

Survey Appendix

CARNEGIE MELLON UNIVERSITY

CARNEGIE INSTITUTE OF TECHNOLOGY

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY

TITLE: The Risk Of Accidents And Spills At Offshore Production Platforms:
A Statistical Analysis Of Risk Factors And The Development Of
Predictive Models

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3	Unqualified personnel
4	Recurring violations
5	Civil penalties assessed
6	Safety devices not being maintained
7	New operators
8	Operator history of noncompliance
9	Knowing and willful violations
10	Facility housekeeping and maintenance
11	Boiler house reports (falsified reports)
12	Operator noncompliance with lease stipulations
13	Inadequate maintenance of gas detection systems
14	Manned facilities
15	Unmanned facilities
16	Third party personnel
17	Operator personnel
18	Oil production
19	Gas production
20	H2S production
21	Operators known as "problem operators"
22	Calls from disgruntled employees
23	Anonymous reports of bad practices of operators.
24	Operator attitude concerning regulations
25	EPA violations
26	Production volume (MCF and BOPD)
27	Waiver for other than daily pollution or monthly production inspections
28	Equipment in use with a history of known failures
29	Platforms equipped with fired components
30	INCs addressing safety systems or devices found in bypass
31	High pressure production
32	Low pressure production
33	High technology operation (automated operation)
34	Low technology operation (partially automated operation RTU)
35	Operations with conditions conducive to potential fires
36	Approved plan violations (including burning and welding)
37	Proximity to shipping lanes
38	Use of new or unproven technology
39	Barge shipping/oil storage
40	Amount of production coming into or crossing platform via pipelines
41	Competitive reservoir (one operator vs. Another)
42	Contractors known as "problem contractors"
43	Complex structures
44	Satellite structures
45	Manpower shortage
46	Drilling exploration vs. Development (deepwater)
47	Drilling in environmentally sensitive areas
48	Use of oil base mud

49	Age of facility
50	Inexperience of operator
51	Lack of knowledge of equipment/operation
52	Rigs new to the Gulf
53	Rigs new to the District
54	Hurricane season
55	Annual crane maintenance
56	Operator compliance with component shut-in
57	Change from oil company to contractor
58	Operator switching contractors and location of records
59	Shallow hazards
60	Wildcat drilling
61	Turnkey drilling operators
62	High pressure workovers
63	Reverse circulation with coil tubing
64	Wellbore equipment uncertainty in workovers
65	Testing of fire loop system to initiate surface and sub-surface shut-in

Table -2 Survey 1 – identification of risk factors

1.3 Survey two

The goal of survey two was to eliminate factors from the original list of 65 and try to broadly categorize the factors. The three broad categories were:

- Operator performance
- Technology
- Current operations

These three categories were ranked against each other with the following results.

Category	Mean Score	Risk Rank
Operator performance	1.11	1
Current operations	2.00	2
Technology	2.89	3

Table -3 Survey 2 – category ranking

The respondents were then asked to rank the individual risk factors within each category. The results of this ranking are shown in Table 4 below.

Distribution of responses on risk factors for offshore operations												
		Respondent districts										
#	Risk categories	H	H	H	L	L	NO	CC	HQ	HQ	aver.	st_dev
A	Operator performance	2	1	1	1	1	1	1	1	1	1.11	0.33

1	Accidents	8	3	6	1	1	4	6	10	1	4.44	3.28
2	Knowing and willful violations	10	4	2	2	2	1	11	3	5	4.44	3.64
3	History of noncompliance	4	2	1	4	4	10	10	2	13	5.56	4.30
4	Safety systems INCs or devices found bypassed	3	6	5	5	5	2	17	9	3	6.11	4.57
5	Safety devices not maintained	5	5	4	6	6	6	15	6	2	6.11	3.59
6	Pollution incidents	9	9	13	3	3	5	3	8	4	6.33	3.57
7	Lack of knowledge of equipment or operation	1	7	10	7	11	14	5	5	7	7.44	3.81
8	Operator attitude regarding regulations	2	1	11	x	15	16	16	1	10	9.00	6.72
9	Falsified reports	11	13	3	11	7	3	9	4	12	8.11	3.98
10	Contractor know as "problem contractors"	7	15	7	x	14	8	4	13	8	9.50	3.96
11	Inadequate maintenance of gas detection systems	12	8	12	10	16	7	14	6	11	10.67	3.28
12	Noncompliance w/ lease stipulations	14	10	9	x	8	9	7	11	17	10.63	3.34
13	New operators	6	16	14	x	17	17	1	17	6	11.75	6.41
14	Poor facility maintenance	17	11	16	8	9	11	2	7	15	10.67	4.82
15	Personnel in violation of training requirements	13	17	18	12	18	13	8	12	14	13.89	3.30
16	Poor facility housekeeping	16	12	15	9	10	12	18	15	16	13.67	3.04
17	EPA violations	15	14	17	x	19	15	13	14	9	14.50	2.93
18	Anonymous reports on operators	x	18	8	x	12	18	12	16	18	14.57	3.95
19	Call from disgruntled employees	x	19	19	x	13	19	19	x	19	18.00	2.45
B	Technology	3	3	3	3	3	3	3	3	2	2.89	0.33
1	Equipment with history of known failures	2	1	2	2	3	1	4	1	1	1.89	1.05
2	Complex structures	3	4	3	3	2	3	5	3	2	3.11	0.93
3	Use of new or unproven Technology	5	2	5	4	4	4	6	2	4	4.00	1.32
4	Platforms equipped with fired components	1	7	4	1	1	x	8	7	6	4.38	3.02
5	Low technology operation)(partial automated RTU)	4	3	6	7	7	5	1	5	5	4.78	1.92
6	Age of facility	8	6	1	5	5	2	7	6	3	4.78	2.33
7	Satellite structure	7	5	7	6	8	6	2	8	7	6.22	1.86
8	High technology operation (automated)	6	8	8	8	6	7	3	4	8	6.44	1.88
C	Current operations	1	2	2	2	2	2	2	2	3	2.00	0.50
1	H2S production	1	5	4	x	21	6	3	6	1	5.88	6.42
2	Conditions conducive to potential fires	12	2	5	2	3	16	4	7	2	5.89	4.99
3	Manned facilities	15	1	3	1	1	8	17	4	4	6.00	6.10
4	Simultaneous operations	7	9	10	6	2	7	20	5	3	7.67	5.29
5	Third party personnel	5	4	2	x	12	15	1	17	11	8.38	6.14
6	Manpower shortage	3	3	1	5	6	20	16	9	16	8.78	6.89
7	Production volume (MCF/BOPD)	10	13	8	9	5	5	21	2	7	8.89	5.56
8	Proximity to environmentally sensitive areas	2	22	13	13	14	1	18	8	6	10.78	7.08
9	Drilling in environmentally sensitive areas	4	17	16	12	16	2	19	8	14	12.00	6.02
10	High pressure production	21	6	11	10	8	13	12	3	8	10.22	5.09
11	Deepwater operations	13	18	17	3	4	26	2	14	5	11.33	8.31

12	Exploration drilling vs. Development drilling	8	16	18	x	17	11	5	15	19	13.63	5.07
13	Oil production	11	12	7	x	22	4	23	16	12	13.38	6.67
14	Unmanned facilities	9	15	23	4	11	23	6	23	10	13.78	7.56
15	Use of oil bas mud	6	10	19	17	18	9	8	20	22	14.33	6.02
16	Gas production	16	11	12	x	23	14	13	10	9	13.50	4.44
17	Barge shipping/oil storage	14	14	9	14	9	12	11	18	24	13.89	4.73
18	Approve plan violations (including burning/welding)	19	24	22	7	7	17	7	1	17	13.44	8.06
19	Sustained high casing pressures	20	8	6	15	19	10	22	19	15	14.89	5.71
20	Proximity to shipping lanes	17	23	14	8	15	19	24	11	13	16.00	5.32
21	Low pressure production	22	7	21	11	10	22	10	21	20	16.00	6.28
22	Presence of gather lines	X	20	15	16	20	21	9	13	21	16.88	4.39
23	Proximity to shore	18	19	24	x	23	3	14	12	25	17.25	7.40
24	Waivers	X	25	20	x	x	25	15	22	18	20.83	3.97
25	Competitive reservoirs	X	21	25	x	x	24	25	x	23	23.60	1.67

Table -4 Survey 2 – results for all factors

1.4 Survey three

There were some problems with survey number two.

- Survey 2 only had 9 respondents. More respondents were desired.
- The categories in survey two were too broad. That is, the survey did not provide enough information to compare risks.

To address these problems, another survey administered. This time there were 13 respondents, and the questions were re-categorized so that direct comparisons could be made.

The broad categories in survey 3 were as follows:

- Performance Risk
 - History of noncompliance
 - History of incidents
 - Operator traits
- Production risk
 - Production Characteristics
 - Simulations operations
 - Location of facility
 - Type of facility

The results are as follows:

Performance risk		Mean score	Risk rank
	History of noncompliance	1.33	1
	History of incidents	1.93	2
	Operator traits	2.73	3
Production risk			
	Production characteristics	1.29	1
	Simultaneous operations	2.21	2
	Location of facility	3.21	3
	Type of facility	3.36	4

Table -5 Survey 3 – category ranking

In addition, within these broad categories, individual risk factors were ranked and compared to each other. The results of these comparisons are listed in Table 6 below.

Risk Category 1 - Performance risk																		
District	H	H	H	L	L	L	NO	NO	LJ	LJ	LJ	LC	CC	HQ	HQ	tot.	aver.	st_dev
History of noncompliance	1	1	1	2	1	1	1	2	2	2	1	1	1	1	2	20	1.33	0.49
Violations (INCs)	1	1	1	3	1	3	2	1	1	1	3	1	1	3	3	26	1.73	0.96
Civil penalties	2	2	2	2	2	1	1	3	3	2	2	3	3	2	2	32	2.13	0.64
Criminal penalties	3	3	3	1	3	2	3	2	2	3	1	2	2	1	1	32	2.13	0.83
History of incidents	2	2	2	1	3	2	2	1	1	1	3	2	3	3	1	29	1.93	0.80
Injury/fatality	1	1	1	1	1	2	1	1	1	1	3	2	1	1	2	20	1.33	0.62
Fire/explosion	3	2	2	2	2	1	2	2	2	3	2	1	2	2	3	31	2.07	0.59
Pollution/event	2	3	3	3	3	3	3	3	5	2	3	3	3	3	4	46	3.07	0.70
Operator traits	3	3	3	3	2	3	3	3	3	3	2	3	2	2	3	41	2.73	0.46
Lack of onsite personnel	1	2	2	1	4	3	1	3	1	1	2	5	4	1	1	32	2.13	1.36
New operator	3	1	1	2	1	1	2	1	5	3	5	4	2	4	2	37	2.47	1.46
Contractors involved	4	3	4	4	2	2	3	2	3	4	3	3	1	2	5	45	3.00	1.07
Turnkey operators	2	4	3	5	3	4	4	5	2	2	4	1	3	3	4	49	3.27	1.16
Service companies	5	5	5	3	5	5	5	4	4	5	1	2	5	5	3	62	4.13	1.30
Risk category 2 - Production risk																		
	H	H	H	L	L	L	NO	NO	LJ	LJ	LJ	LC	CC	HQ	HQ	tot.	aver.	st_dev
Production characteristics	1	1	X	1	2	2	1	1	1	1	3	1	1	1	1	18	1.29	0.61
H2s	1	1	1	1	1	1	2	1	3	1	1	1	1	1	1	18	1.20	0.56
High pressure	6	3	4	4	2	2	5	2	4	2	3	2	2	2	2	45	3.00	1.31
Oil	2	2	5	3	3	3	1	3	1	4	2	6	4	4	6	49	3.27	1.58
Volume	4	4	3	2	4	4	3	6	5	3	4	4	3	5	3	57	3.80	1.01
Storage facilities	3	5	2	5	5	6	4	5	2	6	6	3	5	6	4	67	4.47	1.41
Gas	5	6	6	6	6	5	6	4	6	5	5	5	5	3	5	78	5.20	0.86

Simultaneous operations	2	2	X	3	1	1	4	2	3	2	2	2	3	2	2	31	2.21	0.80
Type of operation	2	1	1	1	2	2	1	1	1	1	1	1	2	2	1	20	1.33	0.49
Number of operations	1	2	2	2	1	1	2	2	2	2	2	2	1	1	2	25	1.67	0.49
Location of facility	4	3	X	4	3	3	2	3	2	4	4	3	2	4	4	45	3.21	0.80
Proximity to sensitive areas	1	1	4	2	1	1	1	1	1	3	2	4	1	2	4	29	1.93	1.22
Complex structures	4	4	2	1	4	4	3	2	4	5	3	1	3	4	2	46	3.07	1.22
Proximity to shore	2	2	3	4	2	5	2	3	2	4	4	3	2	5	5	48	3.20	1.21
Proximity to shipping lanes	3	3	5	3	3	2	4	5	3	2	1	5	5	1	3	48	3.20	1.37
Technology(auto./unproved)	5	5	1	5	5	3	5	4	5	1	5	2	4	3	1	54	3.60	1.64
Type of facility	4	4	X	2	4	4	3	4	4	3	1	4	4	3	3	47	3.36	0.93
Major facility	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	17	1.13	0.35
Onboard personnel	2	3	2	2	2	3	2	2	2	2	1	2	3	2	1	31	2.07	0.59
Minor facility	3	2	3	3	3	2	3	3	3	3	3	3	2	3	3	42	2.80	0.41

Table -6 Survey 3 – further categorizing

1.5 Survey four

In the third survey, two items were considered by the experts to be very important indicators of a platforms' future problems: 1) a prior history of poor inspections and 2) a prior history of accidents and spills. Unfortunately, this survey did not allow the development of survey based risk prediction models. The risk factors were first put into categories, then compared to each other within those categories. This made it difficult to compare the relative importance of risk factors.

For example, under the category **“History of noncompliance,”** the factor **“criminal penalties”** is tied for the third position with **“civil penalties.”** Note that under **“History of incidents,”** the factor **“having experienced a fire or explosion”** was the second ranked risk factor in this category. The important question is: How do you compare the relative merit of **“criminal penalties”** versus **“having experienced a fire or explosion?”** To address this question, a fourth survey was conducted.

In addition to directly comparing risk factors, the fourth survey was designed to quantify the risk factors determined through the three earlier surveys. For example, the definition of the risk factor **“age”** was too ambiguous. The fourth survey sought to quantify what constituted a **“risky age.”** Did the respondent mean old platforms? New platforms? How old, or how new?

The subjects in the fourth survey were all involved in the inspection of offshore operations and were all government employees. There were 59 respondents in all: 47 inspectors, 11 engineers, and one supervisor. There were three sections to the fourth survey.

1. Respondent data – this section is designed to gather some descriptive data on the respondents to see if there is any relationship between a respondents personal traits or experience and their perception of risk
2. Risk quantification – in this section, respondents are asked to quantify their risk estimates by assessing different levels for each risk factor. For example, for platform age, the ages are broken up into 5-year increments and the respondents are asked to assign a perceived riskiness for each 5-year increment.
3. Risk comparisons – in this section, direct comparisons are made between the risk factors and an attempt is made to determine their relative importance.

The following three sections list summary information, graphs, and tables for the fourth survey administered in June 1998.

1.5.1 Respondent data

The respondents were asked the following questions:

1. What is your job title?
2. In which district do you currently work?
3. Years of experience as an inspector?
4. Years of offshore experience (other than as an inspector)?
5. As an inspector, what percentage of your time has been spent as a production inspector?
6. As an inspector, what percentage of your time has been spent as a drilling inspector?
7. Have you ever been injured on a platform?
8. Have you ever seen anyone injured on a platform?
9. Any comments?

The results from some of these questions are summarized in the tables below.

Years Inspector	Count Of Years as an Inspector			Grand Total
	Engineer	Inspector	supervisor	
0	7	4	1	12
0.5		1		1
1	1	4		5
3		1		1
3.5		1		1
7		7		7
8		3		3
9	1	2		3
10		3		3
12		1		1
14		4		4
14.5		1		1
16		1		1
17		1		1
18.5		1		1
19		2		2
20		4		4
21		1		1
23		1		1
24		2		2
25	1	1		2
27	1			1
X		1		1
Grand Total	11	47	1	59

Table -7 Survey 4 – years of experience as an inspector

Times You	Count Of Times You Have Been Injured			Grand Total
	Engineer	Inspector	Supervisor	
0	9	30	1	40
1	2	9		11
2		6		6
3		2		2
Grand Total	11	47	1	59

Table-8 Survey 4 – number of times the respondent has been injured on a platform

Times Others	Count Of Times You Have See Others Injured			Grand Total
	Engineer	Inspector	Supervisor	
0	7	14	1	22

1	2	5		7
2		2		2
3		3		3
4		3		3
5	1	6		7
6		1		1
7		2		2
8		1		1
10	1	2		3
12		1		1
25		1		1
30		1		1
150		1		1
many		2		2
X		2		2
Grand Total	11	47	1	59

Table -9 Survey 4 – number of times the respondent has seen a person injured on a platform

1.5.2 Quantification data

The results from the risk quantification section are summarized in the tables and figures that follow. The last 6 columns contain the count of the number of times the respondents picked that particular level of risk. The “x” means that the respondent did not answer that question.

Questions	Category	aver.	st_dev	X	1	2	3	4	5
age	>25	4.48	0.68	1	0	0	6	18	34
num_inc_5_comp	>25	4.42	0.83	0	0	3	4	17	35
number_sim_ops	>5	4.41	0.75	1	0	1	6	19	32
work_exp	0-3	4.41	0.62	0	0	0	4	27	28
num_inc_25_comp	>25	4.39	0.77	0	0	2	4	22	31
numb_acc_5_yrs	>10	4.34	1.05	1	2	2	7	10	37
op_comp_exp	0-3	4.31	0.65	0	0	0	6	29	24
%_cont_out	76-100	4.27	0.87	0	0	4	4	23	28
num_inc_5_comp	21-25	4.24	0.86	0	0	3	7	22	27
num_inc_50_comp	>25	4.22	0.91	0	0	4	7	20	28
numb_acc_5_yrs	9-10	4.14	0.96	0	1	3	8	22	25
number_sim_ops	5	4.10	0.79	1	0	1	12	25	20
num_inc_25_comp	21-25	4.10	0.79	1	0	3	6	31	18
number_sim_ops	4	4.05	2.62	0	0	2	20	28	8
age	21-25	4.03	0.67	1	0	0	12	32	14
numb_components	>50	4.02	0.82	0	0	2	13	26	18
type_inc	P-103	3.95	0.99	0	2	1	15	21	20
num_inc_50_comp	21-25	3.91	0.96	1	1	3	14	22	18

volume_oil_prod	>25	3.86	0.92	0	1	1	20	20	17
%_cont_out	51-75	3.83	0.72	0	0	4	9	39	7
numb_acc_5_yrs	7-8	3.81	0.88	0	0	6	11	30	12
dist_to_ship_lane	0-1/2	3.81	1.11	0	5	1	9	29	15
num_well_comp	>25	3.81	0.97	0	1	4	16	22	16
type_inc	E-100	3.81	0.98	1	1	4	16	21	16
numb_components	41-50	3.76	0.73	0	0	3	15	34	7
num_inc_5_comp	16-20	3.76	0.80	1	0	2	21	24	11
fired_vessel	fire_vess	3.69	0.65	0	0	0	24	29	6
num_inc_25_comp	16-20	3.69	0.81	0	1	2	19	29	8
age	16-20	3.63	0.64	0	0	1	24	30	4
type_operation	welding	3.59	0.83	0	1	3	22	26	7
storage_vess	storage_vess	3.59	0.79	0	1	3	20	30	5
type_prod_spill	oil	3.59	0.77	0	1	1	25	26	6
work_exp	4-6	3.59	0.62	0	0	2	22	33	2
num_well_comp	21-25	3.59	0.85	0	1	3	23	24	8
dist_to_ship_lane	1/2-1	3.59	1.05	0	5	1	16	28	9
type_inc	G-110	3.58	0.83	0	1	3	23	25	7
type_operation	construction	3.58	0.91	0	1	5	21	23	9
volume_oil_prod	21-25	3.58	0.89	0	1	4	23	22	9
type_operation	well_work_over	3.54	0.70	0	0	3	25	27	4
type_operation	vess_cleanout	3.54	0.75	0	1	2	24	28	4
volume_gas_prod	>40	3.53	1.03	1	2	4	26	13	13
numb_components	31-40	3.53	0.65	0	0	2	27	27	3
op_comp_exp	4-6	3.51	0.60	0	0	2	26	30	1
type_operation	clean_pig_trap	3.48	0.76	3	0	4	26	21	5
number_sim_ops	3	3.47	0.73	0	0	5	24	27	3
num_drill_slots	>35	3.44	1.12	0	5	3	23	17	11
well_press	>2000	3.42	0.95	0	3	3	26	20	7
num_inc_50_comp	16-20	3.41	0.95	0	2	6	24	20	7
numb_acc_5_yrs	5-6	3.38	0.79	1	0	7	26	21	4
volume_gas_prod	36-40	3.37	0.85	0	1	5	30	17	6
type_operation	well_completion	3.36	0.74	0	1	3	32	20	3
numb_components	confidence	3.36	0.76	0	1	3	33	18	4
num_well_comp	16-20	3.36	0.78	0	1	5	28	22	3
num_drill_slots	31-35	3.32	1.01	0	5	2	27	19	6
num_inc_5_comp	11-15	3.31	0.80	1	0	8	28	18	4
type_enf_code	S	3.31	1.10	0	5	7	19	21	7
type_inc	W-100	3.29	0.85	0	1	7	30	16	5
type_inc	P-240	3.29	0.95	0	4	3	29	18	5
volume_oil_prod	16-20	3.29	0.64	0	0	6	30	23	0
type_operation	wire_ln_wk	3.27	0.69	0	2	2	33	22	0
type_operation	crane_op	3.27	0.78	0	1	6	31	18	3
type_prod_spill	both	3.27	0.67	0	1	1	41	13	3
type_prod_acc	oil	3.25	0.78	0	2	4	32	19	2
volume_gas_prod	31-35	3.25	0.66	0	0	5	36	16	2
dist_to_ship_lane	1-11/2	3.22	0.90	1	4	3	30	18	3
type_prod_acc	both	3.22	0.62	0	1	1	43	12	2

%_cont_out	26-50	3.22	0.70	0	1	5	34	18	1
num_on_plat	>20	3.21	1.33	3	7	11	13	13	12
type_operation	fabrication	3.21	0.95	1	3	10	19	24	2
type_inc	H-126	3.19	1.11	0	6	6	25	15	7
numb_components	21-30	3.17	0.57	1	0	3	44	9	2
num_inc_25_comp	11-15	3.17	0.75	1	1	7	33	15	2
num_drill_slots	26-30	3.17	0.89	0	5	2	32	18	2
pres_H2S	H2S_pres	3.15	1.05	0	2	15	21	14	7
well_press	1500-2000	3.15	0.71	0	1	6	37	13	2
type_inc	P-412	3.14	1.09	0	5	11	19	19	5
type_acc_sp	fire	3.08	0.92	0	3	10	28	15	3
type_enf_code	C	3.07	0.72	0	1	8	38	10	2
volume_gas_prod	26-30	3.07	0.58	0	0	8	39	12	0
num_well_comp	11-15	3.07	0.69	0	1	8	37	12	1
num_on_plat	0	3.05	1.49	3	15	4	11	15	11
numb_acc_5_yrs	3-4	3.03	0.67	0	0	12	33	14	0
type_penalty	INC_crim_pen	3.02	1.32	0	9	13	15	12	10
num_drill_slots	21-25	2.98	0.75	0	5	2	41	11	0
volume_oil_prod	11-15	2.98	0.54	0	0	9	42	8	0
num_on_plat	16-20	2.98	1.11	2	6	13	18	16	4
well_press	1000-1500	2.97	0.56	0	1	7	44	7	0
num_inc_50_comp	11-15	2.97	0.99	1	3	17	20	15	3
type_acc_sp	minor_spill	2.95	0.68	0	0	14	35	9	1
type_penalty	INC_civ_pen	2.95	0.97	0	4	15	22	16	2
type_acc_sp	explosion	2.95	1.06	0	6	12	24	13	4
op_comp_exp	7-9	2.95	0.51	0	0	9	44	6	0
work_exp	7-9	2.95	0.51	0	0	9	44	6	0
volume_gas_prod	21-25	2.95	0.54	0	1	7	45	6	0
num_drill_slots	16-20	2.92	0.73	0	4	6	40	9	0
type_acc_sp	major_spill	2.91	1.17	1	10	8	21	15	4
type_operation	painting	2.90	0.92	0	5	11	30	11	2
dist_to_ship_lane	11/2-2	2.90	0.89	1	6	6	36	8	2
age	11-15	2.88	0.56	0	0	13	40	6	0
num_on_plat	11-15	2.88	0.90	3	5	10	29	11	1
number_sim_ops	2	2.85	0.74	0	3	11	38	6	1
water_depth	>400	2.85	1.00	0	9	4	36	7	3
numb_components	11-20	2.83	0.53	0	0	14	41	4	0
type_acc_sp	fatality	2.80	1.06	0	9	11	24	13	2
num_on_plat	6-10	2.80	0.83	0	4	14	32	8	1
water_depth	301-350	2.80	0.91	0	7	7	39	3	3
well_press	500-1000	2.78	0.65	0	3	11	41	4	0
volume_gas_prod	16-20	2.76	0.65	0	4	9	43	3	0
water_depth	251-300	2.75	0.80	0	7	6	42	3	1
num_on_plat	1-5	2.73	0.74	0	4	14	35	6	0
water_depth	151-200	2.71	0.67	0	6	6	46	1	0
dist_to_shore	0-25	2.71	0.95	0	10	5	38	4	2
type_enf_code	W	2.69	0.73	0	4	15	35	5	0
num_inc_5_comp	6-10	2.69	0.86	0	3	23	23	9	1

dist_to_shore	51-75	2.69	0.77	0	8	5	43	3	0
water_depth	201-250	2.69	0.68	0	6	7	45	1	0
num_drill_slots	11-15	2.69	0.70	0	5	11	40	3	0
dist_to_shore	>125	2.69	0.99	0	10	8	33	6	2
dist_to_shore	76-100	2.68	0.75	0	7	8	41	3	0
num_well_comp	6-10	2.68	0.73	0	5	13	37	4	0
water_depth	51-100	2.68	0.80	0	8	7	40	4	0
dist_to_shore	26-50	2.68	0.78	0	9	3	45	2	0
water_depth	101-150	2.68	0.75	0	7	8	41	3	0
type_prod_acc	gas	2.66	0.73	0	3	20	30	6	0
water_depth	0-50	2.66	0.92	0	10	6	39	2	2
dist_to_shore	101-125	2.64	0.85	0	9	8	37	5	0
op_comp_exp	10-12	2.63	0.61	0	0	25	32	1	1
type_acc_sp	vessel_strike	2.61	0.95	0	10	11	31	6	1
num_inc_25_comp	6-10	2.61	0.95	0	7	20	22	9	1
volume_gas_prod	11-15	2.61	0.67	0	5	14	39	1	0
type_acc_sp	weather_dam	2.60	0.88	1	8	13	32	4	1
type_penalty	INC_no_pen	2.59	0.87	0	9	12	32	6	0
type_inc	P-406	2.58	0.89	0	6	22	23	7	1
volume_oil_prod	6-10	2.58	0.72	0	5	18	33	3	0
well_press	0-500	2.56	0.91	0	10	12	32	4	1
fired_vessel	no_fire_vess	2.53	0.75	0	8	13	37	1	0
pres_H2S	H2S_not_pres	2.53	0.75	0	7	16	34	2	0
dist_to_ship_lane	>2	2.53	0.80	0	7	18	30	4	0
age	6-10	2.52	0.63	1	3	23	31	1	0
num_drill_slots	6-10	2.51	0.73	0	7	16	35	1	0
number_sim_ops	1	2.51	0.73	0	7	16	35	1	0
%_cont_out	0-25	2.51	0.90	0	8	20	25	5	1
numb_components	0-10	2.46	0.70	0	6	21	31	1	0
storage_vess	no_storage_vess	2.44	0.70	0	6	22	30	1	0
numb_acc_5_yrs	1-2	2.42	0.79	0	6	27	21	5	0
work_exp	10-12	2.41	0.67	0	6	23	30	0	0
age	0-5	2.41	1.22	0	16	18	15	5	5
num_inc_50_comp	6-10	2.37	1.08	0	16	15	19	8	1
volume_gas_prod	6-10	2.37	0.72	0	7	24	27	1	0
volume_oil_prod	0-5	2.31	0.86	0	13	17	27	2	0
num_well_comp	0-5	2.31	0.86	0	13	17	27	2	0
op_comp_exp	13-15	2.24	0.60	0	4	38	16	1	0
num_drill_slots	0-5	2.24	0.88	0	16	14	28	1	0
work_exp	13-15	2.17	0.68	1	9	30	19	0	0
type_prod_spill	gas	2.17	0.75	0	10	31	16	2	0
volume_gas_prod	0-5	2.15	0.93	0	18	17	21	3	0
op_comp_exp	16-18	2.08	0.68	0	10	35	13	1	0
num_inc_5_comp	0-5	2.08	0.88	0	18	20	19	2	0
num_inc_25_comp	0-5	2.07	0.93	0	19	21	15	4	0
numb_acc_5_yrs	0	2.02	1.03	0	21	23	10	3	2
work_exp	16-18	1.98	0.73	0	15	31	12	1	0
op_comp_exp	>18	1.98	0.76	1	16	28	13	1	0

work_exp	>18	1.95	0.86	0	20	25	11	3	0
num_inc_50_comp	0-5	1.90	0.96	0	27	14	15	3	0

Table -10 Survey 4 – all risk factors from risk quantification section

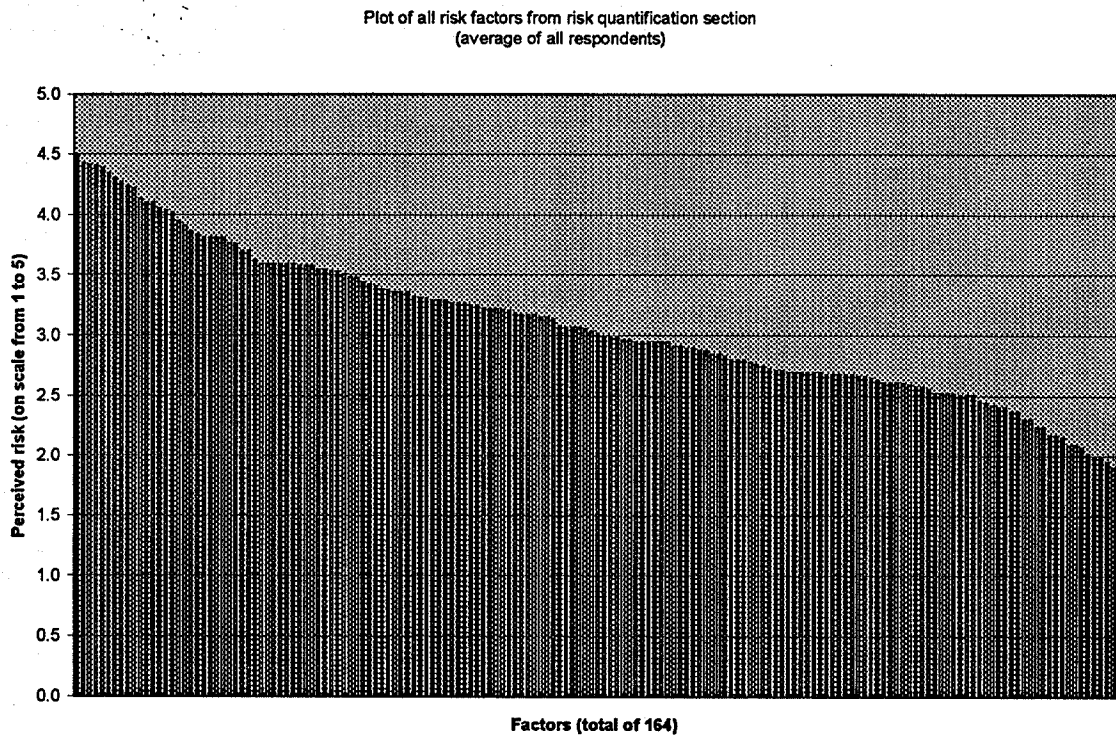


Figure -1 Survey 4 - plot of all risk factors in risk quantification section

Top 25 risk factors from risk quantification section
(average of all respondents)

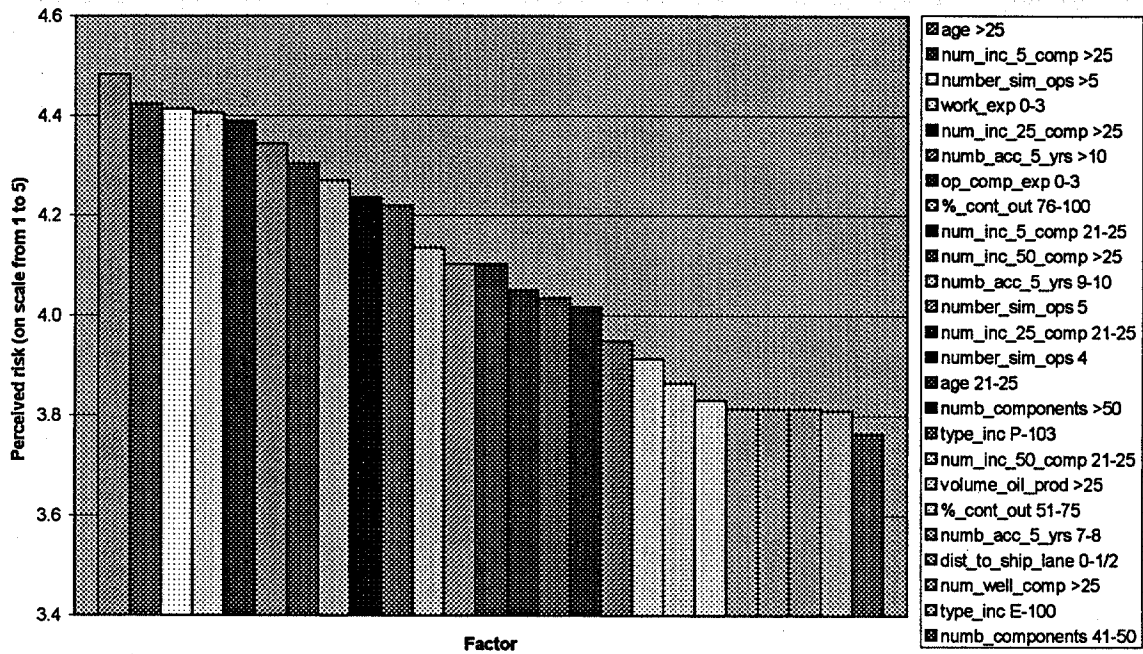


Figure -2 Survey 4 - top 25 risk factors in risk quantification section

The following table show the average level of confidence of the respondents for each question in section one.

q. num	Questions	Category	avg.	st_dev	X	1	2	3	4	5
178	type_operation	Confidence	3.58	0.83	0	1	1	29	19	9
12	%_cont_out	Confidence	3.47	0.75	0	1	2	28	24	4
96	type_prod_acc	Confidence	3.47	0.75	0	1	2	28	24	4
100	type_prod_spill	Confidence	3.46	0.75	0	1	2	29	23	4
26	num_inc_5_comp	Confidence	3.45	0.73	1	1	1	31	21	4
185	number_sim_ops	Confidence	3.44	0.84	0	1	3	31	17	7
7	age	Confidence	3.41	0.84	1	1	4	29	18	6
92	numb_acc_5_yrs	Confidence	3.41	0.81	0	1	4	29	20	5
167	storage_vess	Confidence	3.41	0.75	0	1	1	35	17	5
76	work_exp	Confidence	3.39	0.85	0	2	3	29	20	5
53	type_penalty	Confidence	3.38	0.77	1	1	3	31	19	4
113	volume_oil_prod	Confidence	3.38	0.75	1	1	2	33	18	4
164	fired_vessel	Confidence	3.37	0.74	0	1	2	34	18	4
130	num_well_comp	Confidence	3.36	0.79	1	1	4	30	19	4

33	num_inc_25_comp	Confidence	3.36	0.74	0	1	2	35	17	4
40	num_inc_50_comp	Confidence	3.36	0.69	0	1	1	36	18	3
68	op_comp_exp	Confidence	3.36	0.76	0	1	3	33	18	4
106	well_press	Confidence	3.36	0.76	0	1	4	30	21	3
57	type_enf_code	Confidence	3.34	0.76	1	1	3	33	17	4
49	type_inc	Confidence	3.31	0.79	0	2	3	32	19	3
84	type_acc_sp	Confidence	3.29	0.75	1	1	5	30	20	2
123	volume_gas_prod	Confidence	3.29	0.74	0	1	4	34	17	3
155	dist_to_shore	Confidence	3.29	0.79	0	1	4	36	13	5
19	num_on_plat	Confidence	3.27	0.72	0	1	3	37	15	3
148	water_depth	Confidence	3.24	0.86	1	3	3	33	15	4
161	dist_to_ship_lane	Confidence	3.24	0.84	0	2	5	33	15	4
139	num_drill_slots	Confidence	3.22	0.84	1	1	7	33	12	5
60	pres_H2S	Confidence	3.20	0.92	0	3	5	34	11	6

Table -11 Survey 4 - average respondent confidence

The Figure 3 shows that the respondents' confidence does not depend on their experience.

Plot of years as an inspector vs. confidence level

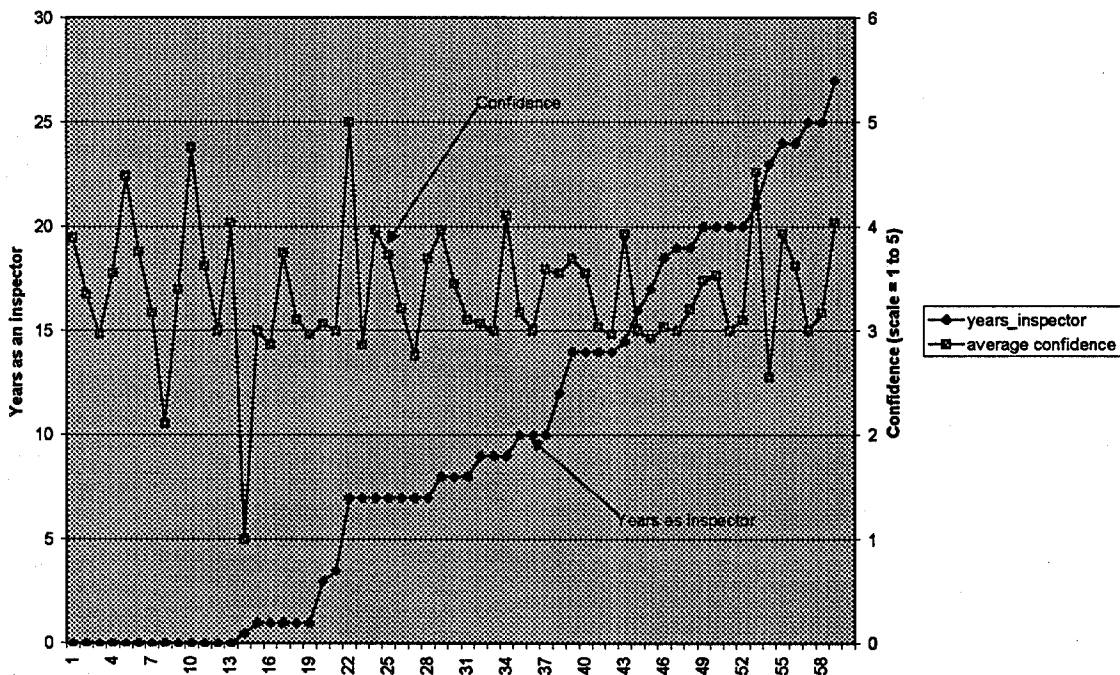


Figure -3 Survey 4 - comparing average respondent confidence versus respondent experience in risk quantification section

Plot of Years as an Inspector vs. Confidence in Risk Estimates.

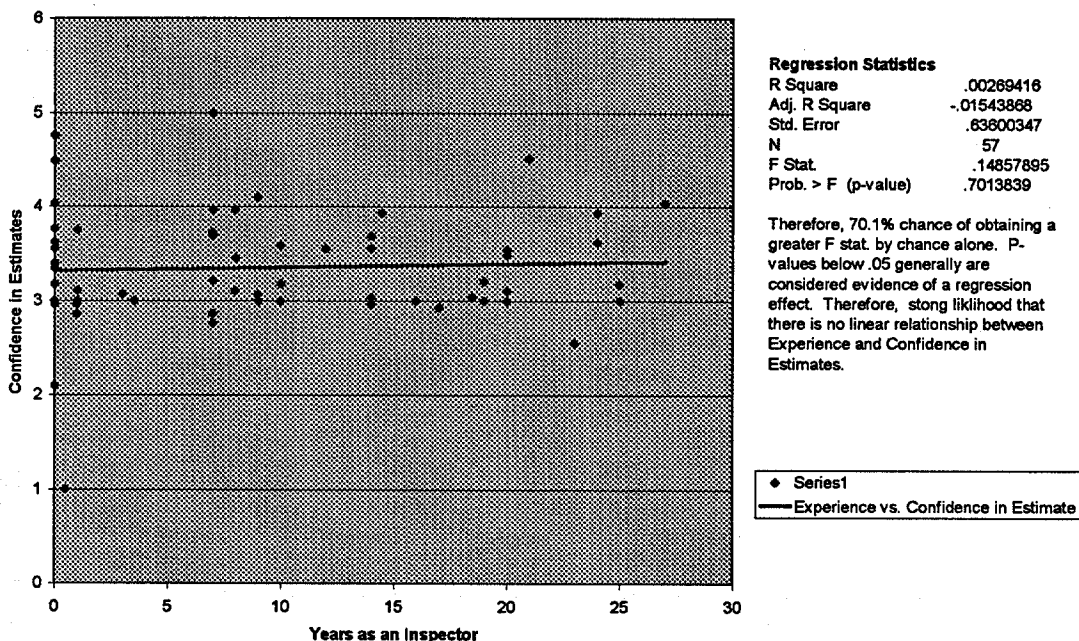


Figure -4 Survey 4 - Regression of Confidence in Risk Estimates versus Years as an Inspector

1.5.3 Comparison data

The following information is from the risk factor comparison section of Survey 4. In the table below, the “p_value” refers to the total number of points the factor received from all respondents. The “c_value” is simply a linear ranking based on the number of times a factor was ranked number “1”, number “2”, and so on. The results are essentially the same for both ranking methods.

Risk Factor	p_value	p_rank	c_value	c_rank
Experience level of the "typical" worker on a platform	5013	1	1335	1
Experience level of the platform's operating company	4138	2	1175	2
Percentage of operations contracted out	3367	3	978	4

Number of people working on a platform	3189	4	992	3
Number of accidents or spills a platform has experienced	3059	5	942	6
Age of Platform	3053	6	966	5
Simultaneous operations	2939	7	941	7
Type of operations conducted	2593	8	841	9
Type of accident or spill that a platform has previously experienced	2583	9	862	8
Type of hydrocarbon a platform produces (gas, oil or both)	2404	10	824	10
Number of INCs that a platform has received	2327	11	793	11
Presence of fired vessel	2297	12	754	13
Number of components	2236	13	759	12
Volume of hydrocarbon produced on a platform per day	2206	14	713	14
Type of INCs that a platform has received	2188	15	691	15
Type of INC enforcement that a platform receives (W,C, or S)	2016	16	645	16
Type of penalty a platform received (no penalty, civil, or criminal)	1912	17	595	19
Presence of H2S	1828	18	602	18
Presence of storage vessel	1781	19	613	17
Number of well completions on a platform	1518	20	492	20
Distance from shipping lanes	1422	21	445	22
Well or reservoir pressure	1410	22	472	21
Distance to shore of a platform	488	23	114	23
Water depth of a platform	365	24	99	24
Number of drill slots	227	25	88	25

Table -12 Survey 4 - comparison of risk factor relative importance

Rank of risk factors from risk comparison section

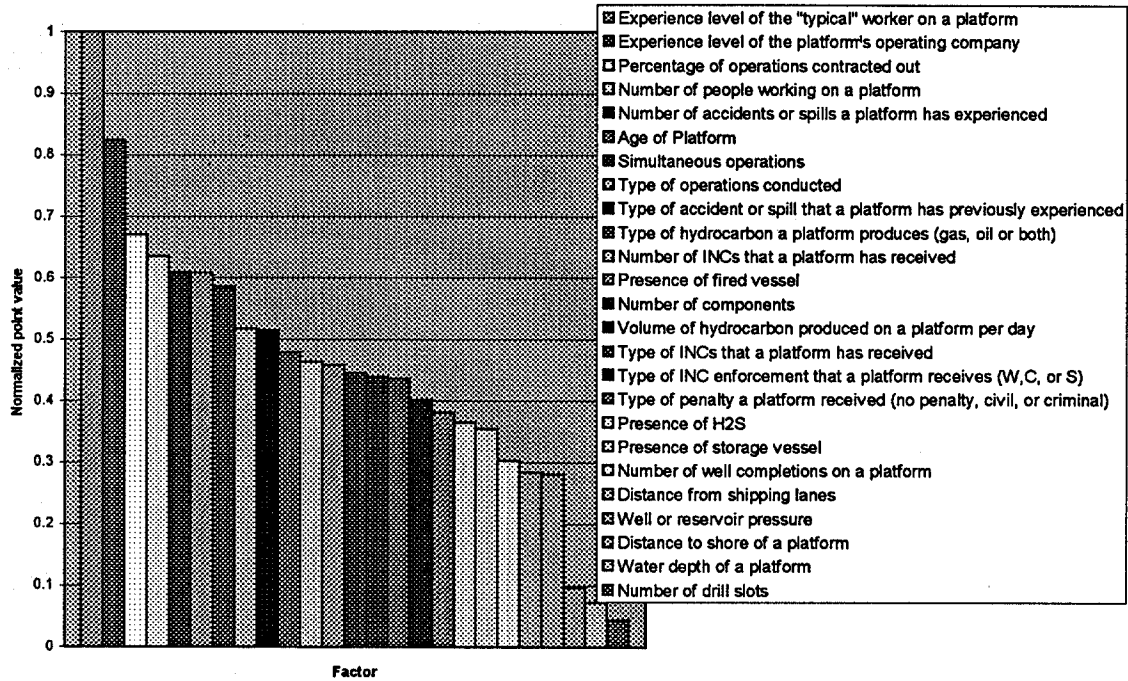


Figure -5 Survey 4 - normalized ranking by number of points given to factor in each position.

1.6 Copy of survey four

The following is a copy of survey four. It was administered in June 1998.

Assessment of Production Platform Risk Factors

Opinion Survey

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Reason for Opinion Survey

The MMS is moving toward a statistical method to assign the inspection frequency of platforms based on the probability of the platform having an accident or spill. To do this, the information in the TIMS database has been analyzed and some mathematical models have been developed. However, some of the information we would like to include in the models is not currently tracked by the MMS in TIMS, or was not available in the old OPAC accident and spill information. Therefore, we would like to get your opinion regarding some of the risk factors so that we can include this information in our models.

The following is a continuation of the surveys conducted in 1996 in which general risk factors were identified. In this survey, you are asked questions regarding how you think various platform traits or characteristics will affect the probability of a production platform having an accident or spill in the future. The questions in this survey pertain to production platforms only, not to drilling platforms. Please keep this in mind when you respond.

The survey has two sections: Risk Quantification and Risk Factor Comparisons. It was designed to be completed in about 30 minutes. The questions generally have either yes or no responses, or boxes in which you may place an "X" to indicate your response.

Personal data

What is your job title _____?

In which district do you currently work _____?

Years of experience as an inspector _____?

Years of offshore experience _____?
(other than as an inspector)

As an inspector, what percentage of your time has been spent as a production inspector _____%?

What percentage of your time has been spent as a drilling inspector _____%?

Personal experiences

Have you ever been injured on a platform?

Yes ___ No ___ How many times _____?

Have you ever seen anyone injured on a platform?

Yes ___ No ___ How many times _____?

Any

comments?

Instructions for section one: Risk Quantification

The purpose of this section is to obtain your opinion regarding how various risk factors affect the probability of an accident or spill on a platform in the next year. For example, if you believe that very old or very new platforms are more likely to have accidents or spills, then you might fill out the table as in the example below. (Note that you should put one and only one "X" in each ROW.)

In addition, for each table like the one below, we would like to know how confident you are in your answers. If you are very sure of your answers, then you might put an "X" in the box under "Very confident." However, if you were taking an "educated guess" and do not have a lot of specific information to support your answers, then you might place an "X" under "Not confident." You may find it difficult to give an answer to some of the questions. This is understood, and all that is asked is for you to provide your best guess, based on your experience as an inspector.

NOTE: You may believe that a factor has no relationship at all to a platform's probability of an accident or spill. If you feel that a risk factor has no impact on the probability of an accident or spill, then mark "average probability" for all levels. You will be given an opportunity in section 2, Risk Factor Comparisons, to state your opinion regarding the importance of each factor as a predictor of an accident or spill.

EXAMPLE

QUESTION: A platform's age may affect its probability of having an accident or spill in the future. For each age category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
0-5				X	
6-10		X			
11-15		X			
16-20			X		
21-25				X	
>25					X
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level			X		

Section one: Risk Quantification

For each row in the tables below, please place an "X" in the box that best represents your estimate for the probability of an accident or spill. Make sure to put one and only one "X" in each row.

QUESTION: A platform's age may affect its probability of having an accident or spill in the future. For each age category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Platform age (years)	Much less than average	Less than average	Average probability	More than average	Much more than average
0-5					
6-10					
11-15					
16-20					
21-25					
>25					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The percentage of operations contracted out on a platform may affect its probability of having an accident or spill in the future. For each percentage of outside contracting, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
% of operations contracted out	Much less than average	Less than average	Average probability	More than average	Much more than average
0-25					
26-50					
51-75					
76-100					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The number of people working on a platform may affect its probability of having an accident or spill in the next year. For each number category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill					
	Number of people on platform	Much less than average	Less than average	Average probability	More than average	Much more than average
	0					
	1-5					
	6-10					
	11-15					
	16-20					
	>20					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.						
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident	
Confidence level						

The following 3 questions pertain to 3 different size facilities:
5 components, 25 components, and 50 components.

QUESTION: The number of INCs that a platform has received in the past may affect its probability of having an accident or spill in the future. Consider a platform with 5 components. For each INC category below (number of INCs received in the past five years), indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill					
	Number of INCs in 5 years	Much less than average	Less than average	Average probability	More than average	Much more than average
	0-5					
	6-10					
	11-15					
	16-20					
	21-25					
	>25					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.						
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident	
Confidence level						

QUESTION: The number of INCs that a platform has received in the past may affect its probability of having an accident or spill in the future. Consider a platform with 25 components. For each INC category below (number of INCs received in the past five years), indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Number of INCs in 5 years	Much less than average	Less than average	Average probability	More than average	Much more than average
0-5					
6-10					
11-15					
16-20					
21-25					
>25					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The number of INCs that a platform has received in the past may affect its probability of having an accident or spill in the future. Consider a platform with 50 components. For each INC category below (number of INCs received in the past five years), indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Number of INCs in 5 years	Much less than average	Less than average	Average probability	More than average	Much more than average
0-5					
6-10					
11-15					
16-20					
21-25					
>25					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

The INC descriptions below are provided to help you answer the next question

Type of INC	Description
G-110	Does the lessee perform all operations in a safe and workmanlike manner, maintain all equipment in a safe condition, and take all necessary precautions to correct and remove any hazardous oil and gas accumulation or other health, safety, or fire hazard?
P-406	Is an operable FSV installed in the final flowline segment?
P-412	Is each wellhead completion equipped with an operable SSV or USV located above the master valve in the vertical run of the tree?
P-240	Does the SSV close within 45 seconds after automatic detection if an abnormal condition or actuation of an ESD?
P-103	Is each surface or subsurface safety device, which is bypassed or blocked out of service, out of service due to start-up, testing, or maintenance and is it flagged and monitored by personnel?
E-100	Is the lessee preventing pollution of offshore waters?
H-126	Is the H2S-detection and H2S-monitoring equipment calibrated?
W-100	Have all wells in the same well-bay which are capable of production hydrocarbons been shut in below the surface with a pump-through-type tubing plug or SSV at the surface with a closed master valve prior to moving well-workover rigs and related equipment (or as otherwise approved by the District Supervisor)?

QUESTION: The type of INCs that a platform has received in the past may affect its probability of having an accident or spill in the future. A platform has received an "average"* number of the following types of INCs in the prior 5 years. For each INC category, indicate how likely it would be for a platform to have an accident or spill in the next year. If there are other INCs that you feel are important predictors of accidents or spills list them in the blank lines provided.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
G-110					
P-406					
P-412					
P-240					
P-103					
E-100					
H-126					
W-100					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

* Note: "average" means typical for a particular platform's size or complexity. What we are trying to measure in this question is your concern for particular types of INCs, not your concern for the rate at which INCs are issued.

QUESTION: The type of penalty a platform receives (no penalty, civil, or criminal) after getting an INC may affect its probability of having an accident or spill in the future. For each penalty category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Penalty type	Much less than average	Less than average	Average probability	More than average	Much more than average
INC-no penalty					
INC - civil penalty					
INC - criminal penalty					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The type of INC enforcement code that a platform receives (W, C, or S) after getting an INC may affect its probability of having an accident or spill in the future. For each enforcement code category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Enforcement code	Much less than average	Less than average	Average probability	More than average	Much more than average
W					
C					
S					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The presence of H2S on a platform may affect its probability of having an accident or spill in the future. For each category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Presence of H2S	Much less than average	Less than average	Average probability	More than average	Much more than average
H2S is present					
H2S is not present					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The experience level of the platform's operating company may affect its probability of having an accident or spill in the future. For each experience category (in years), indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
<u>Operating company</u> experience level (years)					
0-3					
4-6					
7-9					
10-12					
13-15					
16-18					
>18					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The experience level of the "typical" worker on a platform may affect its probability of having an accident or spill in the future. For each experience category (in years), indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
<u>Worker</u> experience level (years)					
0-3					
4-6					
7-9					
10-12					
13-15					
16-18					
>18					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The type of accident or spill that a platform has experienced in the prior 5 years may affect its probability of having an accident or spill in the future. For each accident and spill category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
Explosion					
Fire*					
Fatality					
Major spill					
Minor spill					
Vessel strike					
Weather damage					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

*NOTE: Do not consider galley fires or those that self-extinguish.

QUESTION: The number of accidents or spills that a platform has experienced in the past may affect its probability of having an accident or spill in the future. For each category below (number of accidents or spills in the past five years), indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
Number of Accidents or spills in last 5 years					
0					
1-2					
3-4					
5-6					
7-8					
9-10					
>10					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The type of hydrocarbon a platform produces (gas, oil or both in equal amounts-BOE) may affect its probability of having an accident or spill in the future. For each production type, indicate how likely it would be for a platform to have an accident in the next year.

Place X in box	Probability of having an accident				
Production Type	Much less than average	Less than average	Average probability	More than average	Much more than average
Oil					
Gas					
Oil and Gas equally (BOE)					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The type of hydrocarbon a platform produces (gas, oil or both in equal amounts-BOE) may affect its probability of having an accident or spill in the future. For each production type, indicate how likely it would be for a platform to have a spill in the next year.

Place X in box	Probability of having a spill				
Production Type	Much less than average	Less than average	Average probability	More than average	Much more than average
Oil					
Gas					
Oil and Gas equally (BOE)					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The well or reservoir pressure on a platform may affect its probability of having an accident or spill in the future. For pressure category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Reservoir pressure (psig)	Much less than average	Less than average	Average probability	More than average	Much more than average
0-500					
500-1000					
1000-1500					
1500-2000					
>2000					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The volume of hydrocarbon produced on a platform per day may affect its probability of having an accident or spill in the future. For each oil production volume category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Production volume, BO/day (thousand)	Much less than average	Less than average	Average probability	More than average	Much more than average
0-5					
6-10					
11-15					
16-20					
21-25					
>25					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The volume of hydrocarbon produced on a platform per day may affect its probability of having an accident or spill in the future. For each gas production volume category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Production volume, c.f. /day (million)	Much less than average	Less than average	Average probability	More than average	Much more than average
0-5					
6-10					
11-15					
16-20					
21-25					
26-30					
31-35					
36-40					
>40					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The number of well completions on a platform may affect its probability of having an accident or spill in the future. For each well completion category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
0-5 (minor)					
6-10 (major)					
11-15 (major)					
16-20 (major)					
21-25 (major)					
>25 (major)					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The number of drill slots on a platform may affect its probability of having an accident or spill in the future. For each number of drill slots category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
0-5					
6-10					
11-15					
16-20					
21-25					
26-30					
31-35					
>35					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: A platform's water depth may affect its probability of having an accident or spill in the future. For each water depth category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
0-50					
51-100					
101-150					
151-200					
201-250					
251-300					
301-350					
>400					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: A platform's distance to shore may affect its probability of having an accident or spill in the future. For each distance category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
Distance to shore (std. miles)					
0-25					
26-50					
51-75					
76-100					
101-125					
>125					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: A platform's distance from shipping lanes may affect its probability of having an accident or spill in the future. For each distance category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Distance to shipping lanes (std. miles)	Much less than average	Less than average	Average probability	More than average	Much more than average
0- ½					
½ -1					
1-1 ½					
1 ½ - 2					
>2					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The presence of a fired vessel on a platform may affect its probability of having an accident or spill in the future. For each category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Presence of a fired vessel	Much less than average	Less than average	Average probability	More than average	Much more than average
Fired vessel					
No fired vessel					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The presence of a storage vessel on a platform may affect its probability of having an accident or spill in the future. For each category, indicate how likely it would be for a platform to have an accident or spill in the next year.

Place X in box	Probability of having an accident or spill				
Presence of storage facilities	Much less than average	Less than average	Average probability	More than average	Much more than average
Storage facilities					
No storage facilities					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The type of operation conducted on a platform may affect its probability of having an accident or spill in the future. For each operation category, indicate how likely it would be for a platform to have an accident or spill in the next year. If there are other operations that you feel are important predictors of accidents or spills list them in the blank lines provided.

Place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
Vessel clean out					
Wire line work					
Crane operation					
Construction					
Painting					
Well work over					
Cleaning pig trap					
Fabricating					
Welding					
Well completion					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
Place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The number of simultaneous operations conducted on a platform may affect its probability of having an accident or spill in the future. For each number category, indicate how likely it would be for a platform to have an accident or spill in the next year.

place X in box	Probability of having an accident or spill				
	Much less than average	Less than average	Average probability	More than average	Much more than average
number of operations occurring simultaneously					
1					
2					
3					
4					
5					
>5					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

QUESTION: The number of components on a platform may affect its probability of having an accident or spill in the future. For each category, indicate how likely it would be for a platform to have an accident or spill in the next year.

place X in box	Probability of having an accident or spill				
Number of components on a platform	Much less than average	Less than average	Average probability	More than average	Much more than average
0-10					
11-20					
21-30					
31-40					
41-50					
>50					
It is understood that some questions in the survey are relatively easy to answer, and some are quite difficult. The following boxes allow you to state how confident you are in your estimates.					
place X in box	Not confident	Fairly low confidence	Average confidence	Fairly high confidence	Very confident
Confidence level					

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Instructions for section two: Risk Factor Comparisons

Listed on the following page are the 25 risk factors that you have just evaluated. Now that you have thought hard about the factors, we would like to get your estimates of their relative importance in predicting accidents or spills. We know that you have done similar ranking tasks before, but in this exercise we want to capture the relative importance between the risk factors. This is a somewhat difficult exercise, but is the only way to determine the relative importance of the risk factors.

- 1) Go through the list and cross off any risk factor that you think is not important.
- 2) Take the remaining factors and rank them in order of importance in predicting an accident or a spill from most important (starting with 1) to least important. Do one ranking across all the remaining factors. Only one factor should be ranked "1": the most important.
- 3) We now want to find out how much less important you feel the second factor is than the first. Put 100 by the most important factor. Next to the second factor put a number that indicates how much less important it is. For example, if the second factor was half as important as the first, you would put 50; if it was almost the same importance, you might put 90 (see the example).
- 4) Continue down the list of risk factors in order of their ranks, indicating the relative importance of each. For example, if you put 90 by the second risk and the third risk was half as important as the second, you would put 45 next to the third risk. These weights should never increase as you progress. If two consecutive factors are of equal importance, then you can give them the same weight.
- 5) At anytime you can go back and change either the rank or weight of an item. Just be sure that you are consistent throughout.

EXAMPLE

NOTE: The following example is intended solely to show the process used to fill out the table. It **IS NOT** intended to influence your answers. The questions to be crossed out were picked at random, and the rankings and point values were randomly assigned.

Please **DO NOT** assign rankings based on political ramifications or consequences. Instead, base your ranking on your belief regarding the risk factors influence on the probability of a platform having an accident or spill.

Point Value	Ranking	Risk Factor
		Number of drill slots
		Well or reservoir pressure
		Experience level of the "typical" worker on a platform
10	12	Number of people working on a platform
		Distance from shipping lanes
5	14	Number of well completions on a platform
20	10	Simultaneous operations
30	7	Distance to shore of a platform
20	9	Type of accident or spill that a platform has previously experienced
45	5	Experience level of the platform's operating company
5	15	Number of INCs that a platform has received
		Type of hydrocarbon a platform produces (gas, oil or both)
		Type of operations conducted
15	11	Water depth of a platform
5	13	Type of INC enforcement that a platform receives (W,C, or S)
90	2	Presence of fired vessel
30	6	Volume of hydrocarbon produced on a platform per day
45	4	Age of Platform
25	8	Number of accidents or spills a platform has experienced
		Type of penalty a platform received (no penalty, civil, or criminal)
		Presence of storage vessel
100	1	Percentage of operations contracted out
		Presence of H2S
45	3	Number of components
		Type of INCs that a platform has received

Section two: Risk Factor Comparison

Please **DO NOT** assign rankings based on political ramifications or consequences. Instead, base your ranking on your belief regarding the risk factors influence on the probability of a platform having an accident or spill.

Point Value	Ranking	Risk Factor
		Number of drill slots
		Well or reservoir pressure
		Experience level of the "typical" worker on a platform
		Number of people working on a platform
		Distance from shipping lanes
		Number of well completions on a platform
		Simultaneous operations
		Distance to shore of a platform
		Type of accident or spill that a platform has previously experienced
		Experience level of the platform's operating company
		Number of INCs that a platform has received
		Type of hydrocarbon a platform produces (gas, oil or both)
		Type of operations conducted
		Water depth of a platform
		Type of INC enforcement that a platform receives (W,C, or S)
		Presence of fired vessel
		Volume of hydrocarbon produced on a platform per day
		Age of Platform
		Number of accidents or spills a platform has experienced
		Type of penalty a platform received (no penalty, civil, or criminal)
		Presence of storage vessel
		Percentage of operations contracted out
		Presence of H2S
		Number of components
		Type of INCs that a platform has received

