussed in the Coast Guard's PIRS data, it is clear that the mislabeling of pipeline and platform spills is the most harmful with respect to addressing the pipeline spillage problem. If the Coast Guard data was simply a nonexhaustive collection of spill events, a way could be found to proceed. However, with the confusion that exists between pipeline and platform spills, no simple technique is availble to correct or accommodate the resultant misinformation.

Some further insight into the quality of the PIRS data can be gathered from an analysis of the monthly trends in the data. The number of spills of crude oil by month is listed in Tables 3.5 through 3.17 for platforms and pipelines according to the coastal area codes included in the PIRS format. Table 3.5 aggregates all the coastal regions. In the rows falling under the heading "pipeline spills" we can see a most disconcerting feature of this particular sorting of the data, the peculiar clump of pipeline incidents occurring in August 1973 through November 1973. Was this a real trend, or did the encoder simply decide to call more spills pipeline spills? It is difficult to say, but we should observe that the one correctly identified OPSO spill occurred in this period (i.e. Reference No. 1, on 3 November 1973). Table 3.7 also shows that a substantial portion of these spills occurred in river or channel areas.

In addition to these three federal data bases on oil spillage (the USCG, USGS, and OPSO), there are a number of

TABLE 3

INCICENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: SUM OF ALL AREAS

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	148	76	92	96	101	112	129	129	124	133	180	142
74	105	128	151	131	182	145	187	134	136	120	89	143
75	88	86	104	82	119	98	105	81	83	65	85	67

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	1	0	1	1	0	2	71	56	76	21	1
74	1	0	0	0	1	0	0	0	0	1	1	3
75	5	7	5	3	11	12	6	8	2	9	5	4

TABLE 3

INCICENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: BAY CR SOUND

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	55	22	23	41	34	33	71	6	0	2	48	70
74	74	74	85	65	119	74	102	62	69	66	46	57
75	4	10	26	22	28	26	46	20	23	8	16	16

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	1	0	0	0	0	2	6	0	3	5	0
74	1	0	0	0	1	0	0	0	0	1	1	2
75	3	2	2	1	7	7	2	6	0	3	2	1

TABLE 3.

INCICENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: RIVER OR CHANNEL

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	29	10	12	6	20	18	1	62	38	60	37	3
74	2	0	1	0	1	13	2	4	0	0	0	2
75	0	1	3	6	0	1	1	3	6	2	0	0

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	54	40	57	14	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	2	1	1

TABLE 3.°

INCIDENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: PORT OR HARBOR AREA

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	1	0	0	0	0	1	0	0
74	0	0	0	0	0	0	0	0	2	1	0	0
75	0	0	0	0	0	0	0	1	1	0	2	1

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	1	0	1
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	1	0	1	0	1	0	0	0	0	0	0

TABLE 3.[illegible]

INCIDENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: NON-NAV TRIBUTARY

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	1	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	1	0	0	0	0	0	2	1

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	1	0	0	1	0	0

TABLE 3.1^

INCIDENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

CCASTAL AREA: NON-NAV ENCLOSED

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	1	0	0	0	0	0	0	0	0	1	0

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 3

INCIDENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: BEACH OR SHORE

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	1	0	0	0	2
75	0	1	2	0	0	1	0	0	1	0	0	0

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 3.[illegible]

INCIDENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: BEACH ENCLSD NONNAV

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	3
75	0	1	0	0	0	0	0	0	0	0	0	0

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 3.

INCIDENCE OF PLATFORM AND PIPELINE SPILLS IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: BASELINE TO 3 MILES

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	19	17	18	14	25	28	6	14	25	19	26	14
74	1	0	0	0	0	16	0	4	7	0	3	15
75	36	25	20	11	30	16	9	12	17	16	15	16

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	1	0	0	0	4	12	11	0	0
74	0	0	0	0	0	0	0	0	0	0	0	1
75	2	1	3	1	3	3	1	2	2	0	1	1

TABLE

INCIDENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: 3 TO 12 MILES

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH											
	1	2	3	4	5	6	7	8	9	10	11	12
73	28	10	9	21	12	27	6	30	31	21	5	5
74	0	0	0	0	0	0	0	0	7	2	0	0
75	1	1	0	0	3	1	3	9	23	8	18	13

PIPELINE SPILLS

YEAR	MONTH											
	1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	1	0	0	6	2	3	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	1	0	0	2	1	0

TABLE 3.

INCIDENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: 12 TO 50 MILES

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	14	15	30	11	9	5	43	17	28	28	61	50
74	28	54	65	66	62	42	83	63	51	51	40	64
75	47	46	53	43	57	53	46	35	12	30	31	20

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	1	2	1	1	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	3	0	0	1	1	1	0	0	1	0	1

TABLE

INCIDENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: 50 TO 100 MILES

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	3	2	0	3	0	1	2	0	2	2	2	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	1	0	1	0	0

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	1	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 3.17

INCIDENCE OF PLATFORM AND PIPELINE SPILLS
IN THE GULF OF MEXICO BY YEAR AND MONTH

COASTAL AREA: > 100 MILES OFFSHORE

CRUDE OIL SPILLS ONLY (MATERIAL=1000,1001)

PLATFORM SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0

PIPELINE SPILLS

YEAR	MONTH 1	2	3	4	5	6	7	8	9	10	11	12
73	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0

state agencies that maintain files of varying degrees of completeness that might be applied to the pipeline problem. Louisiana, for example, has a non-automated file system in which a spill report is retained for six months and then discarded. Maine is attempting to automate their spill reporting system and it appears that they have several years of data. However, neither maintains its data in a readily accessible form.

Louisiana's policy of discarding its data is unfortunate because the problem of disaggregating pipeline and platform spillage could be attacked using the USGS data provided we could estimate the spillage that occurred in the adjoining state waters.

The tanker spillage problem can be attacked in part by using the PIRS data as there does not appear to be any systematic and uncorrectable miscoding. However, as we mentioned above, the SBM subsystem is not properly covered in presently available U.S. data bases. In a previous study (Devanney and Stewart, 1974) we compiled as complete a listing of SBM spill incidents as is available today. The data is perhaps of some value in addressing the problem, but we had some strong reservations regarding the accuracy and completeness of the information we managed to uncover. The reader is referred to our report for a discussion of the SBM data problems. Frenkel and Hathaway have attempted a fault tree analysis of SBM systems, but they did not take the matter to its final conclusion. They did calculate some interesting numbers regarding large spills from the connecting hose and they discussed techniques for determining optimal hose replacement strategies.*

The spillage associated with tankers en route and while offloading is well represented in the PIRS data, although we have some strong doubts regarding the completeness of the data as it applies to ships in the offshore region. The following section details our analysis of this problem.

*They calculate an average of 4.6 major hose spills per year and a spillage rate of 8.8×10^{-6} BBLS spilled/BBL handled.