A Study for the U.S. Department of the Interior,
Minerals Management Service

COMPARATIVE HEALTH AND SAFETY RISK ASSESSMENT OF DECOMMISSIONING LARGE OFFSHORE PLATFORMS

Final Report

Case Studies For Decommissioning Of Three Offshore Platforms In The Pacific OCS Region

Conducted by

TWACHTMAN SNYDER & BYRD, INC.
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United States Department of the Interior
Minerals Management Service

June 2003

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Final Report

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TWACHTMAN SNYDER & BYRD, INC.

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SECTION 1 – EXECUTIVE SUMMARY

This study has been prepared for the Minerals Management Service (MMS) in response to their Request for Proposals of September 20, 2001, and the solicitation 1435-01-01-RP-31174, with requested revisions. The study provides a Comparative Risk Assessment of the decommissioning options for removing three specific platforms, as directed by MMS. The selected platforms are Eureka, Hidalgo, and Irene. The characteristics of these platforms are shown in Tables 1.1 and 1.2.

The focus is on removal of the platforms in the Pacific Outer Continental Shelf Region (POCSR). However, the information provided is relevant to all similar platform removals. The risk assessment focuses on health and human safety (HHS). The risk assessment considers the principal options available for complete removal of the subject platforms. The assessment considers the impact of specific removal methods such as diver versus non-diver operations.

1.1 OBJECTIVES, ASSUMPTIONS, AND OVERALL APPROACH

The overall objective of the project is to examine the relevant issues and to quantify them in the context of comparative HHS risk, using state-of-practice methodology and currently available technology. The following are the specific objectives:

1. Define / identify the principal options available for the complete removal of the POCS platforms.

2. Develop plausible complete removal scenarios for three representative platforms using currently available technology. Development of these scenarios include work plans which identify the time and resource requirements.

3. Quantify the specific issues related to the decommissioning of the subject platforms which carry significant risk in terms of HHS. As part of this process, an industry forum on decommissioning safety was held and industry input was solicited.

4. Evaluate the risk issues for the various decommissioning options. The HHS risk is quantified to the maximum extent allowed by the data available.

5. The study does not encompass plugging the wells, cutting and removing the well conductors and casing or onshore dismantlement of the structures. Consideration in this study ends when structures are safely tied down on a cargo barge or other means of transport.

6. This study specifically considers:

    - In-Situ cutting and removing of the jackets in place using a 2000 ton or greater capacity derrick barge or crane vessel (DB). Figure 2.1 shows an example of such a vessel. Table 1.0 shows a sample industry cross section of 2000+ ton capacity lifting vessels.

    - Hopping the jackets into successively shallower water locations using a twin crane semi-submersible crane vessel (SSCV) with greater than 5000 ton capacity. Figure 2.2 shows an example of such a vessel. Also see table 1.0. The jackets are cut into pieces with most of the cuts being above the water surface to minimize diver cuts.

Table 1.0 Sample of Industry Lifting Vessels

Vessel Type	Vessel Name	Vessel Owner	Lifting Capacity (st.)
DB	Hercules	Global Industries	2,000
DB	Castoro Otto	Saipem	2,000
DB	HLS 2000	NPCC	2,000
DB	Stanislav Udin	Stolt	2,000
DB	Pearl Marine	Saipem	2,400
DB	DB 30	McDermott	2,300
DB	DB 101	McDermott	2,100
DB	Odin	McDermott	2,700
DB	DB 50	McDermott	4,400
SSCV	Hermod	Heerema	3,960, 4,950, 8,928[1]
SSCV	Balder	Heerema	4,000, 6,930[1]
SSCV	Saipem 7000	Saipem	7,000, 14,000[1]
SSCV	Thialf	Heerema	7,810, 15,620[1]

Notes: [1] Using Tandem Lift

7. Evaluate options available for mitigation of the most risky aspects of offshore platform decommissioning, including the use of alternative technologies, e.g., diver versus non-diver methods, and alternative lifting systems.

1.2 SUMMARY OF RESULTS

Table 1.1 shows a summary of the selected platform characteristics. Table 1.2 shows how the different labor categories are placed into work categories for the purposes of defining the risk.

Table 1.3 shows the Relative Risk of serious injuries during each decommissioning scenario, broken out by work category. The results are normalized against the **Irene In-Situ Small DB** case, which is considered the most representative of the industries current experience in decommissioning. For the purpose of normalization, the base case is set to an Average Value (AV) of one (1) serious accident during the decommissioning process. The actual AV may be found in Appendix A.

Figure 1.1 shows the Relative Risk of serious injury as a function of water depth for each decommissioning method. Figure 1.2 shows how AV of total man hours vary with water depth. Figure 1.3 shows how the total spread hours vary with the selected decommissioning methods.

1.3 CONCLUSIONS

The results of the study leads to the following conclusions:

- Complete Removal In-Situ will be more time consuming and demand more human resources than the Hopping method. This assumes the use of the technology and methods that are readily available today.
- The Hopping method appears to be much safer in a relative since, when compared to In-situ jacket removal.

- Risk of accidents increase with water depth for both methods, both it increases much faster with the In-situ method.
- Review of the accident rate data presented in the study and the analysis results point to underwater work with divers as the major risk area.
- Every effort should be made to eliminate or reduce diver usage and to shorten the time required for decommissioning in general

Section 2 provides a discussion of the approach taken in this study and the assumptions made. Section 3 presents the results and Section 4 provides a discussion of the results and Section 5 provides additional conclusions and recommendations.

Appendix A provides the detailed results for all scenarios. Appendix B provides a summary of industry accident statistics that have been gathered as part of this study.

Table 1.1 Platform Characteristics

	Eureka	Hidalgo	Irene
Year Installed	1984	1986	1985
Water Depth (ft)	700	430	242
Conductors (#)	60	10	24
Estimated Component Weights (short tons):			
Jacket	18,500	10,950	3,100
Piles	2,000	2,000	1,500
Conductors	3,442	371	552
Deck	5,200	8,100	2,500
Total	29,142	21,421	7,652

Table 1.2 Work Category Groupings

Work Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

Table 1.3 Relative Risk of Serious Injury During Decommissioning

Work Category	Irene In-Situ Small DB (Base Case)	Irene In-Situ Large DB	Hidalgo In-Situ Small DB	Eureka In-Situ Small DB	Hidalgo Hopping Large DB	Eureka Hopping Large DB
On Deck, High Risk	0.075	0.073	0.128	0.174	0.109	0.167
On Deck, Support	0.016	0.010	0.032	0.040	0.012	0.014
Marine & Other Support	0.042	0.038	0.082	0.117	0.065	0.115
Diving, Air	0.394	0.145	0.599	0.364	0.351	0.487
Diving, Saturation	0.473	0.274	2.207	3.706	0.000	0.000
Totals	1.000	0.540	3.048	4.401	0.537	0.782

Figure 1.1 Water Depth Vs. Relative Risk of Serious Injury

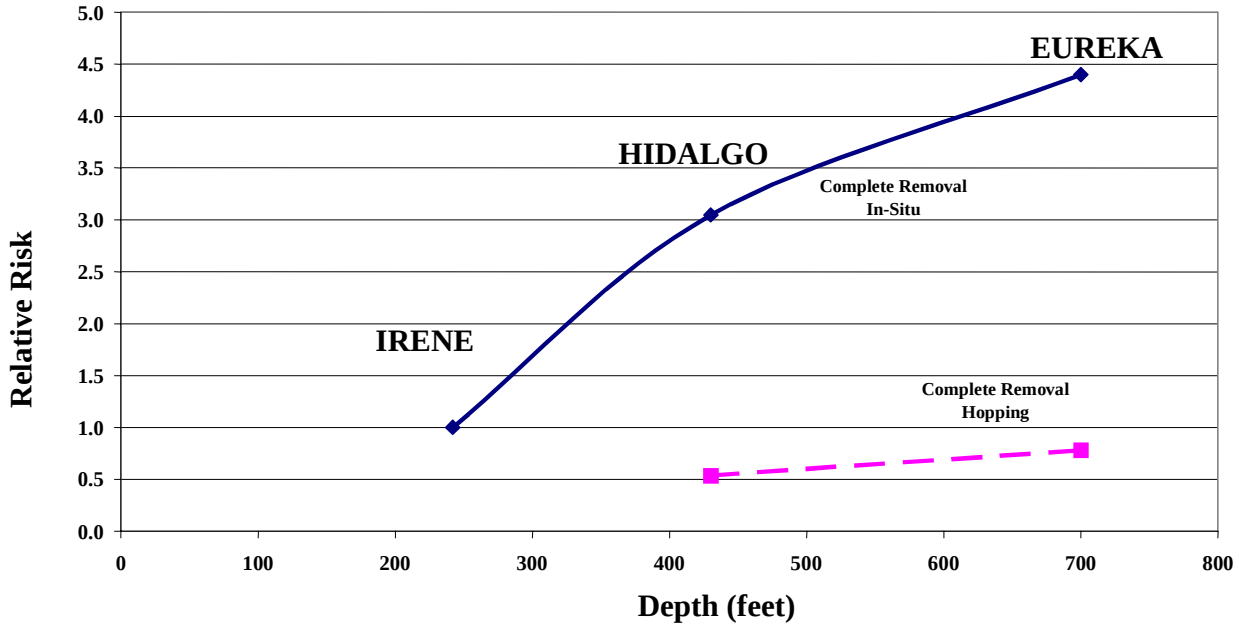


Figure 1.2 Water Depth Vs. Man-Hours

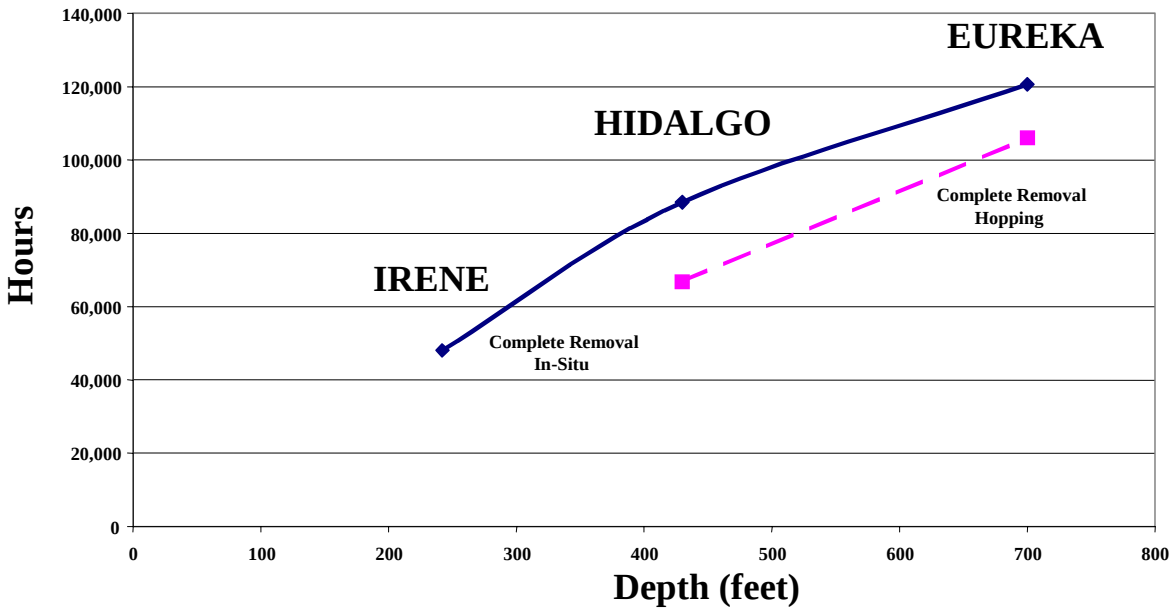
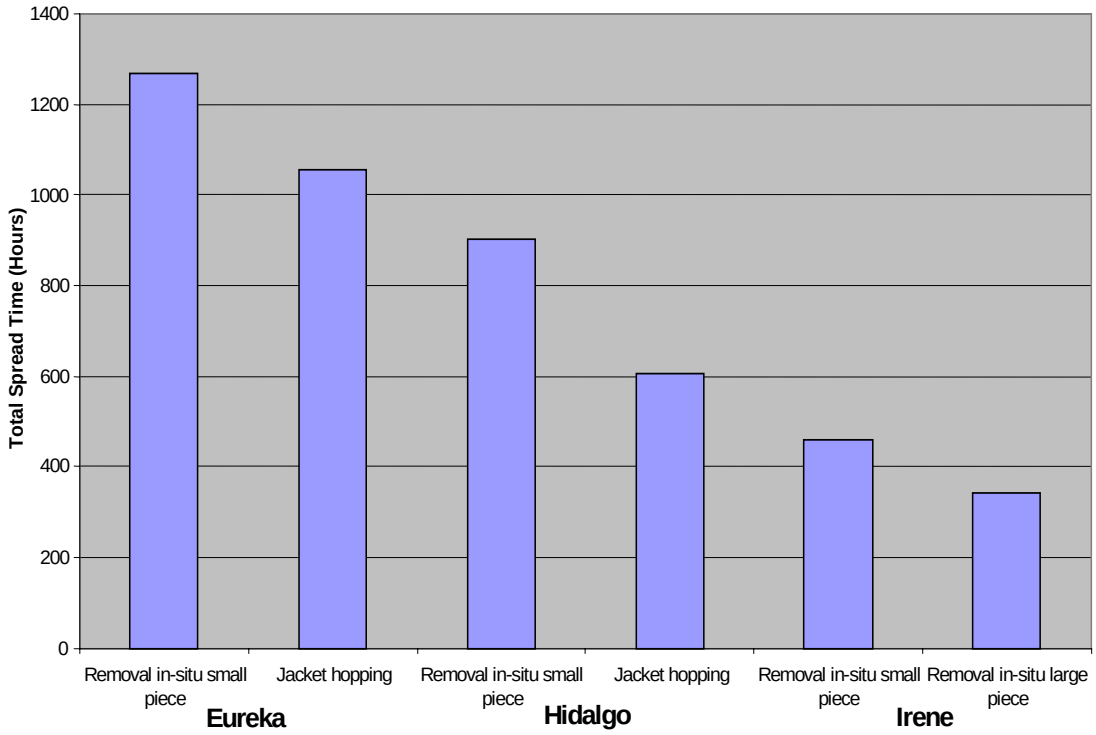


Figure 1.3 Complete Removal
Total Spread Time



SECTION 2 – METHODOLOGY

The focus of the study is on removal of the platforms in the Pacific Outer Continental Shelf Region (POCSR). While there are a range of options available for offshore platform decommissioning in general, this study only looks at complete removal in a manner that would allow all material to be disposed of onshore. The comparative risk assessment focuses on health and human safety (HHS). The assessment considers the principal options available for complete removal of the subject platforms. Specifically, the study compares the risk for serious accidents or fatalities with complete removal by cutting offshore platforms up in-place (in-situ), requiring significant underwater activities, with the alternative of "hopping" the platforms into shallower water, such that most cutting can be done in air. The study assumes as a base case that all underwater cutting will be performed by divers using conventional air-arc techniques. The availability and impact of alternative cutting methods will also be considered.

2.1 OBJECTIVES, ASSUMPTIONS, AND OVERALL APPROACH

The overall objective of the project is to examine the relevant issues and to quantify them in the context of comparative HHS risk, using state-of-practice methodology and currently available technology. The following are the specific objectives:

1. Define / identify the principal options available for the complete removal of the POCS platforms.

2. Develop plausible complete removal scenarios for three representative platforms using currently available technology. Development of these scenarios include work plans which identify the time and resource requirements.

3. Quantify the specific issues related to the decommissioning of the subject platforms which carry significant risk in terms of HHS. As part of this process, an industry forum on decommissioning safety was held and industry input was solicited.

4. Evaluate the risk issues for the various decommissioning options. The HHS risk is quantified to the maximum extent allowed by the data available.

5. The study does not encompass plugging the wells, cutting and removing the well conductors and casing or onshore dismantlement of the structures. Consideration in this study ends when structures are safely tied down on a cargo barge or other means of transport.

6. This study specifically considers:

   - In-Situ cutting and removing of the jackets in place using a 2000 ton or greater capacity derrick barge or crane vessel (DB). Figure 2.1 shows an example of such a vessel. Table 1.0 shows a sample industry cross section of 2000+ ton capacity lifting vessels.

   - Hopping the jackets into successively shallower water locations using a twin crane semi-submersible crane vessel (SSCV) with greater than 5000 ton capacity. Figure 2.2 shows an example of such a vessel. Also see table 1.0. The jackets are cut into pieces with most of the cuts being above the water surface to minimize diver cuts.

Table 1.0 Sample of Industry Lifting Vessels

Vessel Type	Vessel Name	Vessel Owner	Lifting Capacity (st.)
DB	Hercules	Global Industries	2,000
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DB	HLS 2000	NPCC	2,000
DB	Stanislav Udin	Stolt	2,000
DB	Pearl Marine	Saipem	2,400
DB	DB 30	McDermott	2,300
DB	DB 101	McDermott	2,100
DB	Odin	McDermott	2,700
DB	DB 50	McDermott	4,400
SSCV	Hermod	Heerema	3,960, 4,950, 8,928[1]
SSCV	Balder	Heerema	4,000, 6,930[1]
SSCV	Saipem 7000	Saipem	7,000, 14,000[1]
SSCV	Thialf	Heerema	7,810, 15,620[1]

[1] Tandem Lift

7. Evaluate options available for mitigation of the most risky aspects of offshore platform decommissioning, including the use of alternative technologies, e.g., diver versus non-diver methods, and alternative lifting systems.

Figure 2.1 Global Industries' Crane Vessel *Hercules*

Figure 2.2 *Saipem 7000* Semi-submersible Crane Vessel

2.2 SELECTION OF PLATFORMS

The particular platforms which are considered in the study were selected by the MMS, based on achieving a representative sampling of the platforms that may be removed in the first round of decommissioning on the POCS. However, selection of the platforms for this study does not imply that plans are currently being made for their actual removal.

The platforms considered in this study are *Irene*, *Hidalgo*, and *Eureka*. Table 2.1 shows the characteristics of these platforms. Weight characteristics are compared in Figure 2.3. Table 2.2 provides the assumed weights for deck modules.

Table 2.1 Platform Characteristics

	Eureka	Hidalgo	Irene
Year Installed	1984	1986	1985
Water Depth (ft)	700	430	242
Conductors (#)	60	10	24
Estimated Component Weights (short tons):			
Jacket	18,500	10,950	3,100
Piles	2,000	2,000	1,500
Conductors	3,442	371	552
Deck	5,200	8,100	2,500
Total	29,142	21,421	7,652

Figure 2.3 Platform Weight Characteristics

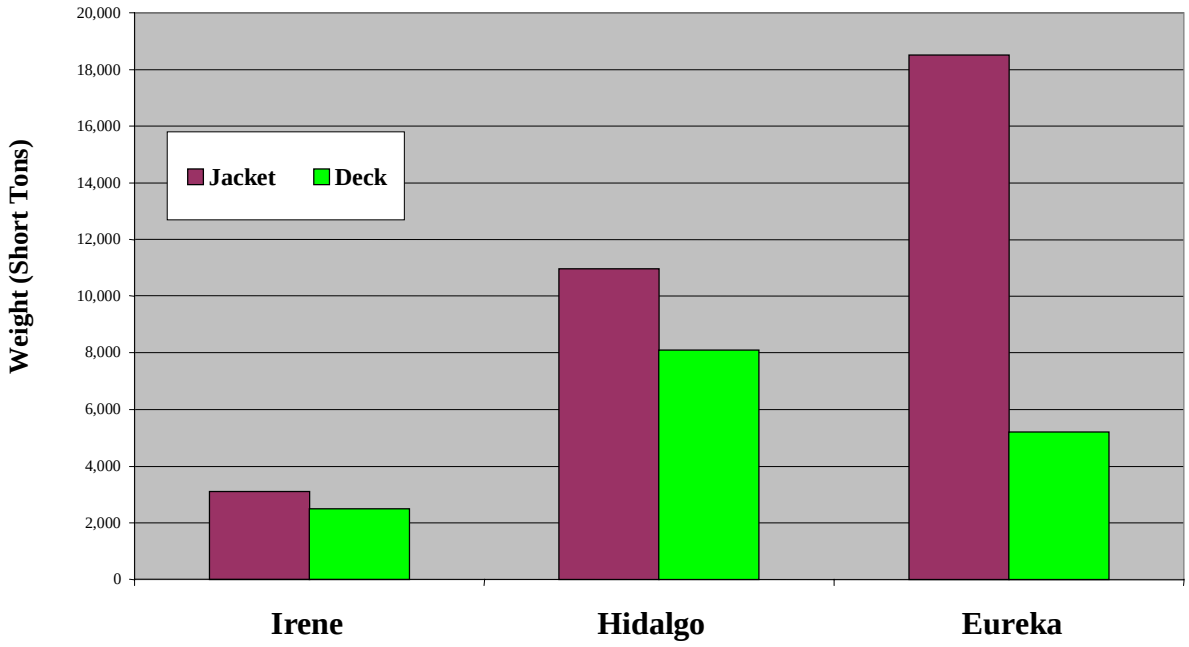


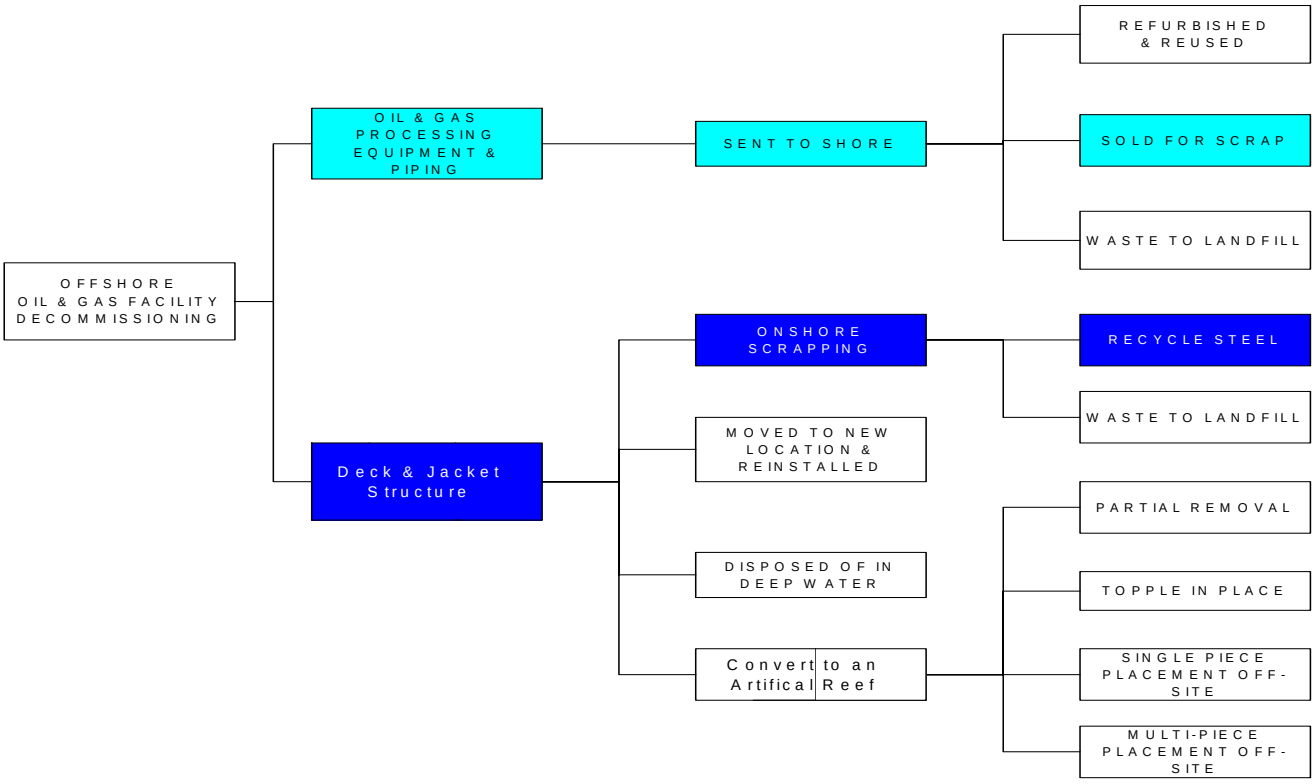
Table 2.2 Assumed Module Lift Weights (short tons)

Eureka	
(detail not available)	1200Maximum lift
Hidalgo	
Water Handling	1378
Production	1254
Compression	1171
Utilities	955
Power	1233
Pipe rack	266
Cap Truss	1071
Quarters	700
Irene	
West Section	1000
East Section	860
Quarters	220
Cranes	30
Flare	25
Misc. components	365

2.3 SELECTION OF DECOMMISSIONING SCENARIOS

Figure 2.4 shows all of the options which are available under U.S. federal law for the decommissioning and disposal of offshore platforms. This study looks only at the option of completely removing all material and disposing of it onshore. This approach is considered the base case for offshore platform decommissioning and it is currently the only option being considered for the POCS.

Figure 2.4 Offshore Platform Disposal Options



A common element for all decommissioning approaches is topsides preparation and deck removal. This was assumed to be the same for all of the scenarios considered in this study. This process involves:

1. Removing all loose material or potential interferences, e.g., flare booms, cranes and helidecks, from the topsides.
2. Flushing and cleaning of all piping and pressure vessels and generally insuring that all hazardous material is removed.
3. Removal of all topside modules and support frames down to the jacket top.
4. Transport of all material to shore for disposal.

This process is illustrated in Figures 2.5 and 2.6.

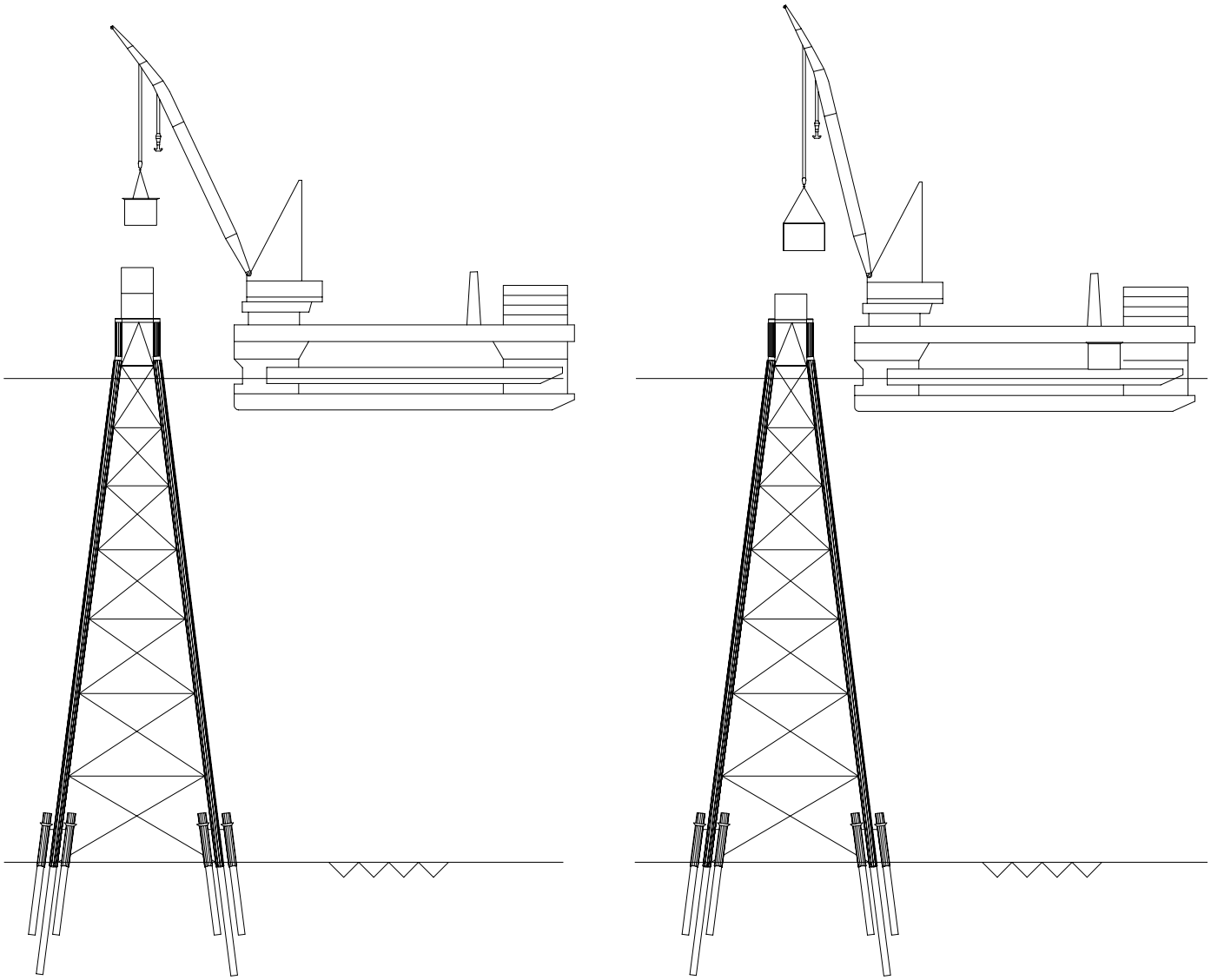


Figure 2.5 Topside module removal with a large derrick barge.

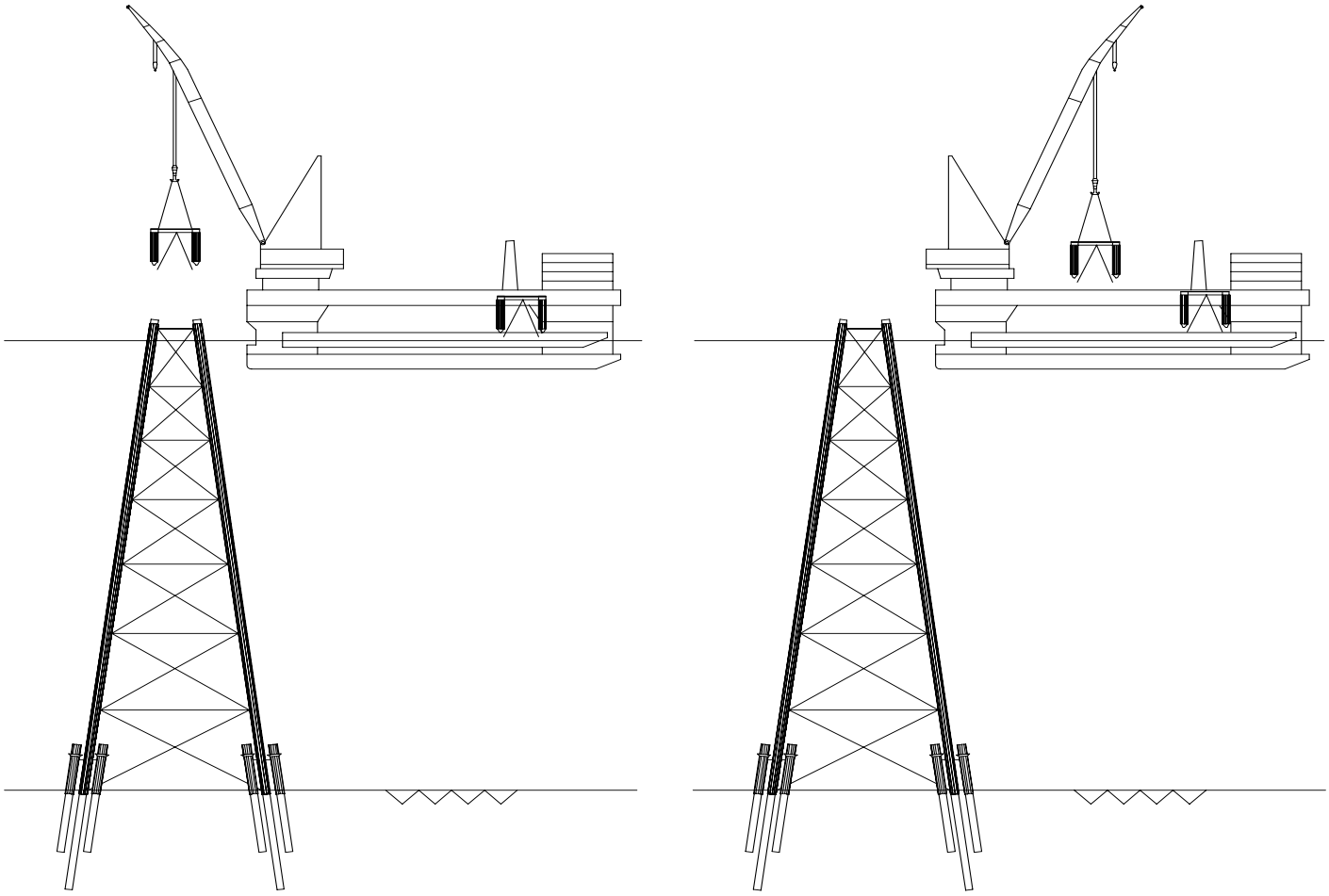


Figure 2.6 Module support frame removal with a large derrick barge.

After removal of the topsides down to the jacket top, two options are considered in the context of complete removal for handling the jackets being considered in this study. It is important to note that these structures are too heavy to be lifted clear of the water using any equipment or systems which are currently available. Therefore, they must be sectioned, or cut in pieces, to be removed. The choices are between cutting the jacket up *in-situ* (in-place), with much of the work done underwater, or moving it to new locations in shallower water where most of the cutting can be done in air. The later method is generally referred to as "hopping, " but has also been referred to as "shallowing-up."

Figure 2.7 provides a method selection matrix for the platforms considered in this study. It was originally intended that all jackets would be evaluated using both methods. However, after considering how the alternative methods would be applied to each jacket using the larger and smaller derrick barges, it was clear that the hopping method did not make sense for the smallest jacket, **Irene**. Therefore it was only evaluated using in-situ removal with each barge. In the case of hopping, the

derrick barge must be able to lift the jacket and move it into shallow water. This eliminates the smaller barge for this method. Conversely, there is no need for a derrick barge any larger than is necessary for the removal of the topsides when in-situ removal is applied. Therefore, the larger barge was not evaluated in that case.

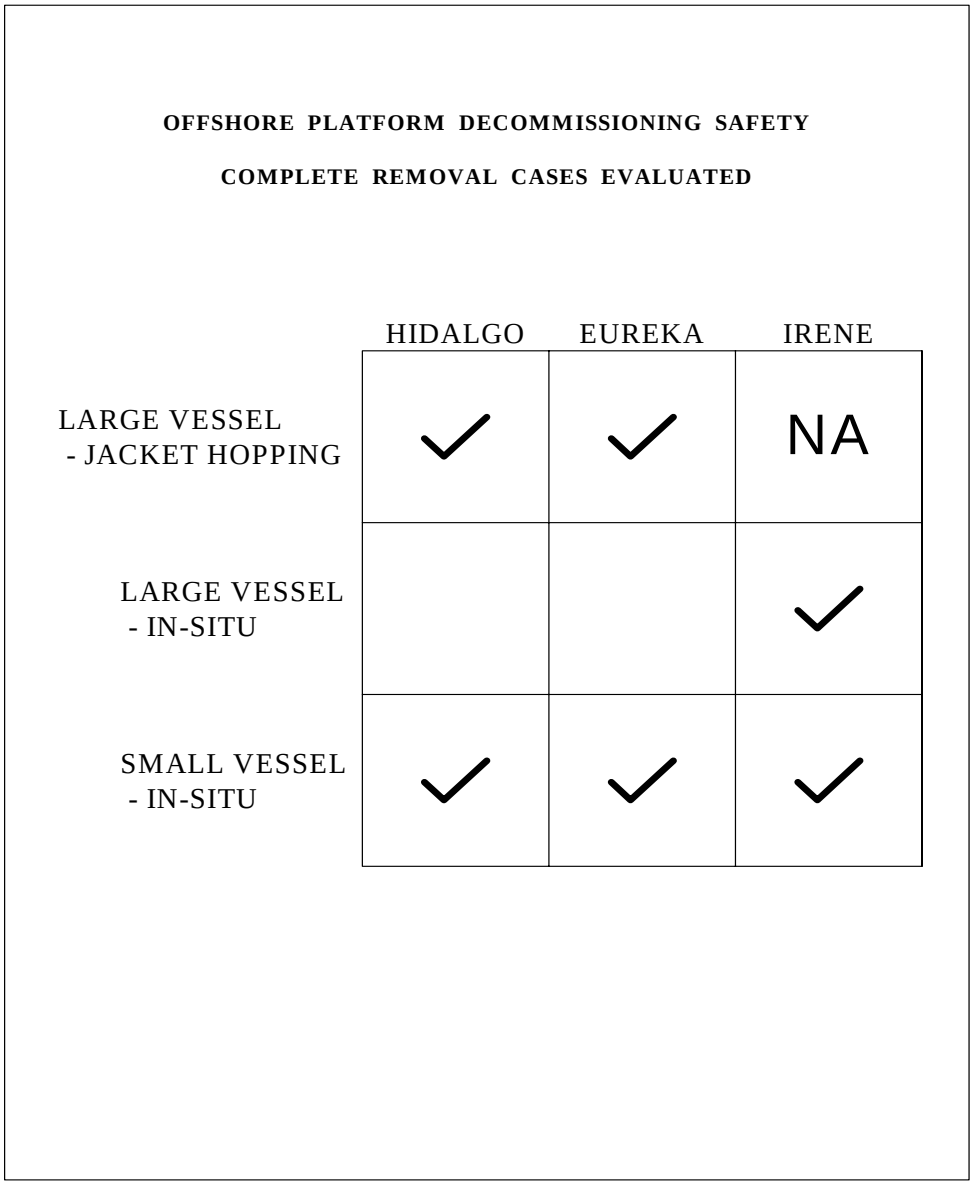


Figure 2.7 Complete Removal Methods Evaluated.

When the hopping method is applied, the supporting piles are severed after the topsides are removed. This can be done with explosives or with mechanical or abrasive water jet (AWJ) cutting. This study does not consider explosive methods of severing piles and skirt piles because, with the exception of the Eureka platform skirt piles, all of the piles and skirt piles are too large to be severed by 50 lb. SWEDE or octagon configured charges. It is possible that dependable shaped charges will be developed which could sever the 60" diameter and 72" diameter piles and skirt piles with explosive charge of suitable weight before these platforms are actually removed. Nevertheless, the study assumes that all piling are cut using abrasive water-jet techniques. Figure 2.8 illustrates how the hopping process would proceed.

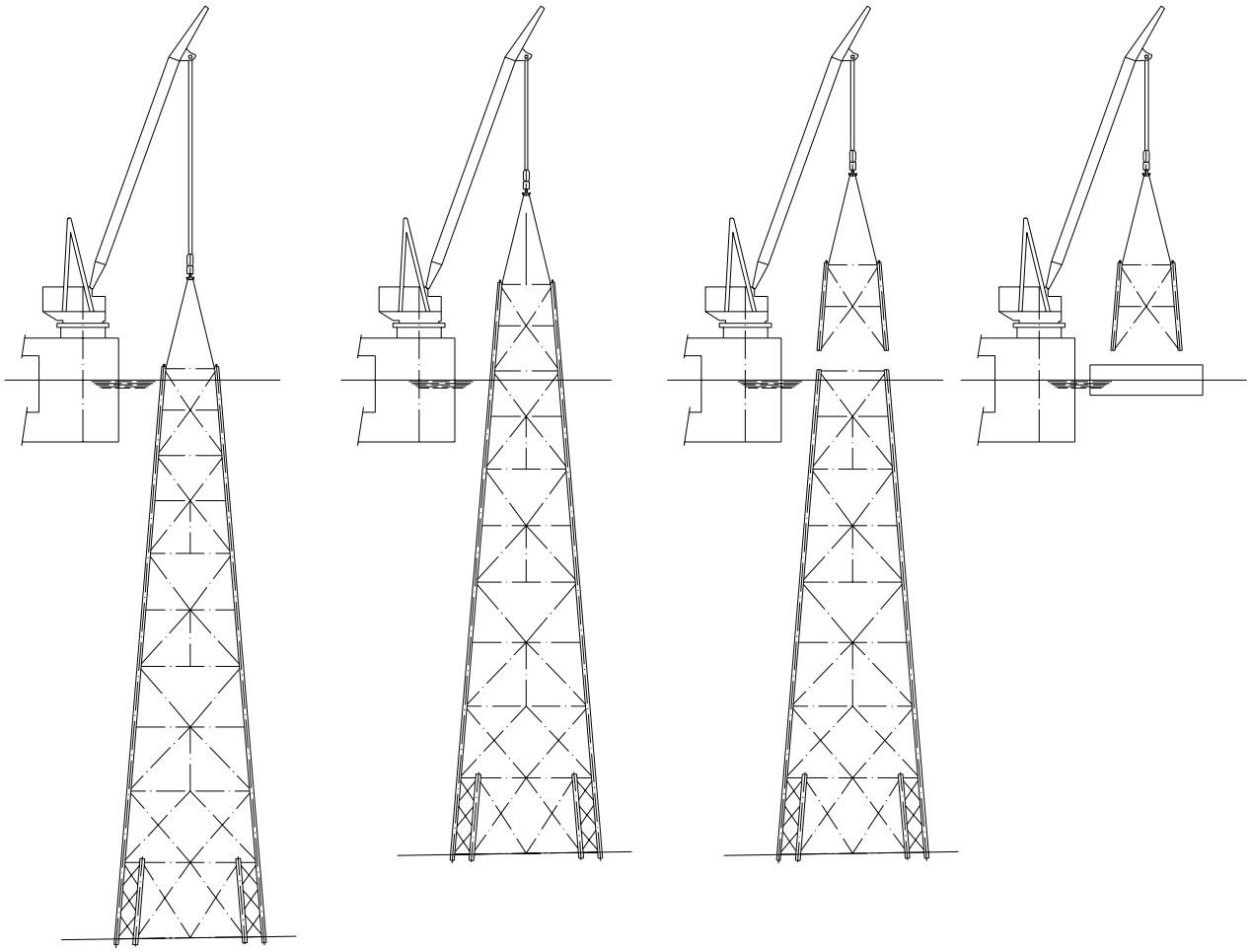


Figure 2.8 Complete removal by jacket "hopping" into shallower water.

The hopping method minimizes the requirement for cutting underwater. However, there are operational issues with respect to gaining access to the members that are to be cut in air. Many of the cuts would be made at significant heights above the water surface and in places on the jacket that are not readily accessible. This is primarily a cost issue, but if not handled properly, it would become a

safety issue. There is also the issue of creating new work 'sites' at each new location where the jacket is placed.

Figure 2.9 illustrates how the Eureka jacket would be sectioned for cutting in-situ using the smaller derrick barge. The detailed procedures for all methods considered are provided in Appendix A.

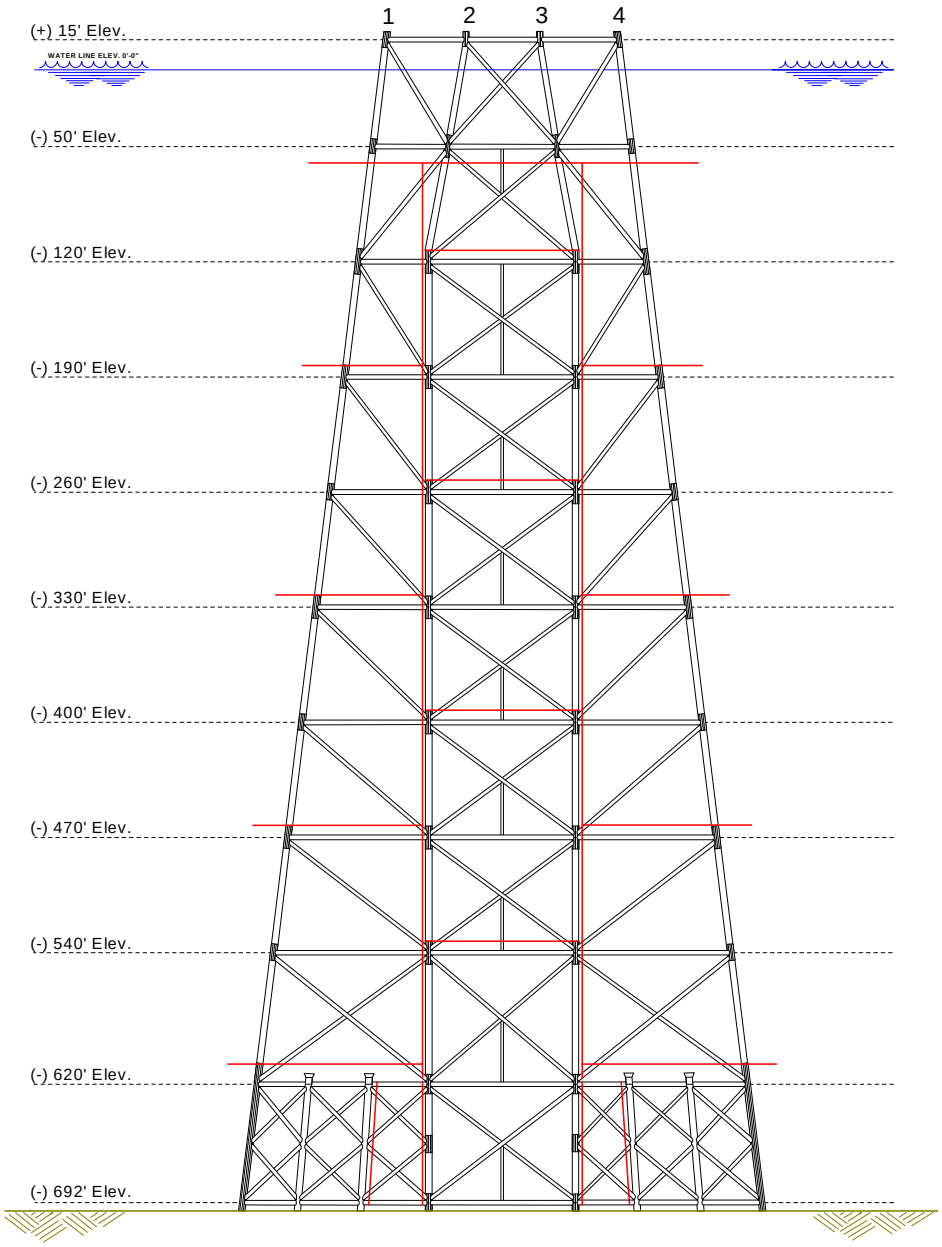


Figure 2.9 Eureka Small Piece In-situ cuts.

2.4 DETERMINING HUMAN RESOURCE REQUIREMENTS

The detailed procedures assumed for the complete removal of the three selected platforms - Eureka, Irene and Hidalgo – are contained in Appendix A, along with sketches showing the cut lines. Figure 2.7 shows the scenarios that have been evaluated. As discussed in Section 2.1, a 2000 ton lift capacity derrick barge (DB) was used as the prototype for the "small piece" in-situ removal method. A 5000+ ton lift capacity Semi-submersible Crane Vessel (SSCV) was used for the "hopping" and "large piece" in-situ removal methods. On-board manning requirements were provided by contractors who operate these type vessels. In assessing the work effort required for particular tasks, only conventional off-the-shelf technology and work methods were applied. Improvements that may be possible with advanced or developing technology will be discussed in Section 4.3, Mitigation.

General Assumptions:
The following assumptions apply to all removal scenarios:

1. Bottom debris, cuttings and/or shell mounds, if any, have been previously removed.
2. Marine Growth has been previously removed.
3. Work performed by saturation divers will incrementally progress downward.
4. Pipelines and pipeline risers have previously been properly abandoned.
5. Access to work-sites is unrestricted.
6. For horizontal members at the mudline and for pipelines, the task hour durations for hand jetting are set at a depth of 3 feet. Jetting to greater depths are not included in this report.
7. Platform configuration is as per supplied structural drawings, which generally were as-built drawings.
8. Additional time on-site due to weather is not considered.

Diving Operations

Offshore salvage diving operations are influenced by several factors, which dictate the make-up and size of the diving crew, and the type of equipment required to accomplish a particular task or tasks.

1. Water Depth
2. Duration of the Workday
3. Tasks to be accomplished
4. Bottom Time required to accomplish a Particular Task
5. Environmental Conditions

Water Depth initially determines the breathing medium to be used by the diver. From the surface to (-) 150', air is the preferred breathing medium, below (-) 150' mixed gas is the preferred medium, depending on the task to be performed. The equipment required for air diving consists of diving compressors capable of supplying air to the diver at 100 to 150psi over that of the bottom pressure. At depths greater than (-) 150' Nitrogen in the air becomes narcotic (Nitrogen Narcosis) to the diver and another breathing medium is required. Nitrogen is replaced by Helium to prevent "Nitrogen Narcosis", and the Oxygen level in the breathing medium is progressively reduced to prevent "Oxygen Toxicity" at deeper depths. This mixing of breathing gases is know as "Mixed-Gas Diving", and has been effective to a depth of 1000'. Beyond 1000', human diving becomes impractical for a variety of reasons; therefore a more economical Remote Operating Vehicle (ROV) typically performs diving tasks. Mixed-Gas diving requires a quantity of compressed gas storage tanks, and the equipment and

personnel capable of mixing and monitoring breathing gas mixtures with great accuracy, along with a compliment of standard diving equipment.

Water Depth and the time a diver spends at that depth also determines the need for additional diving equipment, such as decompression chambers. As the diver descends to deeper depths, the pressure on his body increases, and as the pressure increases his body tissues absorb more of the gas he breaths, until his body reaches the saturation point (it can no longer absorb gas at a particular depth). The rate at which gases are absorbed at a particular depth have been calculated for a given time period, and decompression tables have been produced to allow expanding gases in the divers body to escape at a safe rate while ascending, thereby preventing "The Bends" (decompression sickness). Decompression chambers allow the gas exchange to take place in a controlled environment by quickly recompressing the diver, once on the surface, and then slowly reducing pressure at a specified rate to prevent the expanding gases from ripping body tissue and causing severe pain.

To eliminate the need for post-dive decompression and to increase the divers working time at depth, "Saturation Diving" was introduced. As mentioned previously the divers body will eventually reach a point of saturation, at a given depth. Once the body has reached that point, it no longer absorbs breathing gases into tissues, and therefore incurs no further requirement for decompression other than that already incurred. The diver now can remain at that depth indefinitely without incurring any addition decompression time (accepted industry maximum time in saturation is 30 days). This requires equipment capable of housing teams of divers (usually two to four 2-man teams), under pressure, for prolonged periods and transporting those divers to and from the work site, under pressure, on a daily basis. Once the project is completed, the entire saturation complex and the divers inside will be slowly decompressed over a period of a few days, instead at the end of each dive. The equipment required is highly complex and requires round-the clock monitoring on the surface and at depth. The saturation complex consists of living & sleeping areas, dinning & recreation areas, and shower & toilet facilities for up to twelve (12) men. To transport the dive teams from the pressurized saturation complex to working depth requires a pressurized diving bell, and handling system capable of lowering the diving bell to the work-site. A pressurized transfer lock is required to allow the divers to transfer from the saturation complex to the diving bell with out compromising the other divers in the saturation complex. The saturation complex, transfer lock, diving bell, and bell divers require constant monitoring by the topside saturation crew. Clothes are washed & dried, food trays are pasted in & out, sanitary systems are drained in the saturation complex, while the diving bell is raised and lowered, the bell divers needs are met, and emergency crews stand ready in the event of an emergency. This requires an extensive "round-the-clock" surface support team.

Duration of the workday, required tasks, and required bottom time to accomplish the tasks will also determine the type of equipment and size of the diving crew required. Working "daylight hours" (14 to 16 hours/day) will require less diving personnel than working "around-the-clock" (24 hours/day). Mixed gas diving will require more personnel and equipment than shallow air diving, and saturation diving will require more personnel and equipment than either air or mixed gas diving. Air and mixed gas diving could be conducted during "daylight hours", or "around-the-clock". However, saturation diving must be conducted "around-the-clock", because of the constant monitoring required and the economics of a saturation spread. The task of inspecting the opening of a water intake casing would require much less bottom time than cutting a 72" diameter jacket leg with underwater burning gear. The same two tasks attempted at (-) 35' and at (-) 650' would take approximately the same time to accomplish, but due to the increased water depths, logistics, increased decompression and additional equipment requirements, the time and costs to complete the deeper tasks will increase dramatically.

Environmental conditions on-site pose even more demands on the diving crew and their equipment. Severe underwater currents can adversely affect deepwater diving operations by preventing divers and their needed equipment from reaching the work-site. Unless equipment can be modified or specialized equipment employed, the diving operation would be shutdown. As divers descend to the deeper depths, the increasingly colder water, and the loss of body heat caused by breathing the lighter mixed-gases, requires that thermal protection be provided to keep the diver from succumbing to "hypo-thermia" (abnormally low body temperature). Thermal heating is supplied by sophisticated topside hot water units, which pump heated water through the divers umbilical, to the diver, via the diver's hot water suit. Loss of hot water supply at depth will force the diver to make a hasty retreat to the safety of the diving bell.

Taking these factors into consideration, in the present study, the water depth range for surface diving was set at (-) 0' to (-) 150', and (-) 150' to approximately (-) 700' for saturation diving. Both the surface diving and saturation diving crews were scheduled for a 24-hour (continuous) workday and the crew sizes were adjusted accordingly. The tasks to be accomplished were assessed and the required equipment was supplied. The time to accomplish each task was developed by taking all the above-mentioned factors into consideration.

Other Labor Categories

Determining labor requirements for the other labor categories have followed standard estimating procedures:

1. The detailed complete removal procedure to be followed is developed by experienced offshore construction personnel.
2. Required tasks are determined by experienced offshore platform decommissioning estimators.
3. Individual task work requirements are based on the assumption that the most efficient crew size/configuration used. In estimating task work requirements, the minimum, most probable, and the maximum required are estimated.
4. Total task duration’s are determined by applying the available labor resources to the estimated work effort.
5. In general it is assumed that no more than two (2) work activities are being carried out at any one time.

Tables in Appendix A provide detailed lists of the required tasks assumed for each scenario considered. Also shown are the expected total labor required for each task by labor category. The specific study results are presented in Section 3 and discussed in Section 4.

2.5 DELELOPMENT OF SERIOUS ACCIDENT AND FATALITY RATES

This study has made an effort to gather all of the accident and fatality data that is publicly available, relevant to offshore platform decommissioning. Appendix B provides a report by Professor Robert Bea titled "Summary of Industry Accident Statistics," which identifies the data sources that are available. It was originally intended that individual accident rates would be provided for each of the individual labor categories. However, in the end this was not possible because of the limited availability of data. Another issue is the general lack of accident data from sources in the US offshore industry. To be useable in the context of this study, the "rate" of accidents for a given number of hours worked must be available. All of the sources accessible by this study reported only actual accident information for the US based offshore industry, without the reporting the hours worked associated with the accidents. This information is not useable in the probabilistic models used in this study. Therefore, the accident rates used are based primarily on data generated in Europe. It may be argued that the rates for the US offshore industry are different. However, this can not be verified at this time.

Tables 2.4 and 2.5 (from Appendix B), provide the rates for serious injuries (SIR) and for fatal accidents (FAR), respectively, that have been used.

Table 2.4 – Proposed low bound, most probable, and high bound SIR (injuries per 10E6 hours of exposure) for decommissioning operations

Decommissioning activity	Low bound SIR	Most probable SIR	High bound SIR
Onshore	2.0	5.0	10.0
Offshore above water	2.0	3.0	5.0
Air diving	1700	2000	2300
Saturation diving	1700	2000	2300

Table 2.5 – Proposed low bound, most probable, and high bound FAR (injuries per 10E8 hours of exposure) for decommissioning operations

Decommissioning activity	Low bound FAR	Most probable FAR	High bound FAR
Onshore	5.0	6.0	9.0
Offshore above water	2.0	4.0	6.0
Air diving	500	600	700
Saturation diving	500	600	700

2.6 PROBABILISTIC MODELING OF OFFSHORE DECOMMISSIONING ACCIDENTS

We do not have the ability to specifically predict accidents under any circumstances. However, by careful review of the history of accidents and with a good understanding of the work processes involved, we can draw broad conclusions about the relative safety of one particular approach versus another. That is what this study attempts to do.

This study evaluates the relative risk, in terms of projected serious injury or fatalities from decommissioning of large offshore platforms using two different approaches to complete removal of all material. To accomplish this, probabilistic models have been developed for each of the scenarios considered. These scenarios are shown in Figure 2.7.

The process for developing the probabilistic models is as follows:

1. Detailed task lists are developed for each removal scenario.
2. For each task, the minimum, most probable and maximum duration are determined based on a specified work crew sizes.
3. The above is input as triangular probability distribution functions (PDFs) for task duration in the model.
4. Total work requirements (man-hours) are calculated for each task, including a breakout for each labor category.
5. Overall statistics are calculated for all labor categories for the entire project.
6. The above are applied with accident rate PDFs to develop projected accident statistics.
7. For comparison, the results for each case are normalized against a base case.

The base case in this study is the **Irene** platform in-situ removal using a smaller derrick barge. This is believed to be the project scenario that is closest to what would be considered a “normal” decommissioning project as of the date of this study.

The probabilistic modeling is performed with commercially available software: Palisade’s @Risk for Excel Professional, version 4.5.2. Representative output for each case is contained in Appendix A.

All PDFs in this study are input as triangular distribution functions, as represented in Figure 2.10. The **minimum** (lower bound) value is taken as the value of the variable with a 5% chance of <u>not</u> being exceeded in multiple trials of the same project. The **maximum** (upper bound) is the value that has a 95% chance of <u>not</u> being exceeded. The **most probable** is the value that is expected to be experienced most often.

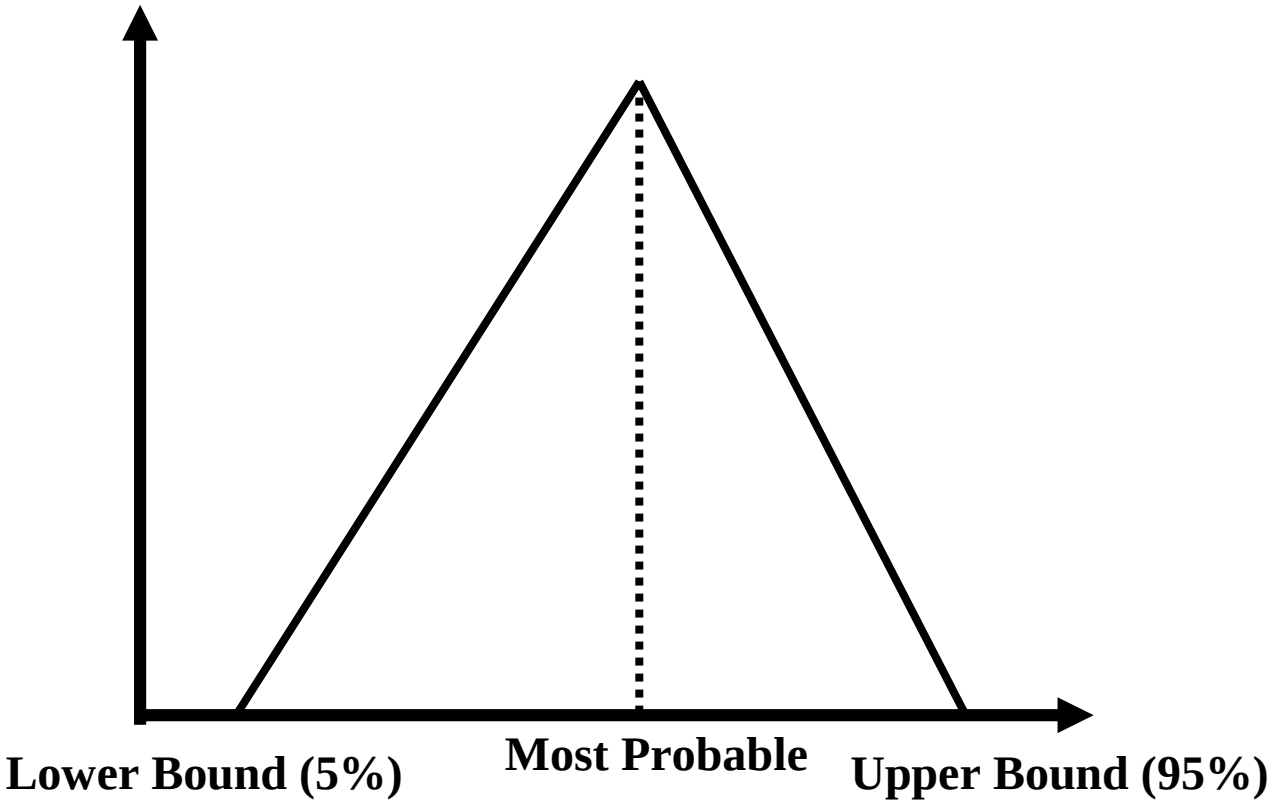


Figure 2.10 Triangular Distribution of Work, FAR or SIR

SECTION 3 - STUDY RESULTS

A summary of selected study results is presented in Section 1. The detailed results for each case considered in the study are contained in Appendix A. Appendix B contains a report on the search for accident data and the development of the accident statistics used in this study. The following table and figures summarize the principal results of the study.

3.1 Tasks and Work-effort Required

1. Table 3.1 compares the Minimum (P5), Most Probable, Average, and Maximum (P95) total task hours for each of the scenarios. Total task hours would equal the duration of the decommissioning projects if tasks are not performed in parallel.
2. Table 3.2 provides a summary of the groupings of decommissioning labor categories as used in this study to define risk.
3. Table 3.3 shows the distribution of the work effort for all work categories for each scenario in terms of the Average Value (AV) for total man-hours.

3.2 Comparative Accident Projections

1. Table 3.4 shows the Relative Risk of serious injuries during each decommissioning scenario, broken out by work category. The results are normalized against the **Irene In-Situ Small DB** case, which is considered the most representative of the industries current experience in decommissioning. For the purpose of normalization, the base case is set to an AV of one (1) serious accident during the decommissioning process. The actual AV may be found in Appendix A.
2. Table 3.5 shows the Relative Risk of fatalities during each decommissioning scenario, broken out by work category. The results are normalized against the **Irene In-Situ Small DB** case as described above.

3.2 Generalization of Results

1. Figure 3.1 shows the AV of total man-hours worked as a function of water depth for the two complete removal methods evaluated. It should be noted that water depth and jacket weight are essentially interchangeable in the context of the POCSR platforms.
2. Figure 3.2 shows the AV of total task hours as a function of water depth for each decommissioning method.
3. Figure 3.3 shows the Relative Risk of serious injury as a function of water depth for each decommissioning method.
4. Figure 3.4 shows the Relative Risk of fatalities as a function of water depth for each decommissioning method.

Table 3.1 Total Task Hour Comparison

Platform/Method	Minimum Hours (P5)	Most Probable Hours	Average Hours	Maximum Hours (P95)
Irene In-Situ Small DB	623	907	1028	1554
Irene In-Situ Large DB	553	791	903	1365
Hidalgo In-Situ	978	1352	1525	2245
Eureka In-Situ	1173	1716	1956	2988
Hidalgo Hopping	695	1052	1176	1780
Eureka Hopping	960	1503	1686	2595
Average Change	**-32%**	**0%**	**13%**	**71%**

Table 3.2 Work Category Groupings

Work Category	Personnel
On Deck High Risk	**Riggers, Welders, Clean Tech. Riggers, X-Ray Hand**
On Deck Support	**Dive Support, Project Mgmt., Foremen, Crane Operator**
Marine & Other Support	**Marine and Other Support**
Air Diving	**Air Divers**
Saturation Diving	**Saturation Divers**

Table 3.3 Average Value of Total Labor Man-Hours by Category

Work Category	IN-SITU				HOPPNG	
	Irene Small DB (Base Case)	Irene Large DB	Hidalgo Small DB	Eureka Small DB	Hidalgo Large DB	Eureka Large DB
On Deck, High Risk	26,864	26,051	45,750	62,134	39,139	59,631
On Deck, Support	5,660	3,639	11,536	14,160	4,131	4,941
Marine & Other Support	15,041	13,778	29,454	41,958	23,322	41,183
Diving, Air	235	87	357	217	209	290
Diving, Saturation	282	163	1,317	2,211	0	0
Total Man-Hours	48,082	43,718	88,414	120,681	66,800	106,045
For Reference: Average Total Task Man-Hours	1028	903	1525	1956	1176	1686

Table 3.4 Relative Risk of Serious Injury During Decommissioning

Work Category	IN-SITU				HOPPNG	
	Irene Small DB (Base Case)	Irene Large DB	Hidalgo Small DB	Eureka Small DB	Hidalgo Large DB	Eureka Large DB
On Deck, High Risk	0.075	0.073	0.128	0.174	0.109	0.167
On Deck, Support	0.016	0.010	0.032	0.040	0.012	0.014
Marine & Other Support	0.042	0.038	0.082	0.117	0.065	0.115
Diving, Air	0.394	0.145	0.599	0.364	0.351	0.487
Diving, Saturation	0.473	0.274	2.207	3.706	0.000	0.000
Totals	1.000	0.540	3.048	4.401	0.537	0.782

Table 3.5 Relative Risk of Fatalities During Decommissioning

Work Category	IN-SITU				HOPPNG	
	Irene Small DB (Base Case)	Irene Large DB	Hidalgo Small DB	Eureka Small DB	Hidalgo Large DB	Eureka Large DB
On Deck, High Risk	0.215	0.208	0.366	0.496	0.313	0.476
On Deck, Support	0.045	0.029	0.092	0.113	0.033	0.039
Marine & Other Support	0.120	0.110	0.235	0.335	0.186	0.329
Diving, Air	0.282	0.104	0.428	0.260	0.251	0.348
Diving, Saturation	0.338	0.196	1.578	2.650	0.000	0.000
Totals	1.000	0.647	2.699	3.855	0.783	1.193

Figure 3.1 Water Depth Vs. Man-Hours

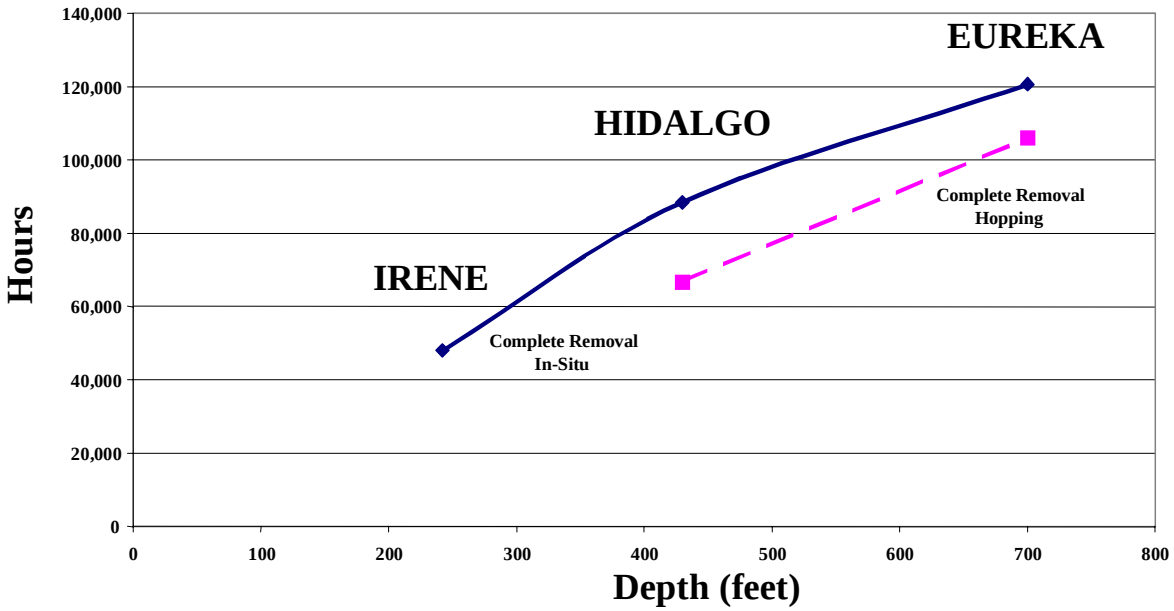


Figure 3.2 Water Depth Vs. Average Total Task Hours

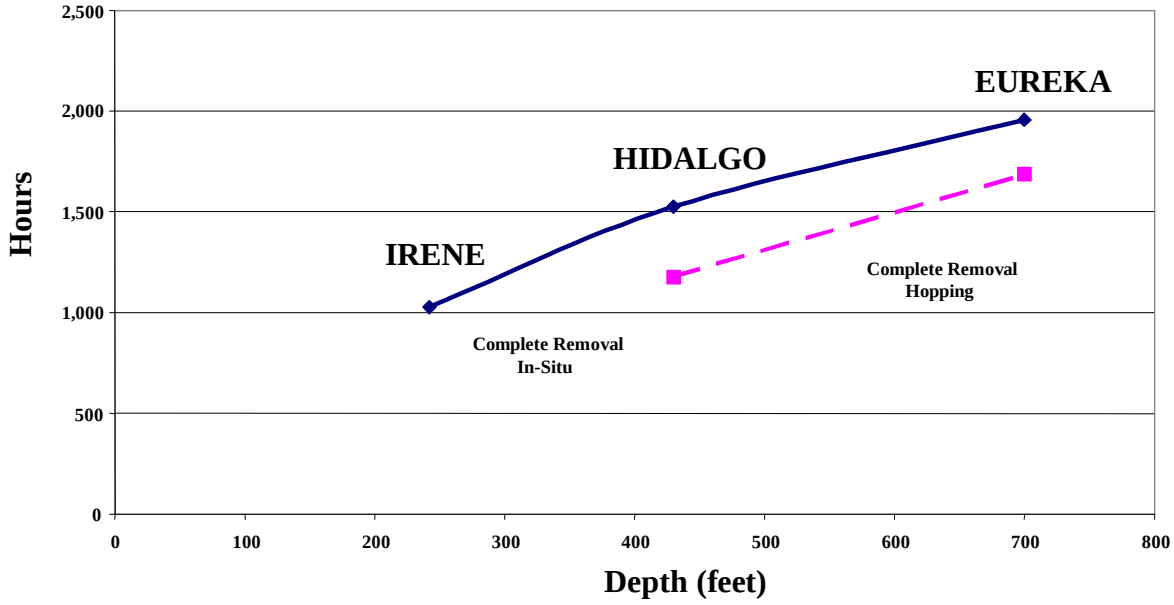


Figure 3.3 Water Depth Vs. Relative Risk of Serious Injury

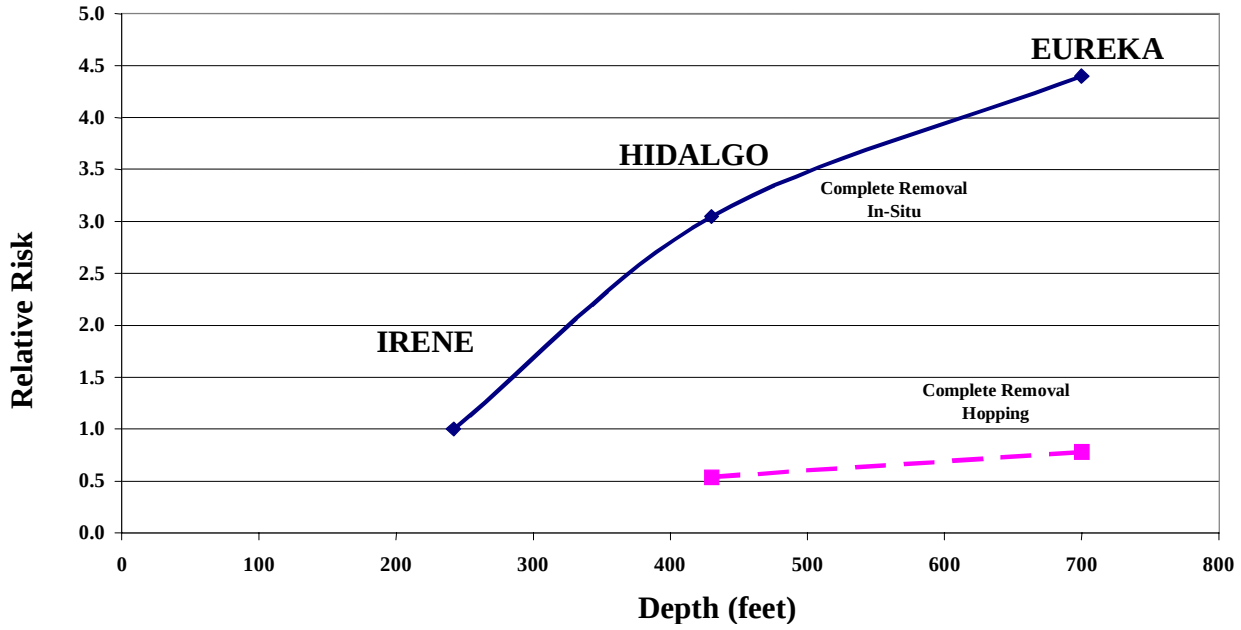
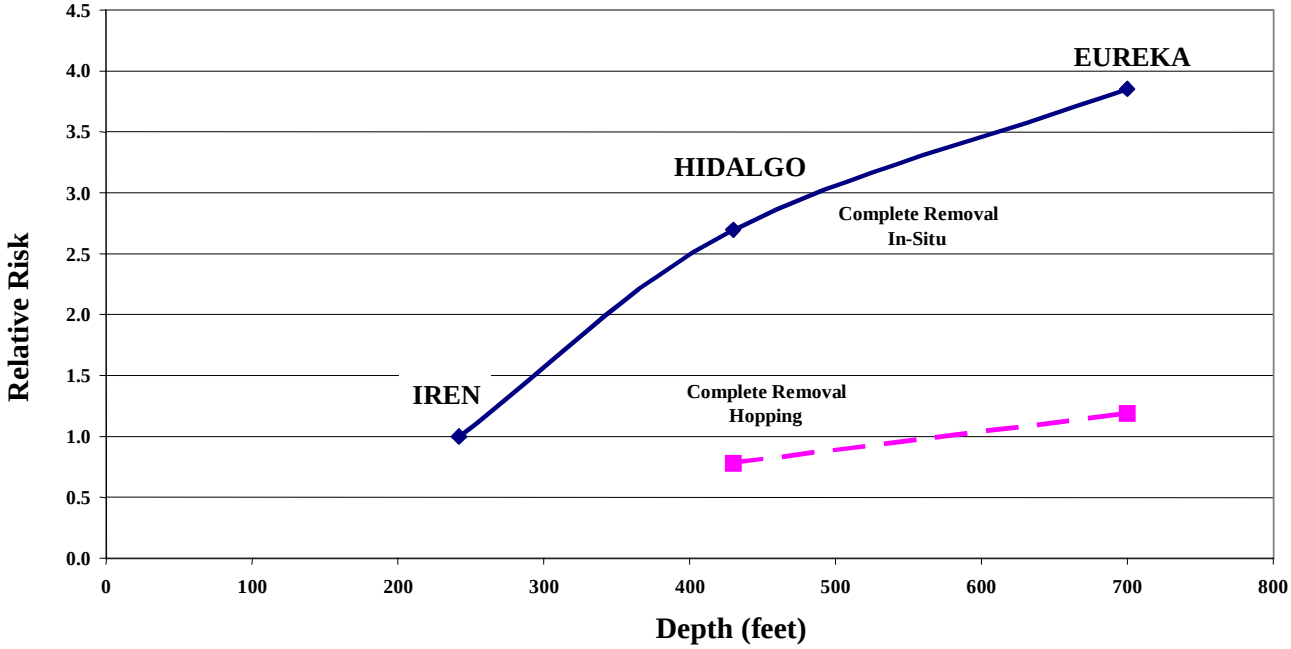


Figure 3.4 Depth Vs. Relative Risk of Fatalities



SECTION 4 - DISCUSSION OF RESULTS

Before proceeding with a discussion of decommissioning methods and their comparative safety, it is worthwhile to make some general observations about risk in decommissioning in general. Examination of Table 3.1, which compares the minimum, most probable, average and maximum total task time for all methods, shows that there is considerably more risk of the work duration increasing than decreasing. This reflects the reality that there are generally many more things that can go wrong in decommissioning than there are opportunities for major improvement, when compared to the most probable outcome. This also leads to the fact that the AV in a probabilistic analysis is higher than the most probably value, in this case about 10%. The AV is the numerical average of all outcome in a probabilistic simulation, while the most probable (or 'mode') value is that with the highest probably of occurring. The AV being higher than the mode indicates a skewed distribution in the direction of higher values, which is negative in this case. The average change represents the sum percent delta from the most probable value.

4.1 Comparison of Decommissioning Methods

Reviewing the results present in Section 3 leads to the following observations:

- Complete Removal In-Situ will be more time consuming and demand more human resources than the Hopping method. This assumes the use of the technology and methods that are readily available today.
- The Hopping method appears to be much safer in a relative since, when compared to In-situ jacket removal.
- Risk of accidents increase with water depth for both methods, both it increases much faster with the In-situ method.
- Review of the accident rate data presented in Section 2 and the results in Section 3 point to underwater work with divers as the major risk area.

4.2 Limitations of the Analysis

- As in any form of modeling, the results are only as good as the input to the model. With respect to the industry's experience, both Hidalgo and Eureka are significantly larger and also in deeper water than anything that has been removed to date. The decommissioning models used in this study were developed by knowledgeable and experienced people, but they contain a large number of assumptions that will eventually need to be verified.
- The accident data used to develop the rates used in this study were not as specific to the offshore industry in general and to decommissioning in particular as would be desired.
- The previous comment is particularly true for the diving accident data. This issue has been discussed with diving industry representatives. A convincing case has been made that the US based diving industry has a much better accident record than is reflected in the data used for this study. However, no data has been made available that would support that assertion. This is apparently because the data is not collected, by the government, in a manner that can be used for this type of analysis.

4.3 Mitigation to Improve Decommissioning Safety

Review of the results of this study indicate that reducing the required time in the water for divers would be the most effective way to improve safety. The following are ways in which this might be accomplished:

4.3.1 Diving Operations with ROV's

In the past 25 years the term "Diving Operations" has taken on new meaning, in that diving operations are not limited to the use of human divers. Increased working depths and major advancements in technology have allowed robotic divers or Remote Operating Vehicles (ROV's) to become an integral part of the diving industry. ROV's have evolved from small underwater observation vehicles, which had little or no real capability, to heavy class working vehicles capable of working at extreme depths in very extreme conditions.

The development of ROV's over the years has not diminished the usefulness of human divers, and in many cases has actually enhanced diver capability. ROV's do have limitations; they can't think, they don't have a sense of touch, they must have visibility, they require specialized tooling, they require extensive maintenance and support systems, and they require a highly technical, highly trained operations group. Divers also have limitations, the greatest of which is water depth. As water depth increases beyond the capability of human divers the ROV begins to play a major role in all phases of the offshore oil & gas industry.

However, engineers involved in deep-water oil & gas projects must include the ROV in formulating their design criteria, thereby making the project "ROV friendly". If the ROV is not considered in the design criteria of the project, its capability becomes extremely limited. Specialized tooling must be developed and incorporated in the design to allow the ROV to accomplish even the simplest of tasks.

The use of ROV's in platform decommissioning has, at this point in time, not been extensive. This is due in part to the fact that most decommissioning projects have been in shallower waters, more suited to human divers, and that the diving tasks involved, such as underwater burning, rigging and jetting, are not tasks for which ROV's are well suited. Advances in technology have introduced new cutting techniques (i.e., diamond wire cutting and abrasive cutting) for which the ROV is better suited, however, they are extremely slow processes and in most cases require the assistance of human divers. The ROV is still not proficient at rigging or jetting, and on-site decision making must be an interpretation of what the ROV operator sees through the lens of the ROV video camera, if he sees anything at all. The use of ROV's in platform decommissioning does not necessarily reduce the exposure of human divers, however it does greatly increase the duration and thereby the cost.

Figure 4.1 shows a diamond-wire cutting system mounted on an ROV. Figure 4.2 shows a test cut being performed on a shackle, which was later carried out remotely at a depth over 2000 feet. While these and other similar systems are being developed, they have never been used to date in the applications that would be required for platforms such as **Eureka** and **Hidalgo**.

Figure 4.3 Shows a mechanical shear system that is actively used in cutting up of scrap material on-shore, and has potential for use in offshore operations. Currently available hardware can sever members to 36 inches diameter, on-shore. However, to date this technology has not been adapted for

offshore applications. It is likely that field application of this type technology is some years away, and would require significant development.

Figure 4.4 shows a manned submersible system that is in active service in the Gulf of Mexico and other areas. It has significant potential for replacing divers in many operations. How its application would effect safety or the overall decommissioning project is not possible to determine at the time of this report.

Figure 4.1 Remotely operated diamond-wire cutting system.

Figure 4.2 Test cut on a deepwater mooring shackle.

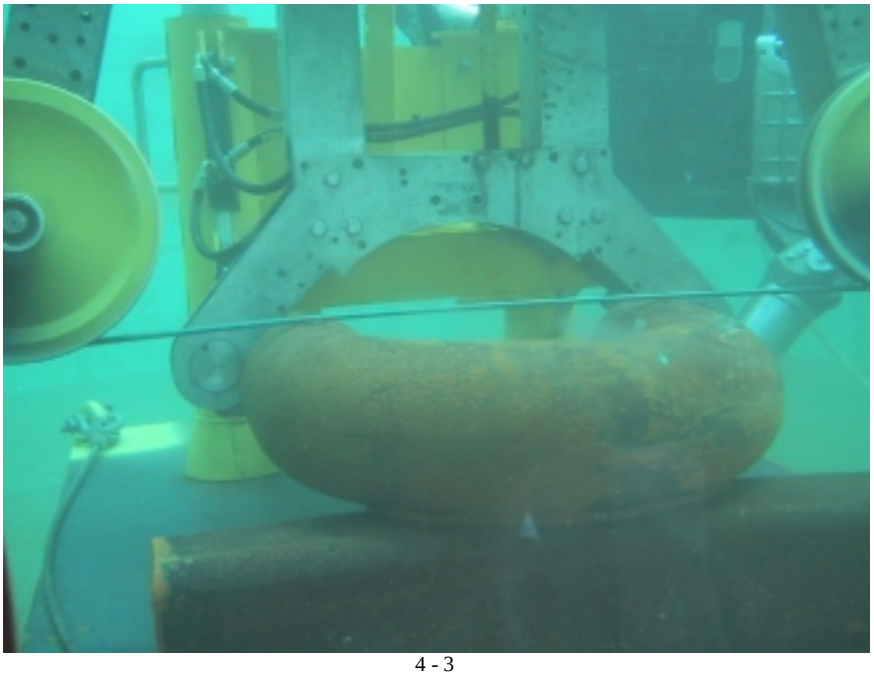


Figure 4.3 Allied-Gator® MT™ mechanical shear.

Figure 4.4 Manned Submersible
(Courtesy of Deep Marine Technology, Inc.)

4.3.2 Reduce the overall project length.

Decommissioning projects on all of the larger POCSR platforms will be carried out with the largest equipment available, typically with work crews numbering in the hundreds. Complete removal of the POCSR platforms will require a very large expenditure of resources and energy. Anything that can be done to reduce project length will improve safety.

SECTION 5 – CONCLUSIONS AND RECOMMENDATIONS

5.1 Diving Safety Data

One of the important limitations encountered in performing this study regards adequate data on oil field diver injury and fatality data. The data that was needed addressed two categories of diving operations:

1) Air diving operations (depths to approximately 150 feet), and
2) Saturation diving operations (depths greater than 150 feet for extended durations).

The data that is needed can be organized into two categories of diver operations risks:

1) Serious injuries (requiring loss of more than 3 days of work time), and
2) Fatalities.

These two categories of diver operations risks were expressed in terms of the rates associated with these risks:

1) Serious Injury Rates (SIR), and
2) Fatal Accident Rates (FAR).

These rates are defined in terms of the number of injuries or fatalities per hour of exposure to the particular category of activity. To develop these rates requires information on:

a) The number of serious injuries or fatalities associated with a given category of operation in a given time period (e.g. one year), and
b) The number of hours that the activity population spent in the category of operation in the given time period.

In this study, the SIR were defined as the number of serious injuries per million (10E6) hours of diver operations in a particular category. The FAR were defined as the number of fatalities per 100 million (10E8) hours of diver operations in a particular category.

The conclusions of this study with respect to diving safety are:

- No source of required data could be located for commercial oil field diver SIR and FAR appropriate to U.S. offshore operations.
- Some data was available on U.S. offshore oil field diver injuries and fatalities. However, no assurance could be provided that this data represented all injuries and fatalities in a given time period. In addition, there was no information available on the diver population exposure that was represented.
- Discrimination between air - gas diving operations and saturation diving operations was even more elusive. Some data was obtained from U.K. regulatory and industry organizations and that data formed the basis for the SIR and FAR that were utilized in this study.
- In the future, if risk based management processes are to be used to help reach decisions on alternatives that can be employed in offshore operations involving diving, then it is suggested that a sustained effort be initiated and maintained by the appropriate agencies to gather, analyze,

document, and communicate the necessary information on commercial oil field diving operations. Such an initiative would require reporting by industry of all commercial diving injuries and fatalities in a given time period (annual) and the number of hours that the divers were exposed to the different categories of diving operations (air – gas and saturation).

5.2 Decommissioning Methodology

As noted previously, all efforts should be made to reduce the time and effort required to implement the decommissioning process and to reduce the requirement for divers. This would include:

- Pursuing alternatives to complete removal of the jackets.

- Considering alternatives which would eliminate the requirement to cut the jackets up, such as disposal in reef sites.

- Encouraging the development and use of remote cutting technology, or other technology that would make the cutting process proceed more quickly, such as use of explosives for cutting jacket members.

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Appendix A – Detailed Results
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A.1.1. IRENE IN-SITU SMALL DERRICK BARGE

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Irene In-Situ Small DB

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Irene
Removal In-Situ – Small Piece

Assumptions:

- The work is performed utilizing a 2000 ton capacity derrick barge or crane ship.
- Wells have been plugged and well conductors / casings have been removed to a depth of 15' BML prior to arrival of the DB.
- All topside components have been cut loose and the deck is cut into 2 – four leg sections prior to arrival of the DB.
- Below water cuts are by divers.
- Divers working above 150' water depth are on deep air.
- Divers working below 150' water depth are in saturation.
- Jacket lifting devices are internal lift tools capable of sealing the legs / piles for deballasting.

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Irene
Removal In-Situ – Small Piece

Procedures:

1. After the DB is positioned at the Irene platform, the topside equipment and the deck are removed and seafastened on cargo barges.

2. Abrasively sever the eight (8) piles at 15' BML with two (2) abrasive cutting spreads working simultaneously.

3. Cut loose and remove all braces between Row 2 and Row 3 from elevation (+)15' to just above elevations (-)165'.

4. Divers cut loose Row 1 – Row 2 jacket legs and braces just above elevations (-)165'. Install closures on the Row 1 and Row 2 piles and deballast. Using both the auxiliary and main blocks of the DB crane, lift this jacket section, rotate it into a horizontal position, place it on a cargo barge and seafasten.

5. Divers cut loose Row 3 – Row 4 jacket legs and braces just above elevations (-)165'. Install closures on the Row 3 and Row 4 piles and deballast. Using both the auxiliary and main blocks of the DB crane, lift this jacket section, rotate it into a horizontal position, place it on a cargo barge and seafasten.

6. Divers cut loose and remove braces from elevation (-)165' through elevation (-)240'.

7. DB crane rig to remaining Row 1 – Row 2 jacket, lift, place on cargo barge and seafasten.

8. DB crane rig to remaining Row 3 – Row 4 jacket, lift, place on cargo barge and seafasten.

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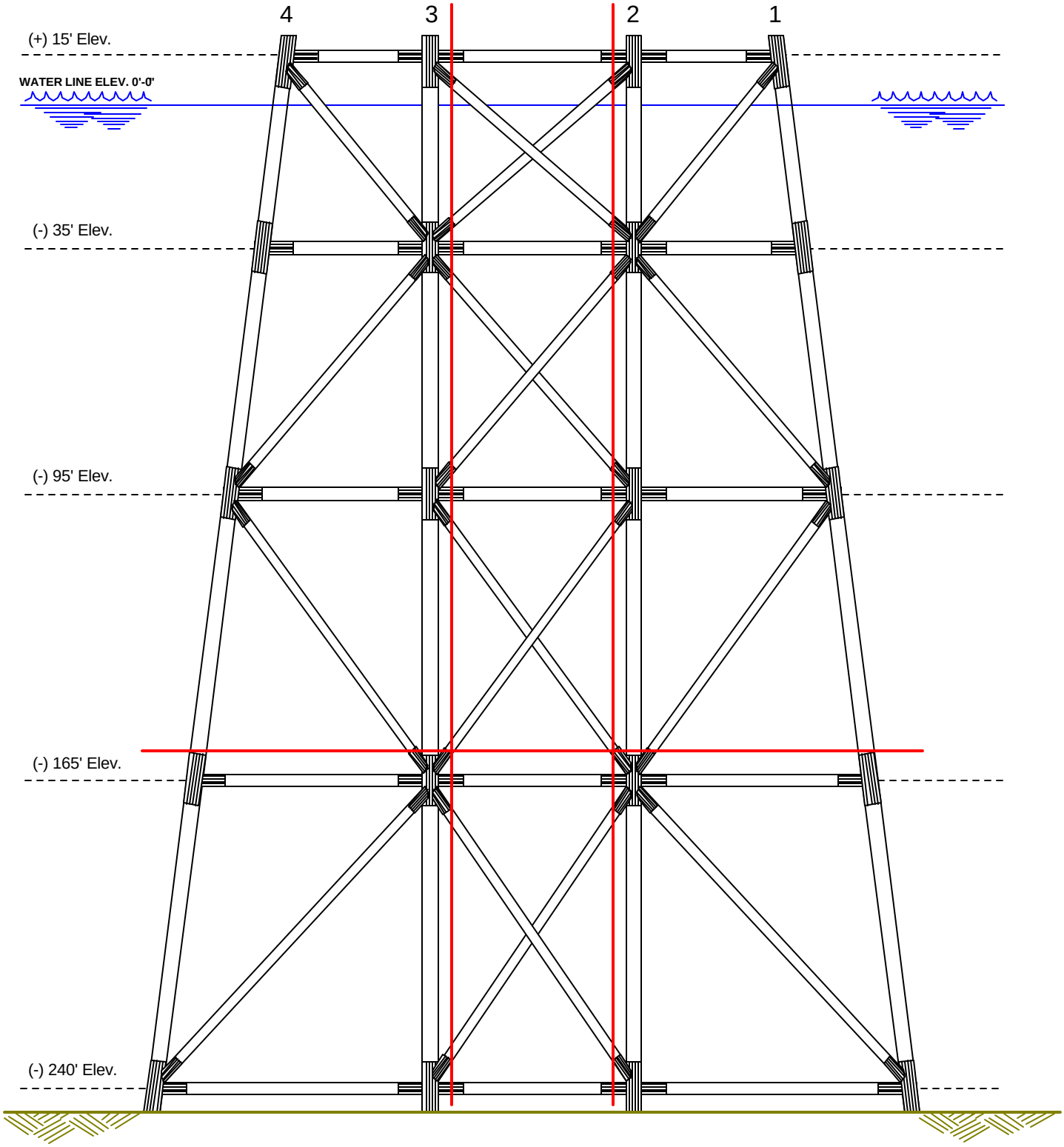

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Platform Task Min. / Max.
Table A.1.1-1. Irene In-Situ Small DB Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Platform Removal Prep	- - - -	- - - -	- - - -
Cleaning/Flushing	120	196	288
Prepare Modules, Cap Truss, and Jacket for Removal	168	252	504
Platform Removal	- - - -	- - - -	- - - -
Platform Inspection			
Set Up DB	2	4	12
Remove Equipment	18	24	36
Cut Deck in Half (as installed)	9	12	24
Remove 1/2 Deck	8	12	18
Seafasten Deck	7	9	12
Remove 1/2 Deck	8	12	18
Sever Piles (8) Abrasively-assume 2 cutting spreads (inc. Jet/Airlifting)	32	54	96
Cut and Remove Braces Between Rows 2 & 3	- - - -	- - - -	- - - -
Cut & Remove Braces Between Rows 2 & 3 (0' to -160')	58	77	135
Cut and Remove Rows 1 & 2	- - - -	- - - -	- - - -
Install Closure Plates in Rows 1 & 2 Piles	5	6	8
Rig Auxillary Block to Top of Jacket Section Row 1 & 2	1	2	4
Cut Rows 1 & 2 Above (-)165'	22	29	51
Deballast Piles	2	3	5
Install Side Slings @ (+)18' & (-)95'	4	6	12
Lift Rows 1 & 2 Top Section of Jacket with Auxillary Block	1	1	2
Rotate Jacket Section Horizontal with Main Block	1	1	2
Set Rows 1 & 2 Top Section of Jacket on CB 240 & Seafasten	10	12	18
Derig From Rows 1 & 2 Jacket Section	2	3	6
Cut and Remove Rows 3 & 4	- - - -	- - - -	- - - -
Install Closure Plates in Rows 3 & 4 Piles	5	6	8
Rig Auxillary Block to Top of Jacket Section	1	2	4
Cut Rows 3 & 4 Above (-)165'	22	29	51
Deballast Piles	2	3	6
Install Side Slings @ (+)18' & (-)95'	5	6	8
Lift Rows 3 & 4 Top Section of Jacket with Auxillary Block	1	1	2
Rotate Jacket Section Horizontal with Main Block	1	1	2
Set Rows 3 & 4 Top Section of Jacket on CB 240 #2 & Seafasten	10	12	18
Derig From Rows 3 & 4 Jacket Section	2	3	6
Cut and Remove Braces Between Rows 2 & 3	- - - -	- - - -	- - - -
NOTE: Switch to Sat. Dive Spread (150' to 300')	- - - -	- - - -	- - - -
Cut & Remove Braces Between Rows 2 & 3 (-160' to -240')	52	69	104
Cut and Remove Rows 1, 2, 3, & 4	- - - -	- - - -	- - - -
Rig to Bottom Section Rows 1 & 2 At (-)165'	8	12	18
Lift & Set on CB #3 (CB 400) & Seafasten	10	12	18
Derig	4	6	8
Rig to Bottom Section Rows 3 & 4 At (-)165'	8	12	18
Lift & Set on CB #3 (CB 400) & Seafasten	10	12	24
Derig	4	6	8
Total Task Hours	**623**	**907**	**1,554**
	31%		**71%**
	Decrease		**Increase**

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Task & Resource Hours
Table A.1.1-2. Irene Small DB In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Platform Removal Prep	----	----	----						
Cleaning/Flushing	120	201	288	1,611	805				2,416
Prepare Modules, Cap Truss, and Jacket for Removal	168	308	504	5,544	1,232				6,776
Platform Removal	----	----	----	----	----	----			
Platform Inspection									
Set Up DB	2	6	12	228	0	174			402
Remove Equipment	18	26	36	988	0	754			1,742
Cut Deck in Half (as installed)	9	15	24	570	0	435			1,005
Remove 1/2 Deck	8	13	18	481	0	367			849
Seafasten Deck	7	9	12	355	0	271			625
Remove 1/2 Deck	8	13	18	481	0	367			849
Sever Piles (8) Abrasively-assume 2 cutting spreads (inc. Jet/Airlifting)	32	61	96	2,305	0	1,759			4,065
Cut and Remove Braces Between Rows 2 & 3	----	----	----	----	----	----			
Cut & Remove Braces Between Rows 2 & 3 (0' to -160')	58	90	135	3,420	900	2,610	90		7,020
Cut and Remove Rows 1 & 2	----	----	----	----	----	----			
Install Closure Plates in Rows 1 & 2 Piles	5	6	8	241	63	184	6		494
Rig Auxillary Block to Top of Jacket Section Row 1 & 2	1	2	4	89	23	68	2		182
Cut Rows 1 & 2 Above (-)165'	22	34	51	1,292	340	986	34		2,652
Deballast Piles	2	3	5	127	33	97	3		260
Install Side Slings @ (+)18' & (-)95'	4	7	12	279	73	213	7		572
Lift Rows 1 & 2 Top Section of Jacket with Auxillary Block	1	1	2	51	13	39	1		104
Rotate Jacket Section Horizontal with Main Block	1	1	2	51	13	39	1		104
Set Rows 1 & 2 Top Section of Jacket on CB 240 & Seafasten	10	13	18	507	133	387	13		1,040
Derig From Rows 1 & 2 Jacket Section	2	4	6	139	37	106	4		286
Cut and Remove Rows 3 & 4	----	----	----	----	----	----			
Install Closure Plates in Rows 3 & 4 Piles	5	6	8	241	63	184	6		494
Rig Auxillary Block to Top of Jacket Section	1	2	4	89	23	68	2		182
Cut Rows 3 & 4 Above (-)165'	22	34	51	1,292	340	986	34		2,652
Deballast Piles	2	4	6	139	37	106	4		286
Install Side Slings @ (+)18' & (-)95'	5	6	8	241	63	184	6		494
Lift Rows 3 & 4 Top Section of Jacket with Auxillary Block	1	1	2	51	13	39	1		104
Rotate Jacket Section Horizontal with Main Block	1	1	2	51	13	39	1		104
Set Rows 3 & 4 Top Section of Jacket on CB 240 #2 & Seafasten	10	13	18	507	133	387	13		1,040

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Task & Resource Hours
Table A.1.1-2. Irene Small DB In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Derig From Rows 3 & 4 Jacket Section	2	4	6	139	37	106	4		286
Cut and Remove Braces Between Rows 2 & 3	----	----	----	----	----	----			
NOTE: Switch to Sat. Dive Spread (150' to 300')	----	----	----	----	----	----			
Cut & Remove Braces Between Rows 2 & 3 (-160' to -240')	52	75	104	2,850	675	2,175		150	5,850
Cut and Remove Rows 1, 2, 3, & 4	----	----	----	----	----	----			
Rig to Bottom Section Rows 1 & 2 At (-)165'	8	13	18	481	114	367		25	988
Lift & Set on CB #3 (CB 400) & Seafasten	10	13	18	507	120	387		27	1,040
Derig	4	6	8	228	54	174		12	468
Rig to Bottom Section Rows 3 & 4 At (-)165'	8	13	18	481	114	367		25	988
Lift & Set on CB #3 (CB 400) & Seafasten	10	15	24	583	138	445		31	1,196
Derig	4	6	8	228	54	174		12	468
Total Task Hours	**623**	**1,028**	**1,554**	**26,864**	**5,660**	**15,041**	**235**	**282**	**48,082**
	31%		**71%**						
	Decrease		**Increase**						

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Risk Assessment Platform Decommissioning Phase 2
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Projected Serious Accidents
Table A.1.1-3. Irene Small DB In-Situ Removal

Risk Category*	Average Value Man-hours	Projected Value Serious Accidents
On Deck, High Risk	26,864	0.0895
On Deck, Support	5,660	0.0189
Marine & Other Support	15,041	0.0501
Diving, Air	235	0.4707
Diving, Saturation	282	0.5640
Totals	48,082	1.1932

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

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Risk Assessment Platform Decommissioning Phase 2
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Projected Fatalities

Table A.1.1-4. Irene Small DB In-Situ Removal

Risk Category*	Average Value Man-hours	Projected Value Fatalities
On Deck, High Risk	26,864	0.0011
On Deck, Support	5,660	0.0002
Marine & Other Support	15,041	0.0006
Diving, Air	235	0.0014
Diving, Saturation	282	0.0017
Totals	48,082	0.0050

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

Figure A.1.1-1. Irene In-Situ Small DB

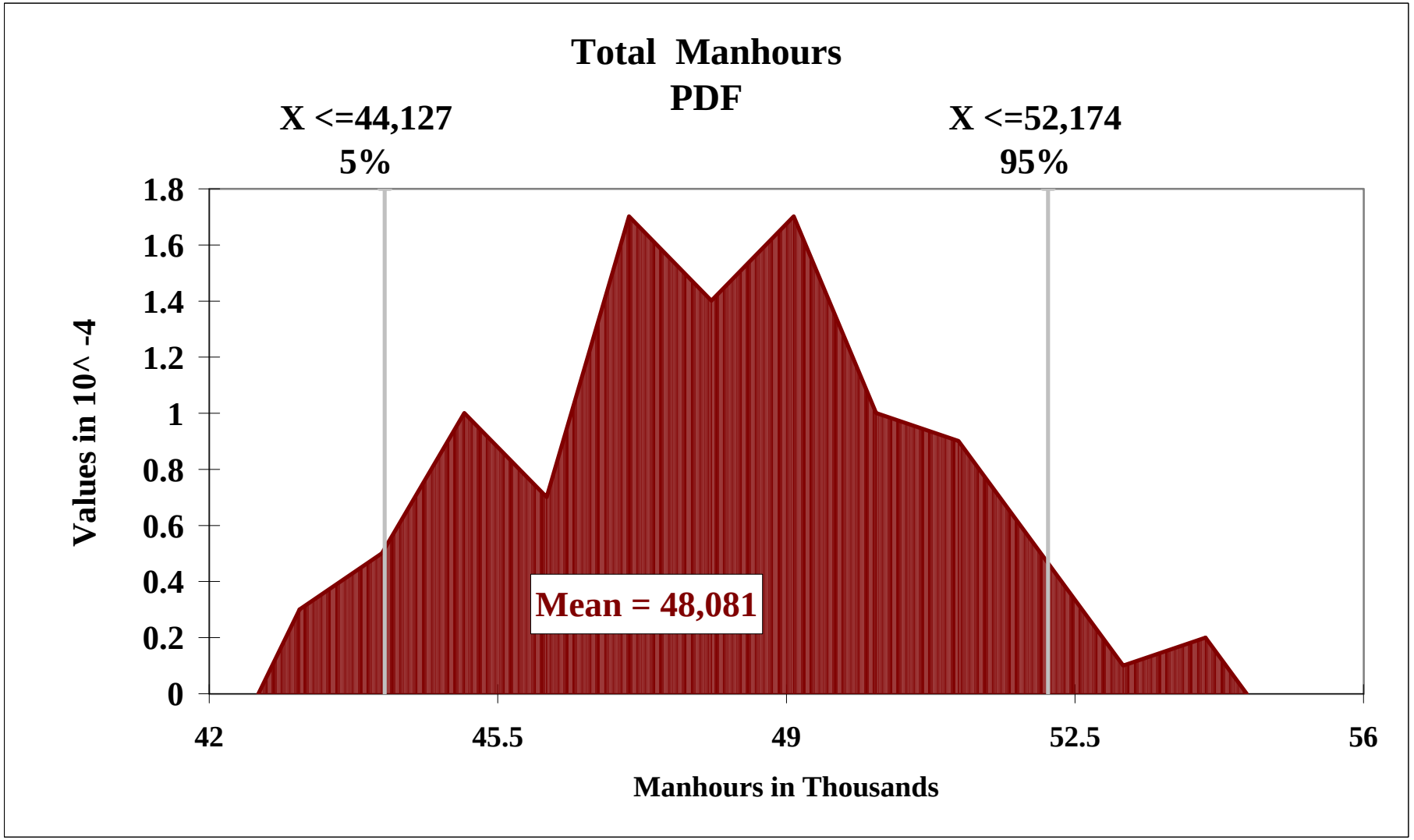


Figure A.1.1-2. Irene In-Situ Small DB

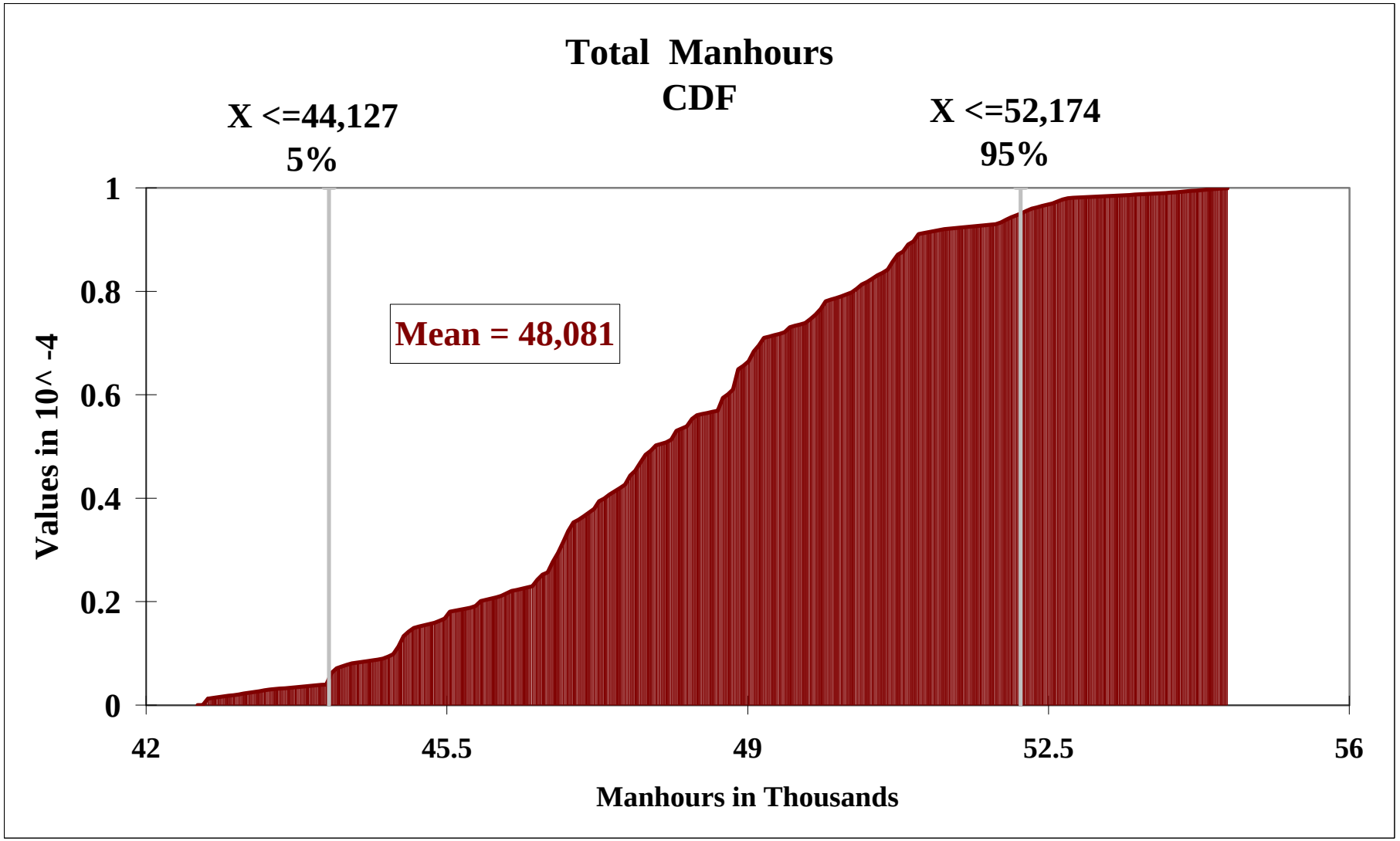


Figure A.1.1-3. Irene In-Situ Small DB

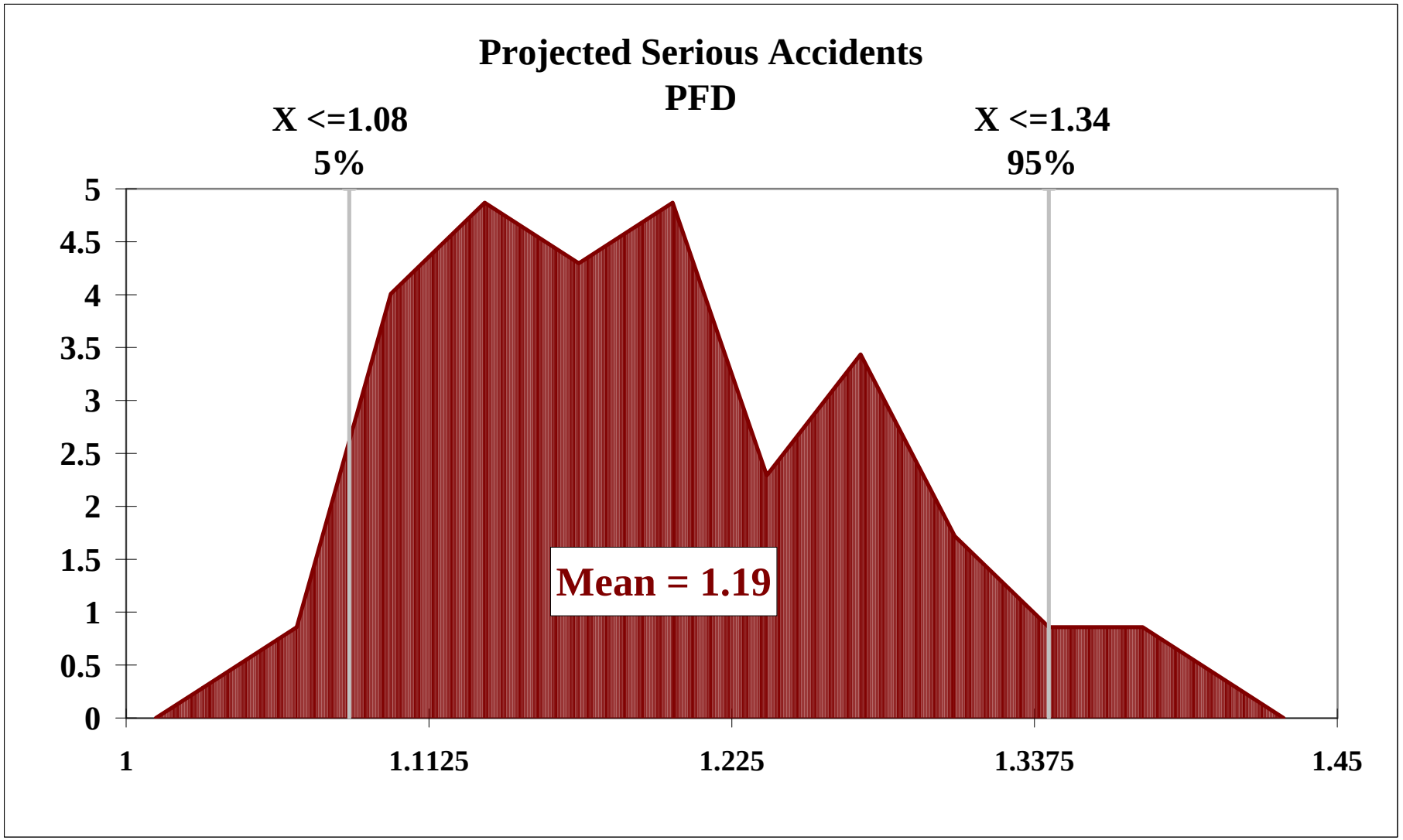


Figure A.1.1-4. Irene In-Situ Small DB

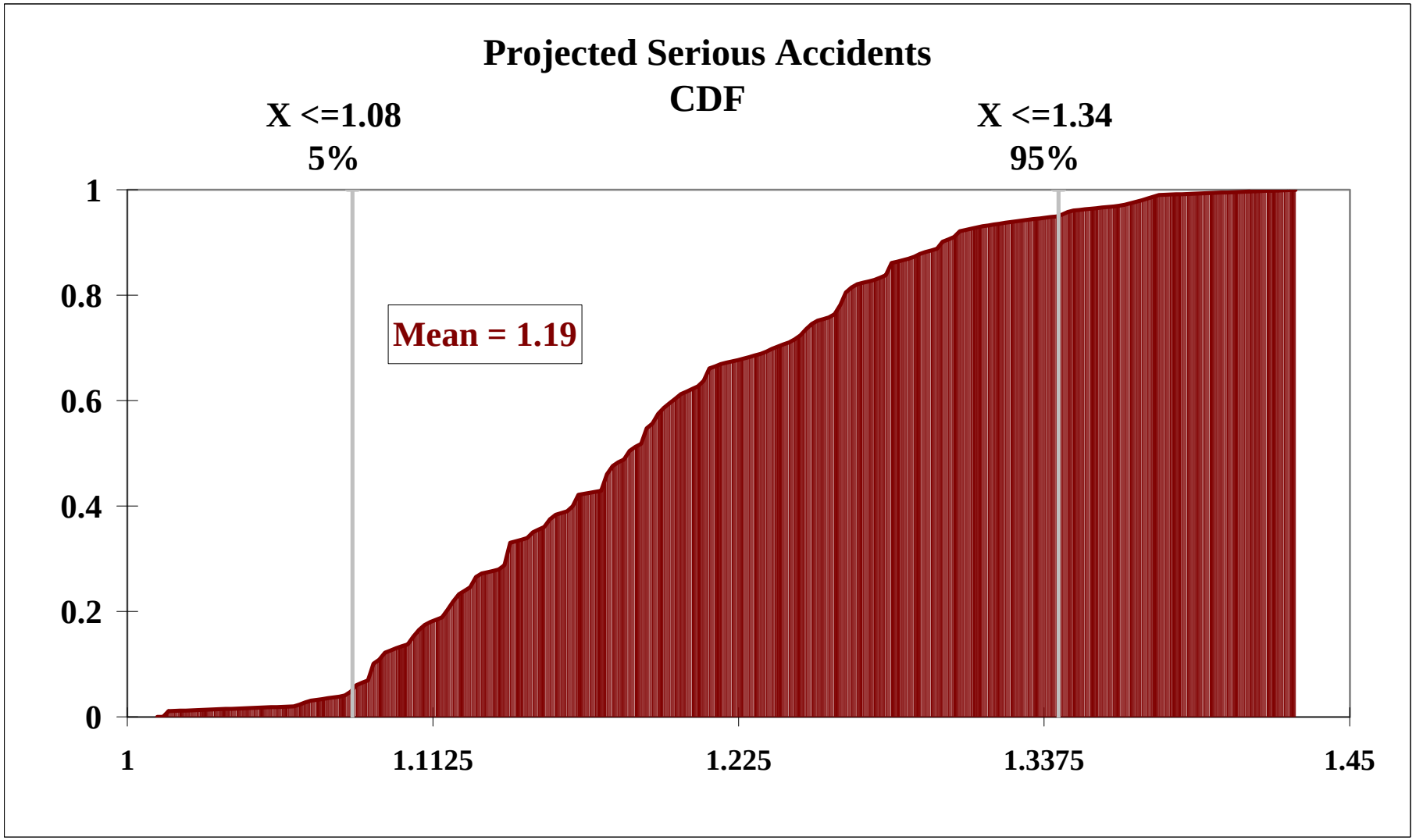


Figure A.1.1-5. Irene In-Situ Small DB

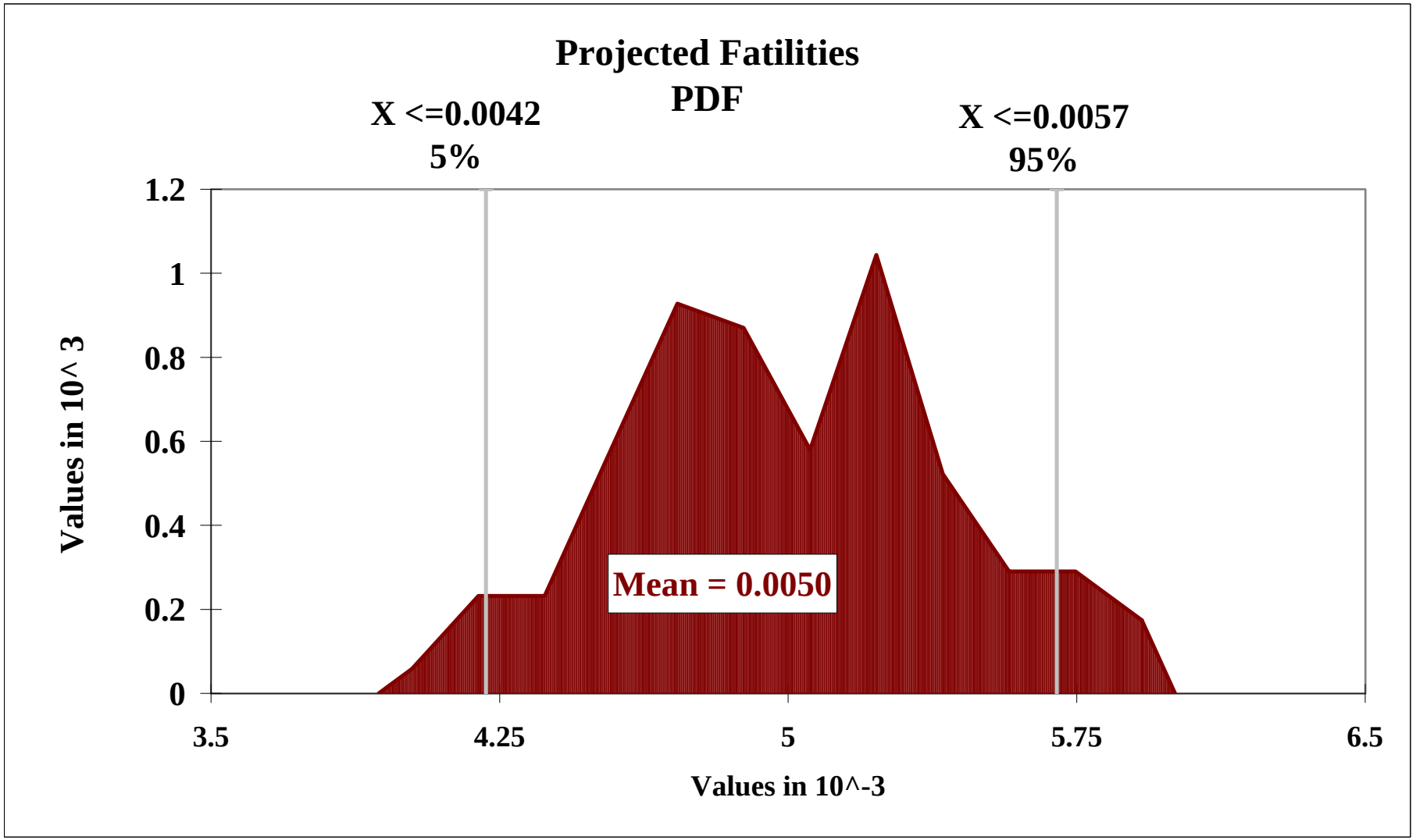
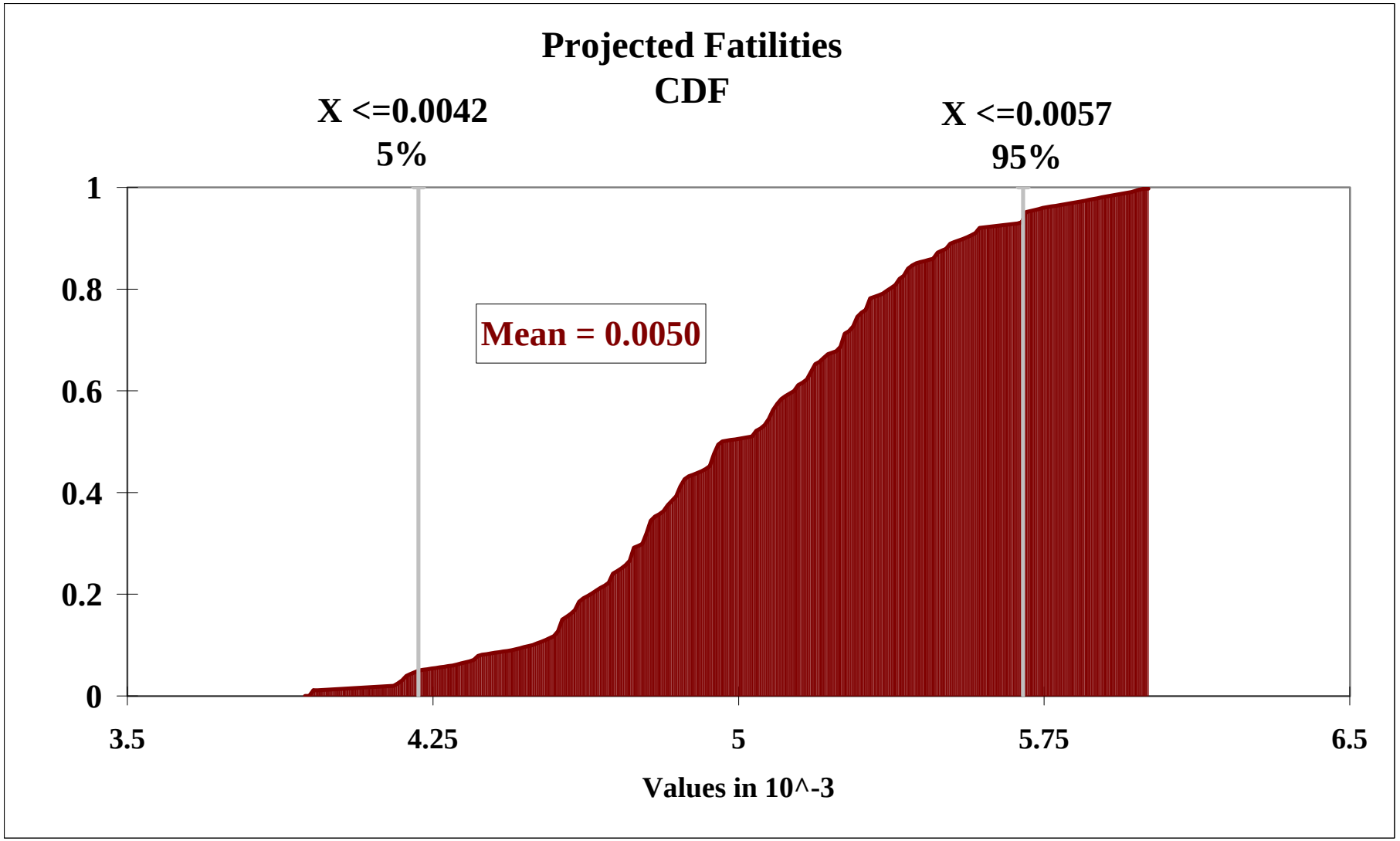


Figure A.1.1-6. Irene In-Situ Small DB



A.1.2. IRENE IN-SITU LARGE DERRICK BARGE

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Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

Irene In-Situ Large DB

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Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

IRENE
REMOVAL IN-SITU – LARGE PIECE

Assumptions:

- The work is performed utilizing a large twin crane SSCV.
- Wells have been plugged and well conductors / casings have been removed to a depth of 15' BML prior to arrival of the DB.
- All topside components have been cut loose and the deck is cut into 2 – four leg sections prior to arrival of the SSCV.
- Below water cuts are by divers.
- Divers working above 150' water depth are on deep air.
- Divers working below 150' water depth are in saturation.
- Jacket lifting devices are internal lift tools capable of sealing the legs / piles for deballasting.

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IRENE
REMOVAL IN-SITU – LARGE PIECE

Procedures:

1. After the DB is positioned at the Irene platform, the topside equipment and deck are removed and seafastened on cargo barge(s).

2. Abrasively sever the eight (8) piles at 15' BML with two (2) abrasive cutting spreads working simultaneously.

3. Cut loose and remove all braces between Row 2 and Row 3 from elevation (+)15' through elevation (-)240'.

4. Install closures on the Row 3 and Row 4 piles and deballast. Using both SSCV cranes, lift this jacket section, rotate it into a horizontal position, place it on a cargo barge and seafasten.

5. Install closures on the Row 1 and Row 2 piles and deballast. Using both SSCV cranes, lift this jacket section, rotate it into a horizontal position, place it on a cargo barge and seafasten.

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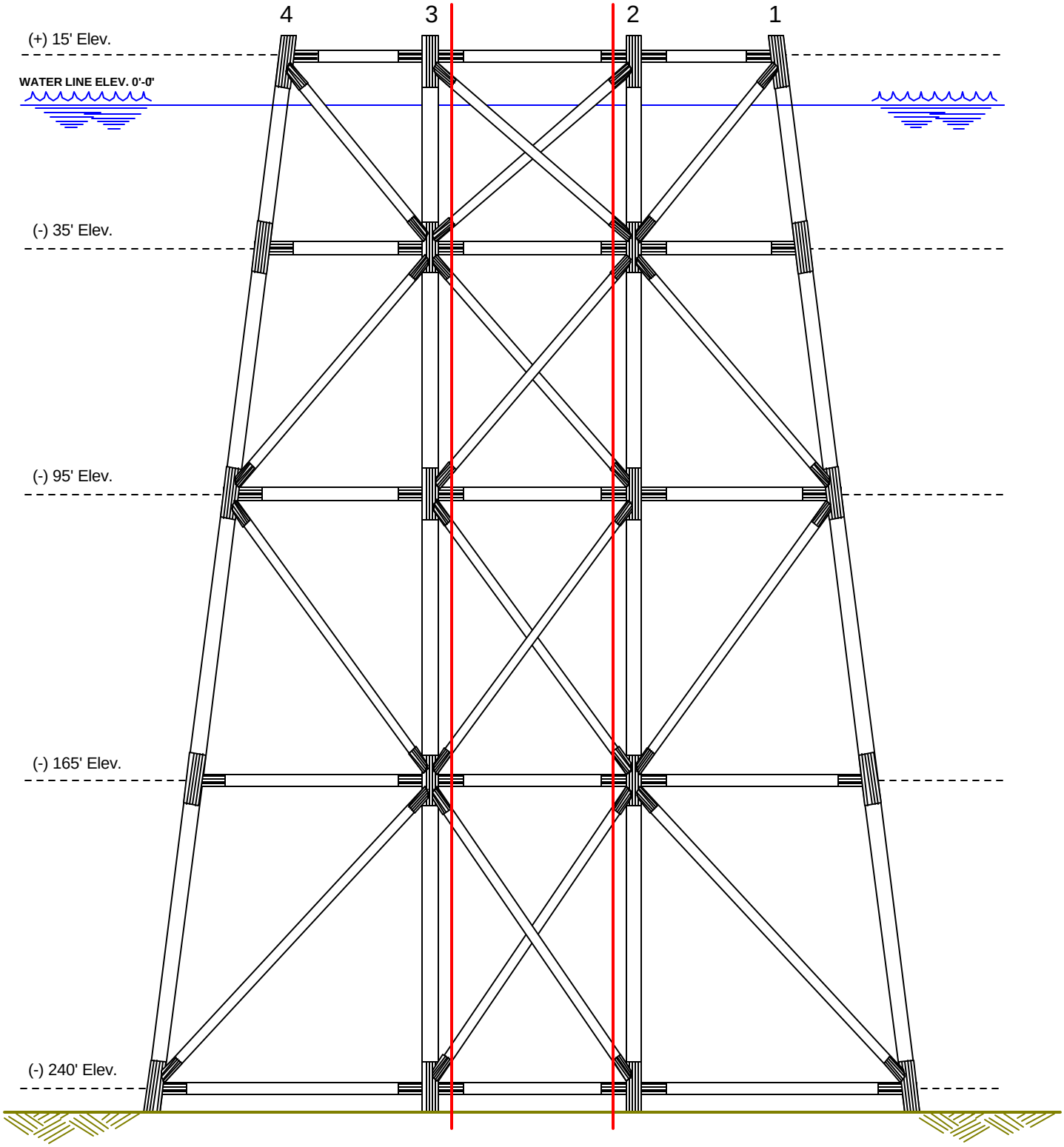

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Platform Task Mn. / Max.
Table A.1.2-1. Irene Large DB In-Situ Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Platform Removal Prep	- - - -	- - - -	- - - -
Cleaning/Flushing	120	196	288
Prepare Modules, Cap Truss, and Jacket for Removal	168	252	504
Platform Removal	- - - -	- - - -	- - - -
Platform Inspection			
Setup SSCV Onsite	2	4	12
Remove Equipment From Deck	18	24	36
Cut Deck in Two Sections	9	12	24
Remove 1st Deck	8	12	18
Seafasten Deck	7	9	12
Remove 2nd Deck	8	12	18
Seafasten	7	9	12
Sever Piles Abrasively, including jet/air lift	32	54	96
Cut and Remove Braces between Rows 2 & 3	- - - -	- - - -	- - - -
Cut & Remove Braces Between Rows 2 & 3 (Surface air at (-) 35' and (-)95' cuts)	62	72	126
Cut & Remove Braces Between Rows 2 & 3 (Sat. Divers at (-)165' and (-)240' cuts)	65	72	108
Cut and Remove Rows 1 & 2	- - - -	- - - -	- - - -
Install Closure Plates	5	6	8
Lift 1 & 2 Row Jacket Section With one crane	1	2	4
Install Side Lift Slings	4	6	12
Rotate Jacket Section Horizonatal with 2nd crane	1	1	2
Set Jacket Section on 100 X 300 CB	1	2	4
Seafasten	10	12	18
Derig	2	3	6
Cut and Remove Rows 3 & 4	- - - -	- - - -	- - - -
Install Closure Plates	5	6	8
Lift 3 & 4 Row Jacket Section with one crane	1	2	3
Install Side Lift Slings	4	6	12
Rotate Jacket Section Horizonatal with 2nd crane	1	1	2
Set Jacket Section on 100 X 300 CB	1	2	4
Seafasten	10	12	24
Derig	1	2	4
Total Task Hours	**553**	**791**	**1,365**
	30%		**73%**
	Decrease		**Increase**

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.2-2. Irene - Large DB In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Platform Removal Prep	----	----	----						
Cleaning/Flushing	120	201	288	1,611	805				2,416
Prepare Modules, Cap Truss, and Jacket for Removal	168	308	504	5,544	1,232				6,776
Platform Removal	----	----	----						
Platform Inspection									
Setup SSCV Onsite	2	6	12	288	0	210			498
Remove Equipment From Deck	18	26	36	1,248	0	910			2,158
Cut Deck in Two Sections	9	15	24	720	0	525			1,245
Remove 1st Deck	8	13	18	608	0	443			1,051
Seafasten Deck	7	9	12	448	0	327			775
Remove 2nd Deck	8	13	18	608	0	443			1,051
Seafasten	7	9	12	448	0	327			775
Sever Piles Abrasively, including jet/air lift	32	61	96	2,912	0	2,123			5,035
Cut and Remove Braces between Rows 2 & 3	----	----	----	----	----	----			
Cut & Remove Braces Between Rows 2 & 3 (Surface air at (-) 35' and (-)95' cuts)	62	87	126	4,160	867	3,033	87		8,147
Cut & Remove Braces Between Rows 2 & 3 (Sat. Divers at (-)165' and (-)240' cuts)	65	82	108	3,920	735	2,858		163	7,677
Cut and Remove Rows 1 & 2	----	----	----	----	----	----			
Install Closure Plates	5	6	8	304	0	222			526
Lift 1 & 2 Row Jacket Section With one crane	1	2	4	112	0	82			194
Install Side Lift Slings	4	7	12	352	0	257			609
Rotate Jacket Section Horizonatal with 2nd crane	1	1	2	64	0	47			111
Set Jacket Section on 100 X 300 CB	1	2	4	112	0	82			194
Seafasten	10	13	18	640	0	467			1,107
Derig	2	4	6	176	0	128			304
Cut and Remove Rows 3 & 4	----	----	----	----	----	----			
Install Closure Plates	5	6	8	304	0	222			526
Lift 3 & 4 Row Jacket Section with one crane	1	2	3	96	0	70			166
Install Side Lift Slings	4	7	12	352	0	257			609
Rotate Jacket Section Horizonatal with 2nd crane	1	1	2	64	0	47			111

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.2-2. Irene - Large DB In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Set Jacket Section on 100 X 300 CB	1	2	4	112	0	82			194
Seafasten	10	15	24	736	0	537			1,273
Derig	1	2	4	112	0	82			194
Total Task Hours	**553**	**903**	**1,365**	**26,051**	**3,639**	**13,778**	**87**	**163**	**43,718**
	30%		**73%**						
	Decrease		**Increase**						

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

Projected Serious Accidents
Table A.1.2-3. Irene - Large DB In-Situ Removal

Risk Category*	Average Value Man-hours	Projected Value Serious Accidents
On Deck, High Risk	26,051	0.0868
On Deck, Support	3,639	0.0121
Marine & Other Support	13,778	0.0459
Diving, Air	87	0.1733
Diving, Saturation	163	0.3267
Totals	43,718	0.6449

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
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Projected Fatalities

Table A-1.2-4. Irene - Large DB In-Situ Removal

Risk Category*	Average Value Man-hours	Projected Value Fatalities
On Deck, High Risk	26,051	0.0010
On Deck, Support	3,639	0.0001
Marine & Other Support	13,778	0.0006
Diving, Air	87	0.0005
Diving, Saturation	163	0.0010
Totals	43,718	0.0032

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

Figure A.1.2-1. Irene In-Situ Large DB

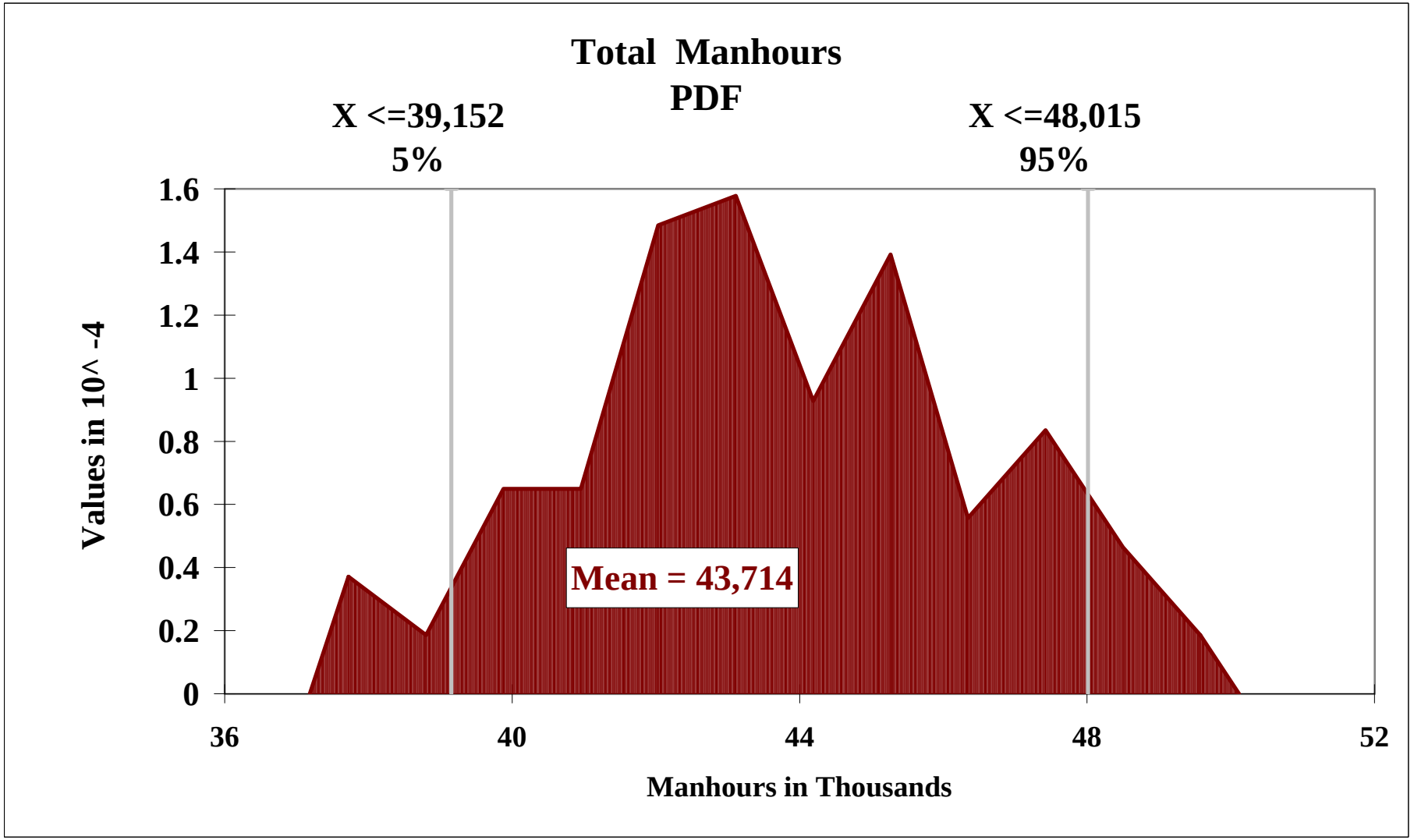


Figure A.1.2-2. Irene In-Situ Large DB

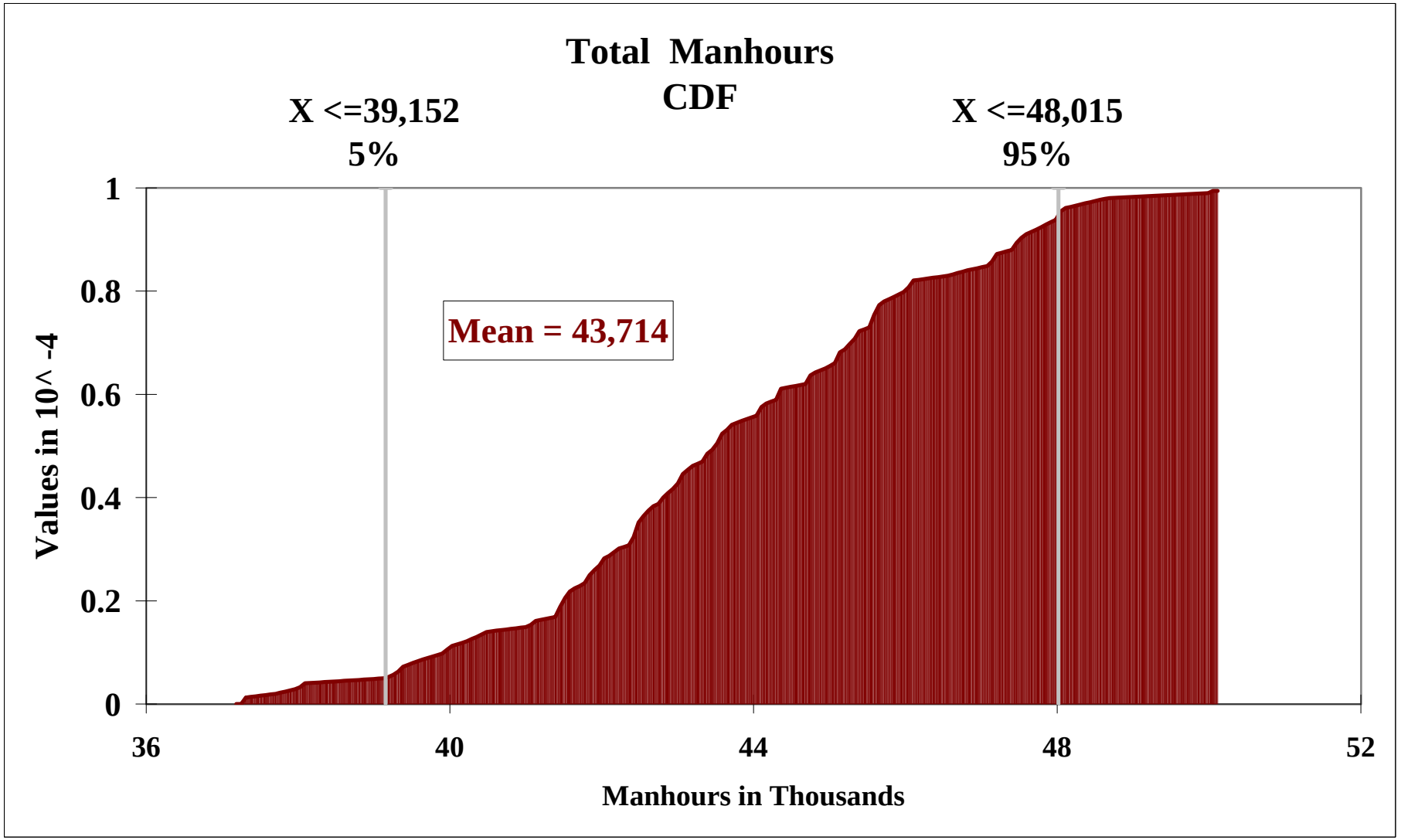


Figure A.1.2-3. Irene In-Situ Large DB

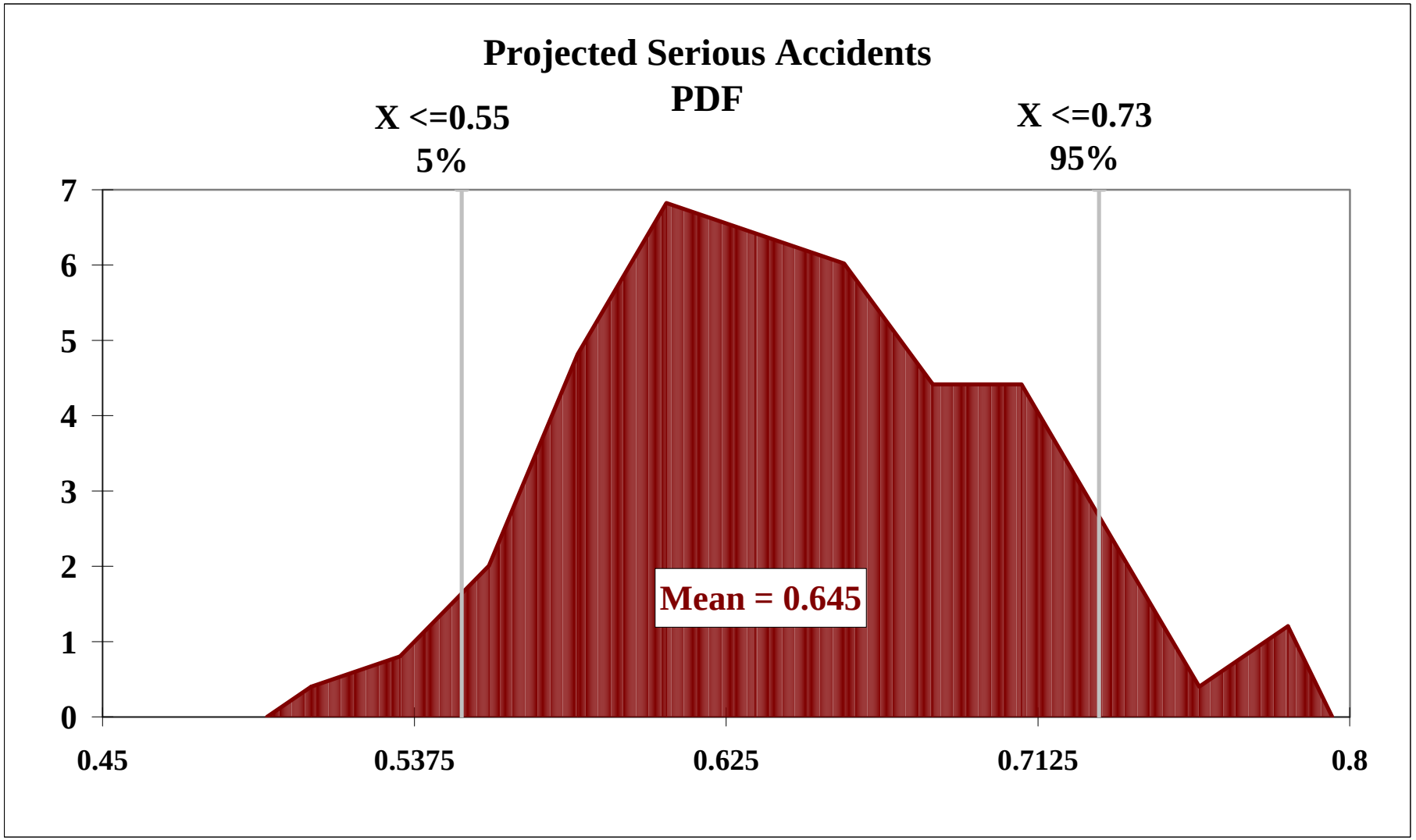


Figure A.1.2-4. Irene In-Situ Large DB

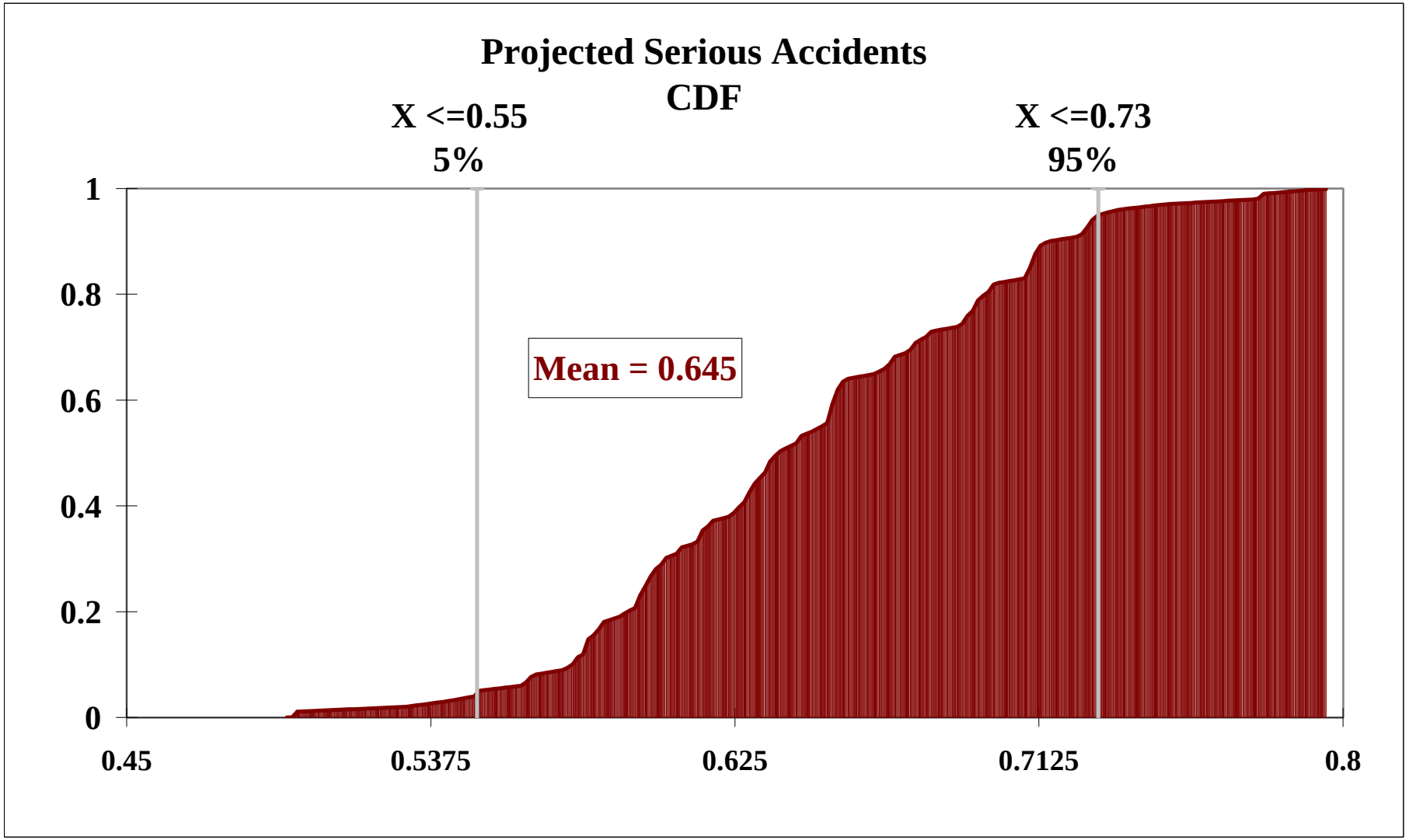


Figure A.1.2-5. Irene In-Situ Large DB

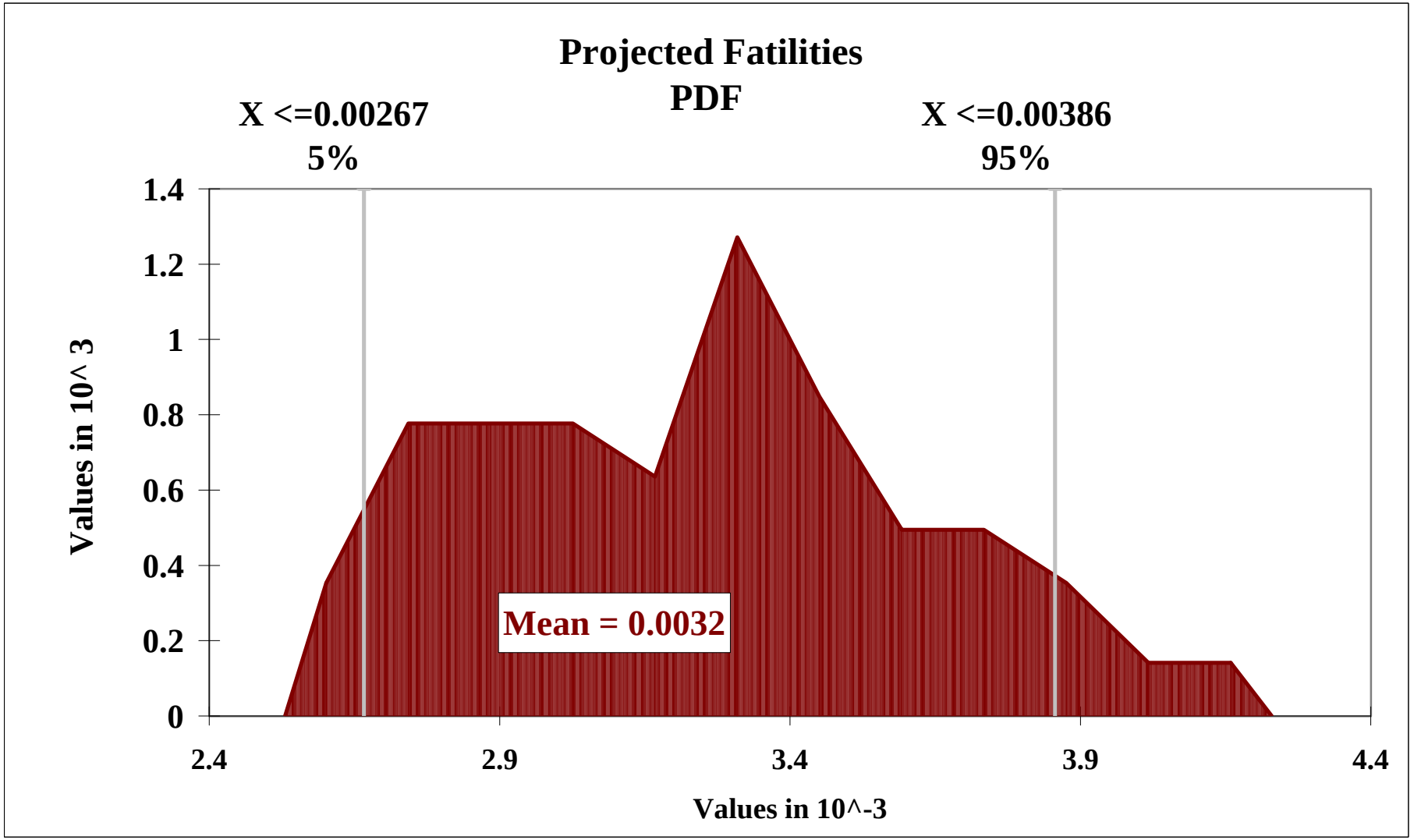
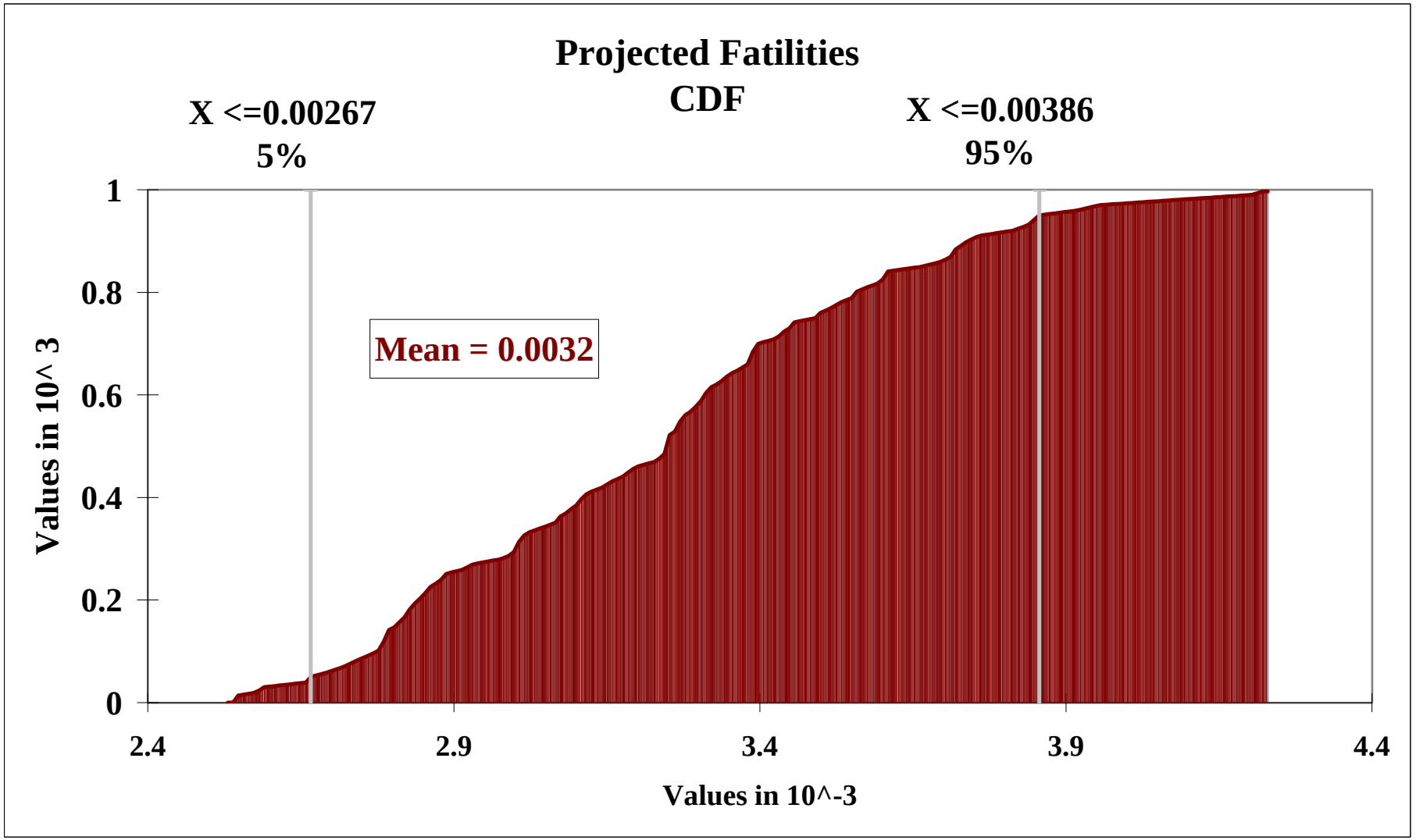


Figure A.1.2-6. Irene In-Situ Large DB



A.1.3. HIDALGO IN-SITU REMOVAL

U. S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

Hidalgo In-Situ Removal

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

HIDALGO
REMOVAL IN-SITU – SMALL PIECE

Assumptions:

- The work is performed utilizing a 2000 ton capacity derrick barge or crane ship.
- Wells have been plugged and well conductors / casings have been removed to a depth of 15' BML prior to arrival of the DB.
- All topside components have been cut loose prior to arrival of the DB.
- Below water cuts are by divers.
- Divers working above 150' water depth are on deep air.
- Divers working below 150' water depth are in saturation.
- Skirt pile mud plugs are removed prior to arrival of the DB.
- Jacket lifting devices are internal lift tools capable of sealing the legs / piles for deballasting.

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

HIDALGO
REMOVAL IN-SITU – SMALL PIECE

Procedures:

1. After the DB is positioned at the Hidalgo platform, the topside equipment and the cap truss are removed and secured on cargo barges.

2. Abrasively sever the eight (8) piles and eight (8) skirt piles at 15' BML with two (2) abrasive cutting spreads working simultaneously.

3. Cut and remove all bracing between Row 2 - Row 4 from the (+) 20' elevation to above the (-)115' elevation.

4. Divers cut the jacket legs and vertical diagonal braces in the Row 4 – Row 5 jacket section above the (-)115' elevation. This jacket section is lifted by the DB crane, placed on a cargo barge and seafastened.

5. Divers cut the jacket legs and vertical diagonal braces in the Row 1 – Row 2 jacket section above the (-)115' elevation. This jacket section is lifted by the DB crane, placed on a cargo barge and seafastened.

6. Divers cut and removed all bracing between Row 2 and Row 4 to above the (-)270' elevation.

7. Divers cut the jacket legs and vertical diagonal braces in the Row 4 – Row 5 jacket section above the (-)270' elevation. This jacket section is lifted by the DB crane, placed on a cargo barge and seafastened.

8. Divers cut the jacket legs and vertical diagonal braces in the Row 1 – Row 2 jacket section above the (-)270' elevation. This jacket section is lifted by the DB crane, placed on a cargo barge and seafastened.

9. Divers cut and remove all bracing between Row 2 and Row 4 to above the (-)350' elevation.

10. Divers cut Row 4 – Row 5 jacket legs and braces above the (-)350' elevation, taking care to leave at least one-half of 42" vertical diagonal braces still attached to the jacket legs and the 48" vertical braces in the Row 4 and Row 5 planes from just above the (-)350' elevation down to the mudline elevation horizontal framing. This jacket section is lifted by the DB crane, placed on a cargo barge and seafastened.

11. Divers cut Row 1 – Row 2 jacket legs and braces above the (-)350' elevation, taking care to leave atleast one-half of 42" vertical diagonal braces still attached to the jacket legs and the 48" vertical braces in the Row 1 and Row 2 planes from just above the (-)350' elevation down to the mudline elevation horizontal framing. This jacket section is lifted by the DB crane, placed on a cargo barge and seafastened.

12. Divers cut and removal all remaining bracing between Row 2 and Row 4.

13. The remaining Row 1 – Row 2 jacket section (-350' elevation to the mudline) is lifted by the DB crane, placed on a cargo barge and seafastened.

14. The remaining Row 4 – Row 5 jacket section (-350' elevation to the mudline) is lifted by the DB crane, placed on a cargo barge and seafastened.

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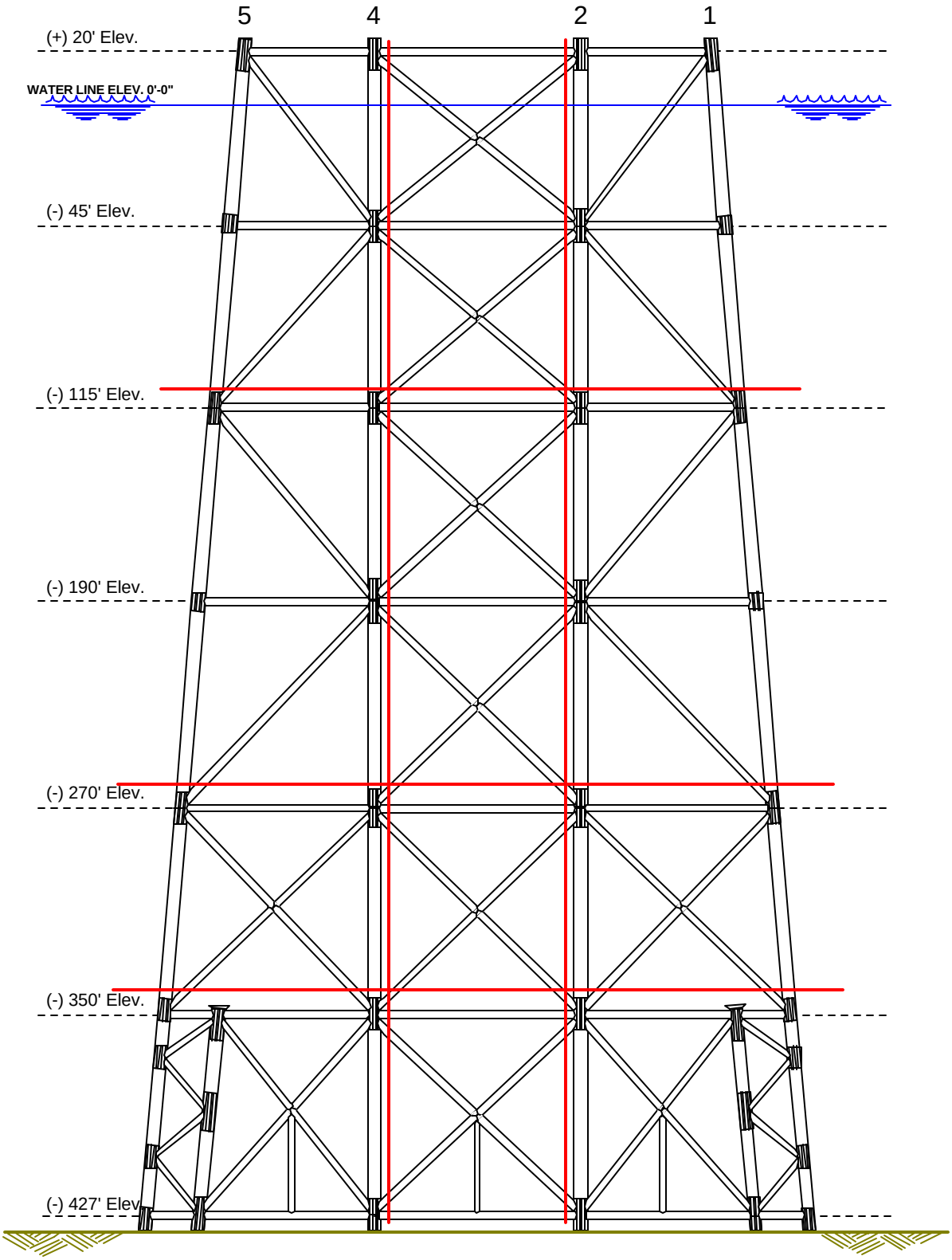

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Platform Task Min. / Max.
Table A.1.3-1. Hidalgo In-Situ Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Platform Removal Prep	- - - -	- - - -	- - - -
Cleaning/Flushing	120	196	288
Prepare Modules, Cap Truss, and Jacket for Removal	168	252	504
Platform Removal	- - - -	- - - -	- - - -
Platform Inspection			
Setup DB Onsite	2	4	12
Remove Equipment (Modules)	18	24	36
Remove Cap Truss (requires 110' wide CB)	8	10	18
Sever All Legs and Skirt Piles 15' below mudline (abrasive cutting-assume 2 abrasive cutting spreads)	64	96	144
Cut & Remove Bracing Between Rows 2 & 4	- - - -	- - - -	- - - -
Remove Bracing Between Rows 2 & 4 from (+) 20' to Below (-) 115' El.	46	61	107
Install Lifting Appurtenances on Rows 1 & 2 @ surface	2	4	8
Rig to Rows 1&2 at Surface	2	4	6
Cut Rows 1 & 2	- - - -	- - - -	- - - -
Sever Rows 1 & 2 Jacket Section and Risers Horizontally Above (-) 115' El.	27	35	62
Lift Rows 1 & 2 Jacket Section & Set on CB #1	1	2	4
Seafasten	10	12	18
Derig From Jacket Section 1 & 2	2	4	8
Install Lifting Appurtenances on Rows 4 & 5 @ surface	2	4	8
Rig to Rows 4&5 at Surface	2	4	6
Cut Rows 4 & 5	- - - -	- - - -	- - - -
Sever Rows 4 & 5 Jacket Section and Risers Horizontally Above (-) 115' El.	27	35	62
Lift Rows 4 & 5 Jacket Section and Set on CB #1	1	2	4
Seafasten	10	12	18
Derig From Rows 4 & 5 Jacket Section	2	4	8
Cut & Remove Bracing Between Rows 2 & 4	- - - -	- - - -	- - - -
NOTE: Switch Dive Spread to Sat. Divers (150' to 300')	- - - -	- - - -	- - - -
Remove Bracing Between Rows 2 & 4 to Below (-) 270' El.	80	94	141
Install Lifting Appurtenances on Rows 1 & 2 @ (-) 110'	2	4	8
Rig to Rows 1&2 at (-)110'	4	8	16
Cut Rows 1 & 2	- - - -	- - - -	- - - -
Sever Rows 1 & 2 Jacket Section and Risers Horizontally Above (-) 270' El.	40	47	71
Lift Rows 1 & 2 Jacket Section & Set on CB #1	1	3	5
Seafasten	10	12	18
Derig From Jacket Section 1 & 2	2	4	8
Install Lifting Appurtenances on Rows 4 & 5 @ (-) 110'	2	4	8
Rig to Rows 4&5 at (-)110'	4	8	16
Cut Rows 4 & 5	- - - -	- - - -	- - - -
Sever Rows 4 & 5 Jacket Section and Risers Horizontally Above (-) 270' El.	40	47	71
Lift Rows 4 & 5 Jacket Section and Set on CB #1	1	3	5

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Platform Task Min. / Max.
Table A.1.3-1. Hidalgo In-Situ Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Seafasten	10	12	18
Derig From Rows 4 & 5 Jacket Section	2	4	8
Cut & Remove Bracing Between Rows 2 & 4	- - - -	- - - -	- - - -
Remove Bracing Between Rows 2 & 4 to Mudline El.	88	103	155
Install Lifting Appurtenances on Rows 1 & 2 @ (-) 265'	2	4	8
Rig to Rows 1&2 at (-)265'	8	10	18
Cut Rows 1 & 2	- - - -	- - - -	- - - -
NOTE: Switch Dive Spread to Sat. Divers (300' to 700')	- - - -	- - - -	- - - -
Sever Rows 1 & 2 Jacket Section and Risers Horizontally Above (-) 350' El.	40	47	71
Lift Rows 1 & 2 Jacket Section & Set on CB #1	2	4	6
Seafasten	10	12	18
Derig From Jacket Section 1 & 2	2	4	8
Install Lifting Appurtenances on Rows 4 & 5 @ (-) 265'	2	4	8
Rig to Rows 4&5 at (-)265'	8	10	18
Cut Rows 4 & 5	- - - -	- - - -	- - - -
Sever Rows 4 & 5 Jacket Section and Risers Horizontally Above (-) 350' El.	40	47	71
Lift Rows 4 & 5 Jacket Section and Set on CB #1	2	4	6
Seafasten	10	12	18
Derig From Rows 4 & 5 Jacket Section	2	4	8
Cut Rows 1, 2, 4 & 5	- - - -	- - - -	- - - -
Install Lifting Appurtenances on Rows 1 & 2 @ (-) 348'	3	6	9
Rig to Rows 1&2 at (-)348'	8	10	18
Lift Rows 1 & 2 Jacket Section & Set on CB #1	2	4	6
Seafasten	10	12	18
Derig From Jacket Section 1 & 2	2	4	8
Install Lifting Appurtenances on Rows 4 & 5 @ (-) 365'	3	6	9
Rig to Rows 4&5 at (-)348'	8	10	18
Lift Rows 4 & 5 Jacket Section & Set on CB #1	2	4	6
Seafasten	10	12	18
Derig From Jacket Section 4 & 5	2	4	8
Total Task Hours	**978.00**	**1,352.00**	**2,245.00**
	28%		**66%**
	Decrease		**Increase**

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.3-2. Hidalgo In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Platform Removal Prep	----	----	----						
Cleaning/Flushing	120	201	288	1,611	805				2,416
Prepare Modules, Cap Truss, and Jacket for Removal	168	308	504	5,544	1,232				6,776
Platform Removal	----	----	----						
Platform Inspection									
Setup DB Onsite	2	6	12	228	60	174	6		468
Remove Equipment (Modules)	18	26	36	988	260	754	26		2,028
Remove Cap Truss (requires 110' wide CB)	8	12	18	456	120	348	12		936
Sever All Legs and Skirt Piles 15' below mudline (abrasive cutting-assume 2 abrasive cutting spreads)	64	101	144	3,851	1,013	2,939	101		7,904
Cut & Remove Bracing Between Rows 2 & 4	----	----	----	----	----	----			
Remove Bracing Between Rows 2 & 4 from (+) 20' to Below (-) 115' El.	46	71	107	2,711	713	2,069	71		5,564
Install Lifting Appurtenances on Rows 1 & 2 @ surface	2	5	8	177	47	135	5		364
Rig to Rows 1&2 at Surface	2	4	6	152	40	116	4		312
Cut Rows 1 & 2	----	----	----	----	----	----			
Sever Rows 1 & 2 Jacket Section and Risers Horizontally Above (-) 115' El.	27	41	62	1,571	413	1,199	41		3,224
Lift Rows 1 & 2 Jacket Section & Set on CB #1	1	2	4	89	23	68	2		182
Seafasten	10	13	18	507	133	387	13		1,040
Derig From Jacket Section 1 & 2	2	5	8	177	47	135	5		364
Install Lifting Appurtenances on Rows 4 & 5 @ surface	2	5	8	177	47	135	5		364
Rig to Rows 4&5 at Surface	2	4	6	152	40	116	4		312
Cut Rows 4 & 5	----	----	----	----	----	----			
Sever Rows 4 & 5 Jacket Section and Risers Horizontally Above (-) 115' El.	27	41	62	1,571	413	1,199	41		3,224
Lift Rows 4 & 5 Jacket Section and Set on CB #1	1	2	4	89	23	68	2		182
Seafasten	10	13	18	507	133	387	13		1,040
Derig From Rows 4 & 5 Jacket Section	2	5	8	177	47	135	5		364
Cut & Remove Bracing Between Rows 2 & 4	----	----	----	----	----	----			
NOTE: Switch Dive Spread to Sat. Divers (150' to 300')	----	----	----	----	----	----			
Remove Bracing Between Rows 2 & 4 to Below (-) 270' El.	80	105	141	3,990	945	3,045		210	8,190
Install Lifting Appurtenances on Rows 1 & 2 @ (-) 110'	2	5	8	177	42	135		9	364
Rig to Rows 1&2 at (-)110'	4	9	16	355	84	271		19	728
Cut Rows 1 & 2	----	----	----	----	----	----		----	
Sever Rows 1 & 2 Jacket Section and Risers Horizontally Above (-) 270' El.	40	53	71	2,001	474	1,527		105	4,108

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.3-2. Hidalgo In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Lift Rows 1 & 2 Jacket Section & Set on CB #1	1	3	5	114	27	87		6	234
Seafasten	10	13	18	507	120	387		27	1,040
Derig From Jacket Section 1 & 2	2	5	8	177	42	135		9	364
Install Lifting Appurtenances on Rows 4 & 5 @ (-) 110'	2	5	8	177	42	135		9	364
Rig to Rows 4&5 at (-)110'	4	9	16	355	84	271		19	728
Cut Rows 4 & 5	----	----	----	----	----	----		----	
Sever Rows 4 & 5 Jacket Section and Risers Horizontally Above (-) 270' El.	40	53	71	2,001	474	1,527		105	4,108
Lift Rows 4 & 5 Jacket Section and Set on CB #1	1	3	5	114	27	87		6	234
Seafasten	10	13	18	507	120	387		27	1,040
Derig From Rows 4 & 5 Jacket Section	2	5	8	177	42	135		9	364
Cut & Remove Bracing Between Rows 2 & 4	----	----	----	----	----	----		----	
Remove Bracing Between Rows 2 & 4 to Mudline El.	88	115	155	4,383	1,038	3,345		231	8,996
Install Lifting Appurtenances on Rows 1 & 2 @ (-) 265'	2	5	8	177	42	135		9	364
Rig to Rows 1&2 at (-)265'	8	12	18	456	108	348		24	936
Cut Rows 1 & 2	----	----	----	----	----	----		----	
NOTE: Switch Dive Spread to Sat. Divers (300' to 700')	----	----	----	----	----	----		----	
Sever Rows 1 & 2 Jacket Section and Risers Horizontally Above (-) 350' El.	40	53	71	2,001	474	1,527		105	4,108
Lift Rows 1 & 2 Jacket Section & Set on CB #1	2	4	6	152	36	116		8	312
Seafasten	10	13	18	507	120	387		27	1,040
Derig From Jacket Section 1 & 2	2	5	8	177	42	135		9	364
Install Lifting Appurtenances on Rows 4 & 5 @ (-) 265'	2	5	8	177	42	135		9	364
Rig to Rows 4&5 at (-)265'	8	12	18	456	108	348		24	936
Cut Rows 4 & 5	----	----	----	----	----	----		----	
Sever Rows 4 & 5 Jacket Section and Risers Horizontally Above (-) 350' El.	40	53	71	2,001	474	1,527		105	4,108
Lift Rows 4 & 5 Jacket Section and Set on CB #1	2	4	6	152	36	116		8	312
Seafasten	10	13	18	507	120	387		27	1,040
Derig From Rows 4 & 5 Jacket Section	2	5	8	177	42	135		9	364
Cut Rows 1, 2, 4 & 5	----	----	----	----	----	----		----	
Install Lifting Appurtenances on Rows 1 & 2 @ (-) 348'	3	6	9	228	54	174		12	468
Rig to Rows 1&2 at (-)348'	8	12	18	456	108	348		24	936
Lift Rows 1 & 2 Jacket Section & Set on CB #1	2	4	6	152	36	116		8	312
Seafasten	10	13	18	507	120	387		27	1,040
Derig From Jacket Section 1 & 2	2	5	8	177	42	135		9	364

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.3-2. Hidalgo In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Install Lifting Appurtenances on Rows 4 & 5 @ (-) 365'	3	6	9	228	54	174		12	468
Rig to Rows 4&5 at (-)348'	8	12	18	456	108	348		24	936
Lift Rows 4 & 5 Jacket Section & Set on CB #1	2	4	6	152	36	116		8	312
Seafasten	10	13	18	507	120	387		27	1,040
Derig From Jacket Section 4 & 5	2	5	8	177	42	135		9	364
Total Task Hours	**978**	**1,525**	**2,245**	**45,750**	**11,536**	**29,454**	**357**	**1,317**	**88,414**
	28%		**66%**						
	Decrease		**Increase**						

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Projected Serious Accidents
Hidalgo In-Situ Removal

Risk Category*	Average Value Man-hours	Projected Value Serious Accidents
On Deck, High Risk	45,750	0.1525
On Deck, Support	11,536	0.0385
Marine & Other Support	29,454	0.0982
Diving, Air	357	0.7147
Diving, Saturation	1,317	2.6333
Totals	88,414	3.6371

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

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Projected Fatalities
Hidalgo In-Situ Removal

Risk Category*	Average Value Man-hours	Projected Value Fatalities
On Deck, High Risk	45,750	0.0018
On Deck, Support	11,536	0.0005
Marine & Other Support	29,454	0.0012
Diving, Air	357	0.0021
Diving, Saturation	1,317	0.0079
Totals	88,414	0.0135

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

Figure A.1.3-1. Hidalgo In-Situ Removal

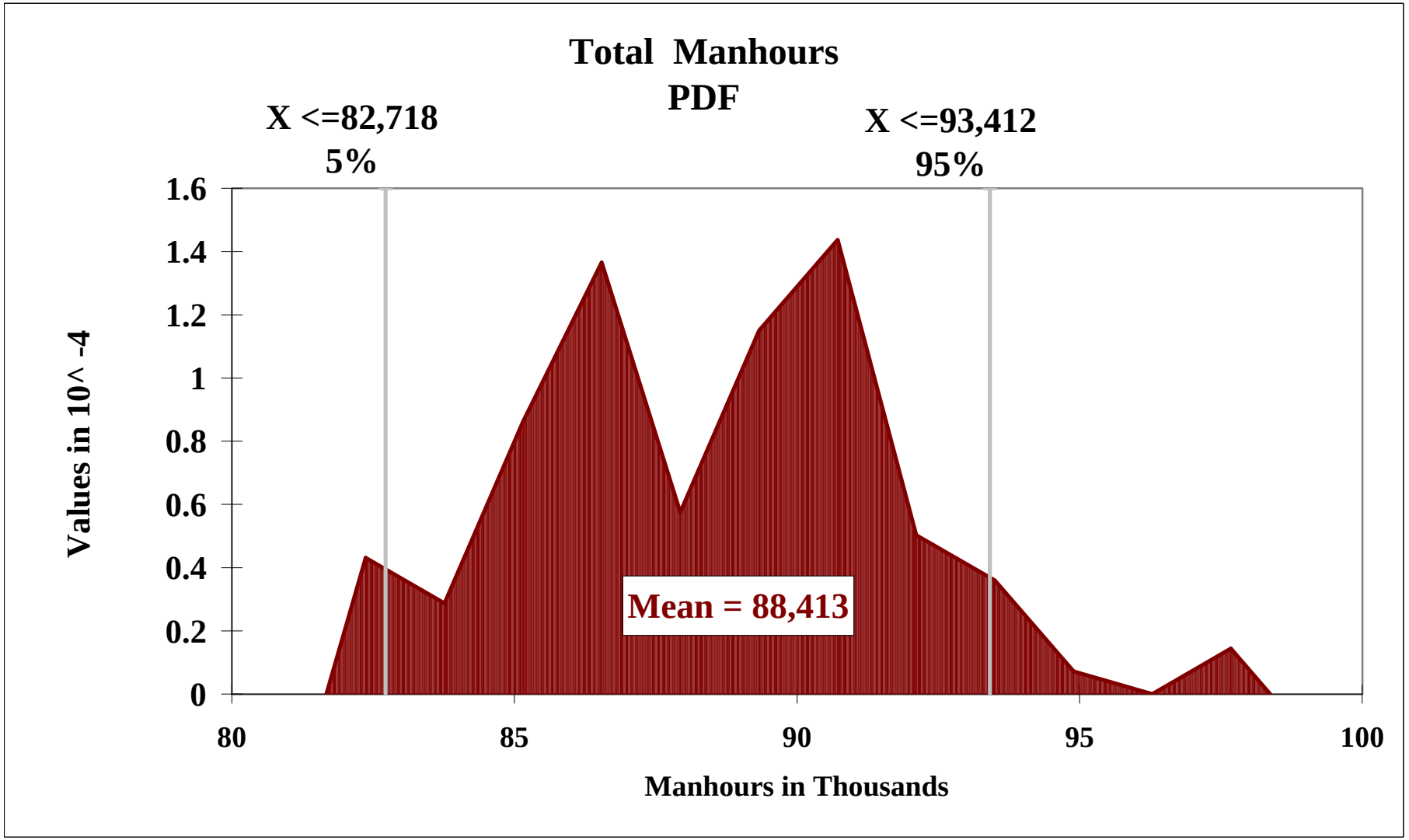


Figure A.1.3-2. Hidalgo In-Situ Removal

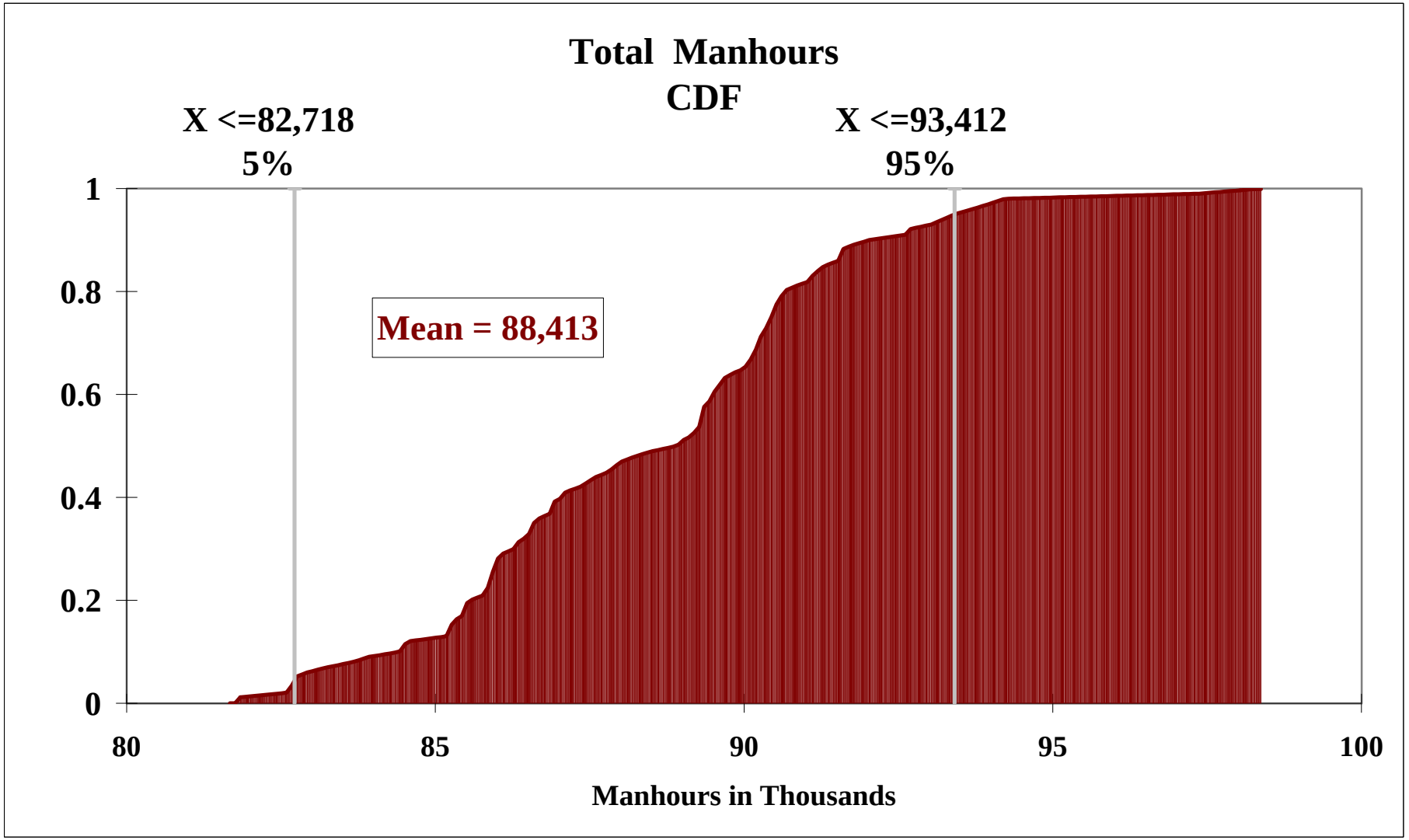


Figure A.1.3-3. Hidalgo In-Situ Removal

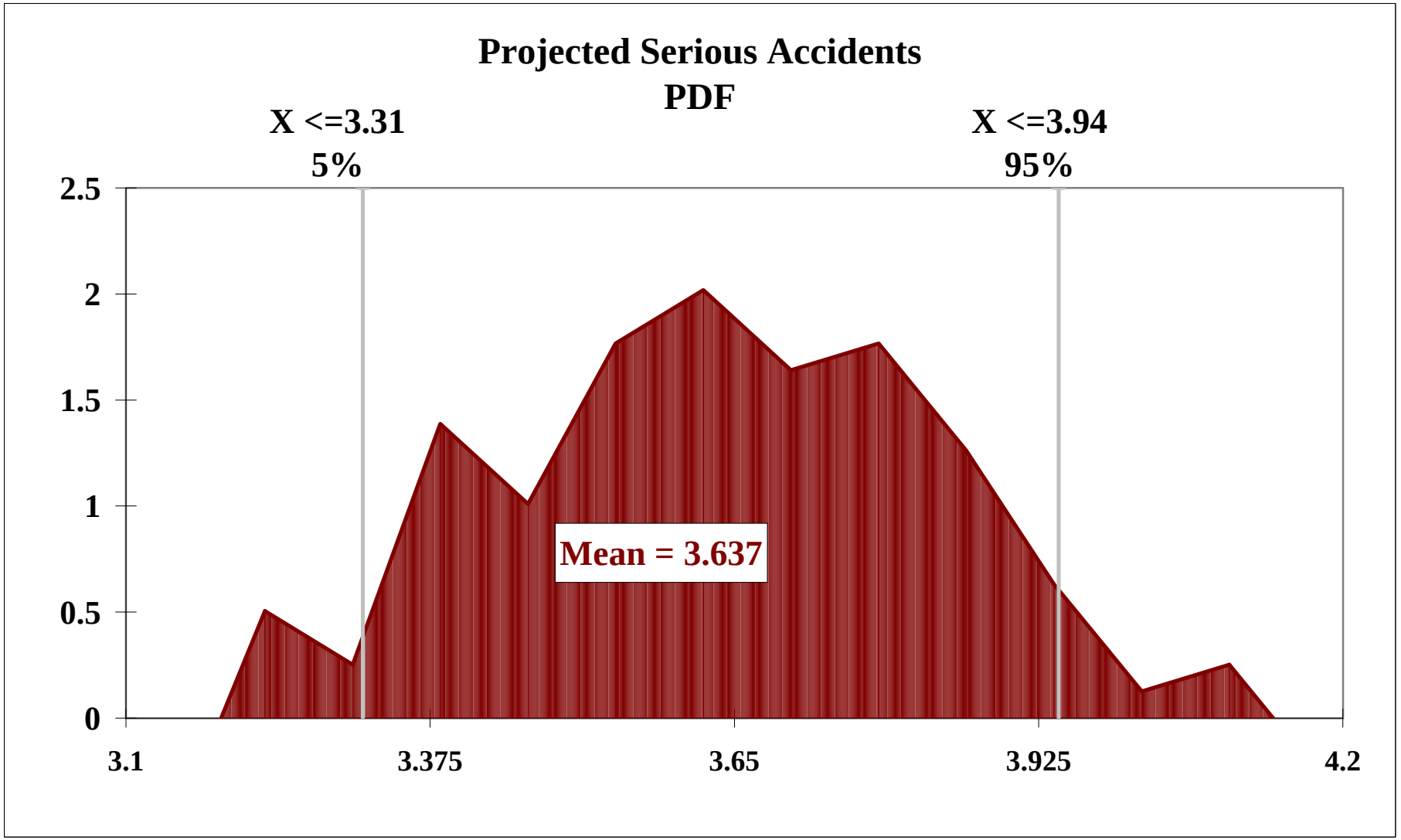


Figure A.1.3-4. Hidalgo In-Situ Removal

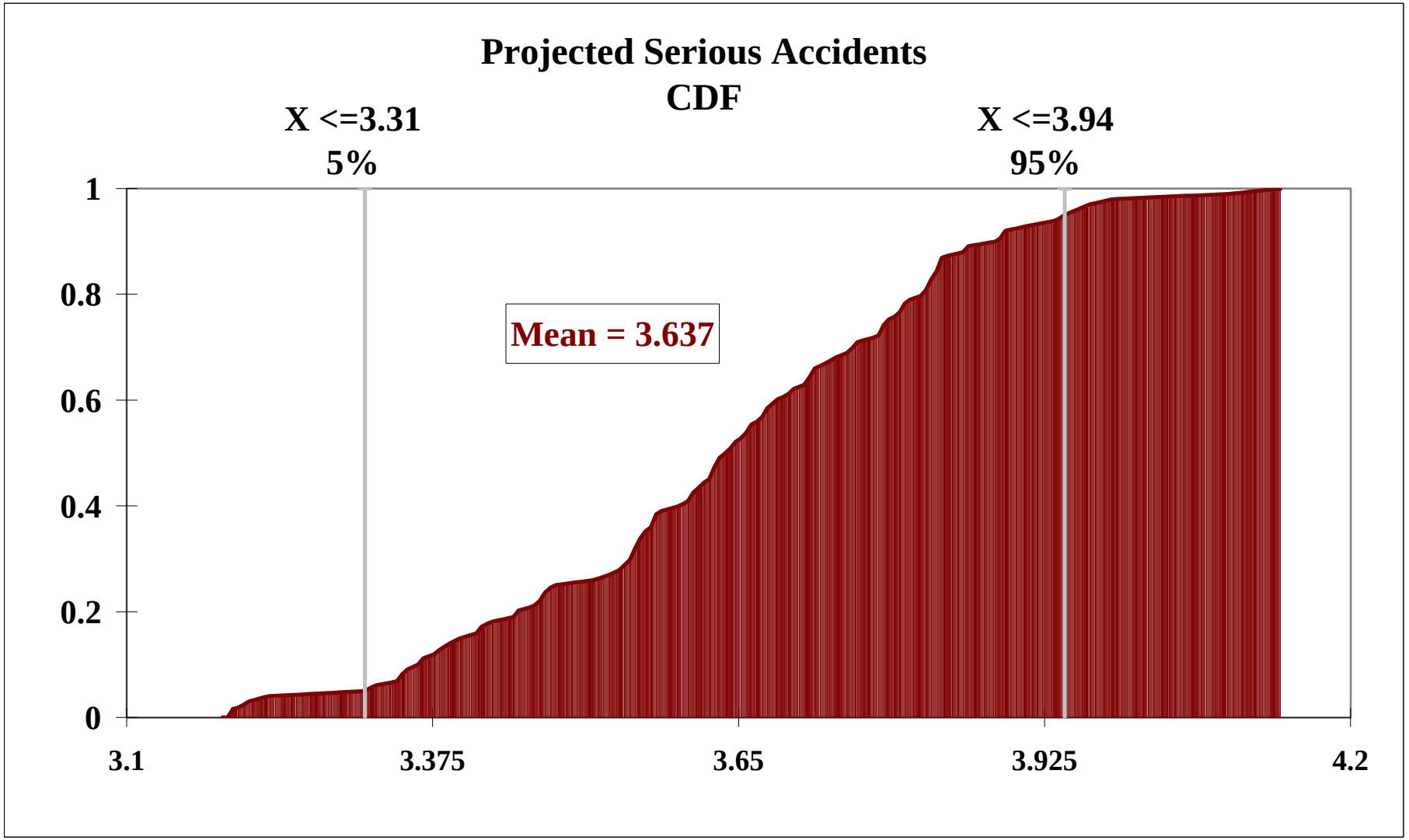


Figure A.1.3-5. Hidalgo In-Situ Removal

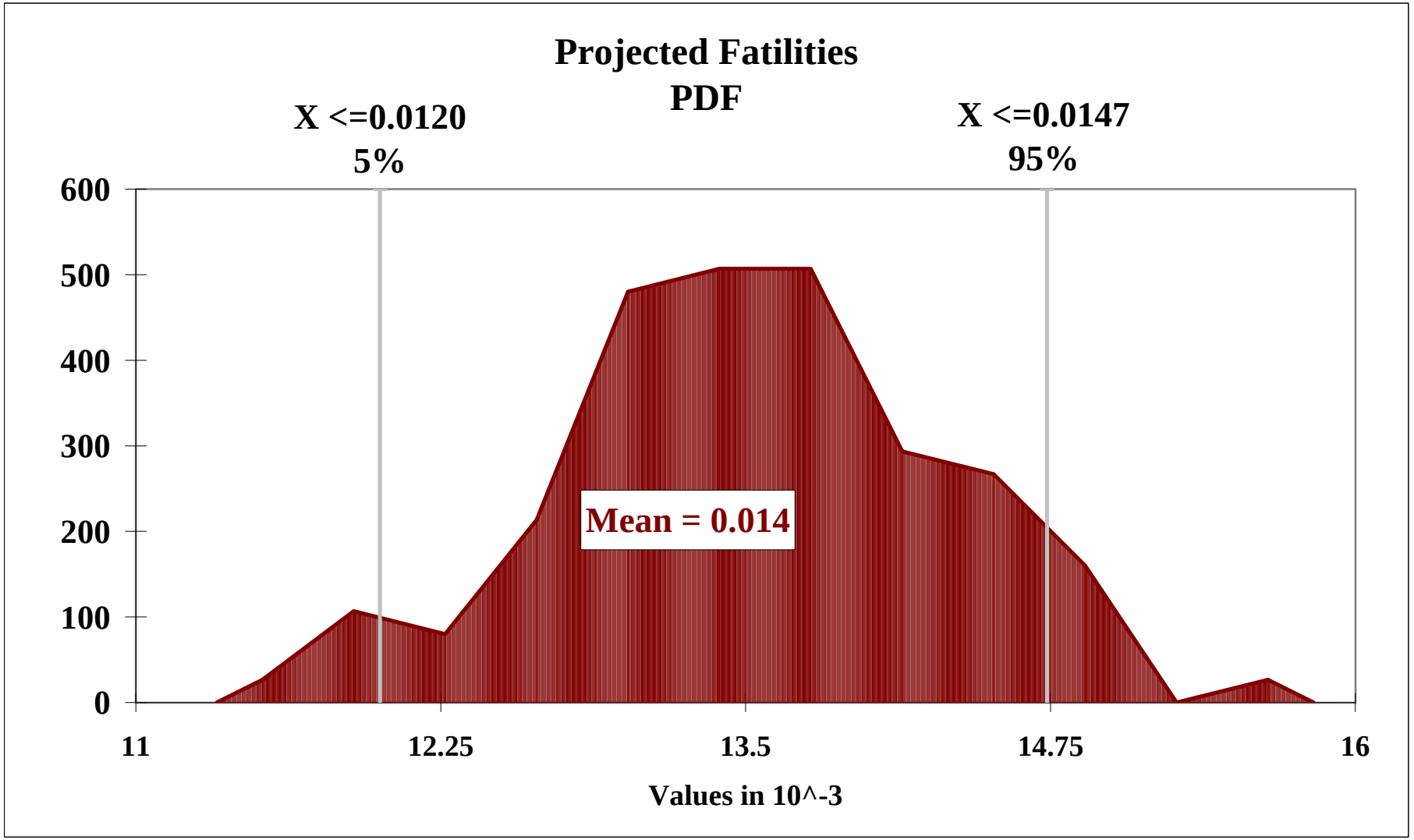
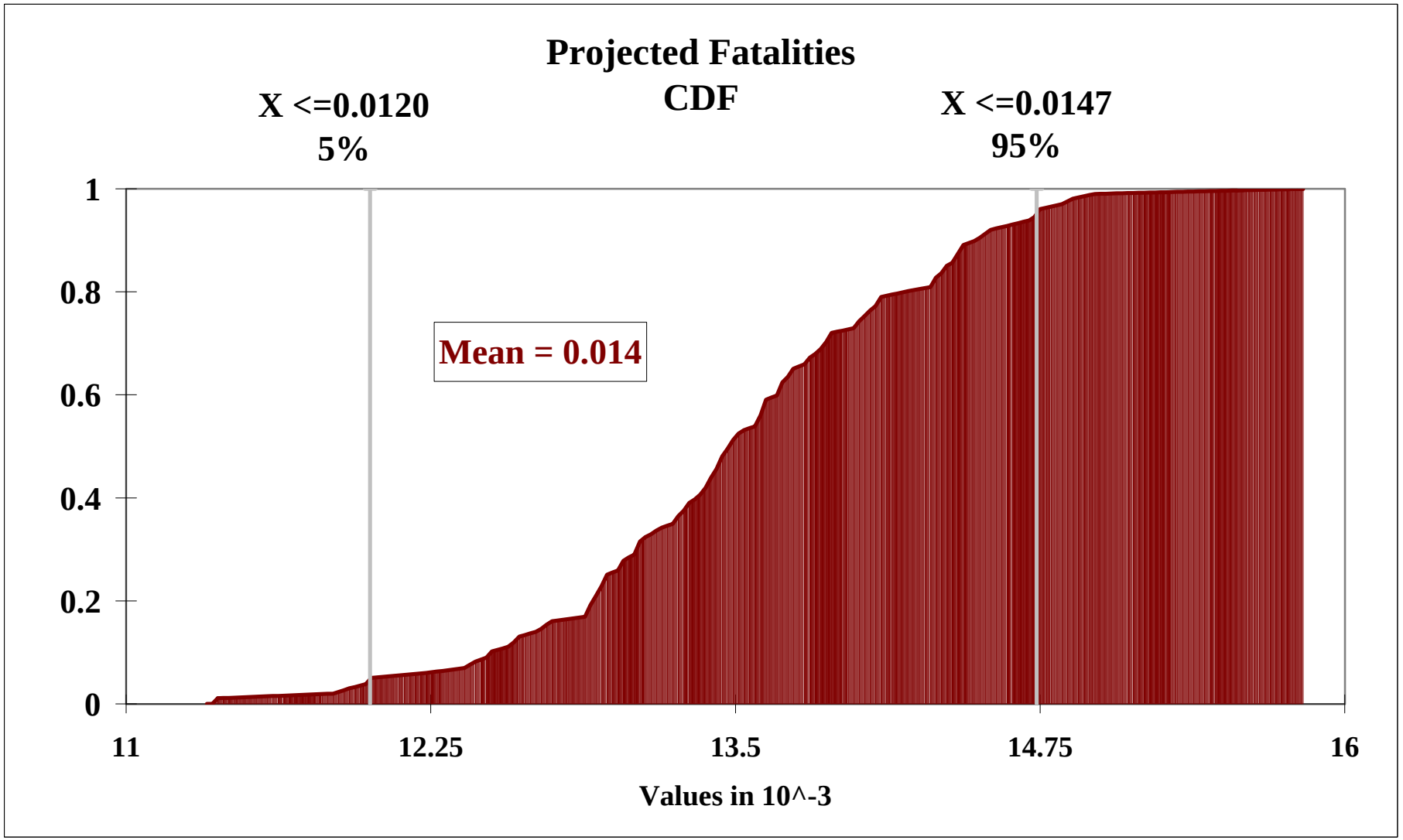


Figure A.1.3-6. Hidalgo In-Situ Removal



A.1.4. EUREKA IN-SITU REMOVAL

U. S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

Eureka In-Situ Removal

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

EUREKA
REMOVAL IN-SITU – SMALL PIECE

Assumptions:

- The work is performed utilizing a 2000 ton capacity derrick barge or crane ship that does not have D.P.
- Mud plugs have been removed from skirt piles to a depth of 20' BML prior to arrival of the DB.
- Well have been plugged and well conductors / casings have been removed to a depth of 15' BML prior to arrival of the DB.
- All topside components have been cut loose prior to arrival of the DB.
- Below water cuts are by divers.
- Divers working above 150' water depth are on deep air.
- Divers working below 150' water depth are in saturation.
- Jacket lifting devices are internal lift tools capable of sealing the legs / piles for deballasting.

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Risk Assessment Platform Decommissioning Phase 2
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EUREKA
REMOVAL IN-SITU – SMALL PIECE

Procedures:

1. After the DB is positioned at the Eureka platform the topside equipment and deck are removed and secured on cargo barge(s).

2. Abrasively cut the 24 skirt piles at 15' BML with two (2) abrasive cutting spreads working simultaneously.

3. Divers cut the jacket legs and braces below the (-)50' elevation. This jacket section is lifted off by the DB crane, placed on cargo barge and seafastened.

4. Divers cut the braces outside the Row 2 legs to just above elevation (-)190' and cut the Row 1 legs just above elevation (-)190'. This section is removed by the DB crane, placed on a cargo barge and seafastened.

5. Divers cut the braces outside the Row 2 legs to just above elevation (-)330' and cut the Row 1 legs just above elevation (-)330'. This section is removed by the DB crane, placed on a cargo barge and seafastened.

6. Divers cut the braces outside the Row 2 legs to just above elevation (-)470' and cut the Row 1 legs just above elevation (-)470'. This section is removed by the DB crane, placed on a cargo barge and seafastened.

7. Divers cut the braces outside the Row 2 legs to just above elevation (-)620' and cut the Row 1 legs just above elevation (-)620'. This section is removed by the DB crane, placed on a cargo barge and seafastened.

8. Divers cut the braces outside the Row 3 legs to just above elevation (-)190' and cut the Row 4 legs just above elevation (-)190'. This section is removed by the DB crane, placed on a cargo barge and seafastened.

9. Divers cut the braces outside the Row 3 legs to just above elevation (-)330' and cut the Row 4 legs just above elevation (-)330'. This section is removed by the DB crane, placed on a cargo barge and seafastened.

10. Divers cut the braces outside the Row 3 legs to just above elevation (-)470' and cut the Row 4 legs just above elevation (-)470'. This section is removed by the DB crane, placed on a cargo barge and seafastened.

11. Divers cut the braces outside the Row 3 legs to just above elevation (-)620' and cut the Row 4 legs just above elevation (-)620'. This section is removed by the DB crane, placed on a cargo barge and seafastened.

12. Divers cut the Row 2 and Row 3 legs individually just above the (-)120' elevation and place and seafasten on a cargo barge (see page 11 of 18). Then cut the vertical diagonal braces just above the (-)120' elevation and place and secure on a cargo barge.

13. Divers cut loose the Row 2 – Row 3 legs and the vertical and diagonal braces just above the (-)260' elevation. This jacket section is lifted by the DB crane, placed on a cargo barge and seafastened.

14. Divers cut loose the Row 2 – Row 3 legs and the vertical and diagonal braces just above the (-)400' elevation. This jacket section is lifted by the DB crane, placed on a cargo barge and seafastened.

15. Divers cut loose the Row 2 – Row 3 legs and the vertical and diagonal braces just above the (-)540' elevation. This jacket section is lifted by the DB crane, placed on a cargo barge and seafastened.

16. Divers cut loose and remove braces between Row 2 and Row 3 legs and skirt pile guides just outboard of Row 2 and Row 3. Braces are placed and seafastened on a cargo barge.

17. Remove the Row 2 – Row 3 jacket section from the (-)540' elevation to the mudline, place on a cargo barge and seafasten.

18. Remove the section containing the skirt piles outboard of Row 2 and place on a cargo barge on seafasten.

19. Remove the section containing the skirt piles outboard of Row 3 and place on a cargo barge on seafasten.

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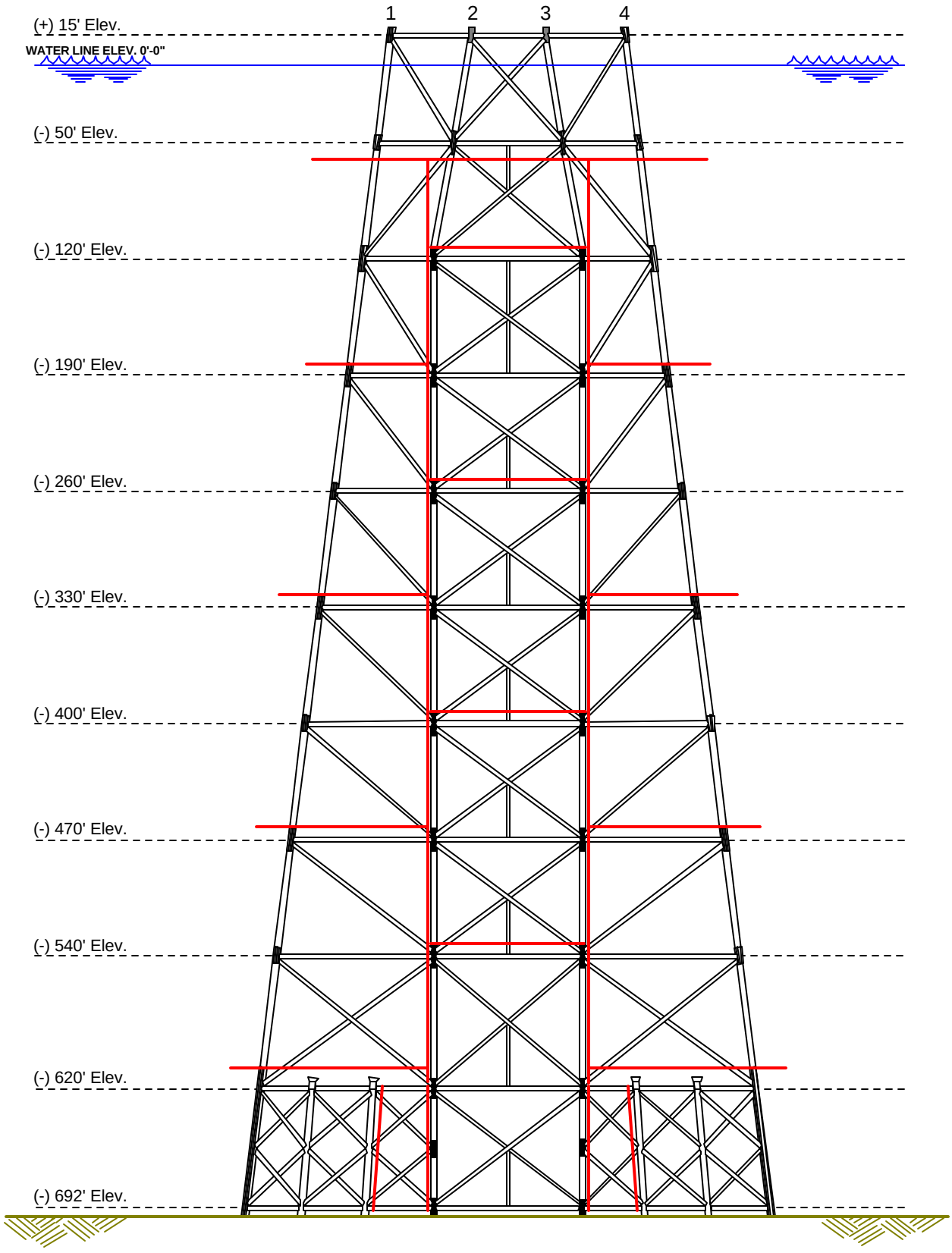

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Platform Task Min. / Max.
Table A.1.4-1. Eureka In-Situ Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Platform Removal Prep	- - - -	- - - -	- - - -
Cleaning/Flushing	120	196	288
Prepare Modules, Cap Truss, and Jacket for Removal	168	252	504
Platform Removal	- - - -	- - - -	- - - -
Platform Inspection			
Set Up DB	2	4	12
Remove Equipment From Top Deck	18	30	48
Cut Deck	- - - -	- - - -	- - - -
Cut Deck in Four 4 Leg Sections (as installed, may be cut prior to DB arrival)	12	18	36
Remove NW 4 Leg Deck Section	8	12	18
Remove NE 4 Leg Deck Section	8	12	18
Reposition DB	6	16	18
Remove SW 4 Leg Deck Section	8	12	18
Remove SE 4 Leg Deck Section	8	12	18
Remove Bracing Between Rows AI & BI	- - - -	- - - -	- - - -
Cut & Remove All Braces Between Rows AI & BI (+ 15' to -0')	8	18	24
Cut & Remove All Braces Between Rows AI & BI (0' to -60')	23	30	53
Remove A & AI Section @ (-)50'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Rows A & AI	3	4	8
Sever Jacket Section Rows A & AI @ (-) 60'	18	23	41
Lift & Set Rows A & AI on CB & Seafasten	10	12	18
Derig From Rows A & AI	2	4	8
Remove B & BI Section @ (-)50'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig To Rows B & BI	2	4	8
Sever Jacket Section Rows B & BI @ (-) 60'	18	23	41
Lift & Set B & BI Legs on CB	1	2	4
Seafasten	8	12	18
Derig From B & BI Legs	2	4	8
Remove Leg A1 and Associated Braces Between (-)50' to (-)180'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg A1 @ (-) 50'	1	2	4
Sever Connecting Braces from Row 1 to Row 2 @ Row 2, and from Row A to Row B @ Midpoint	8	10	18
NOTE: Switch Dive Spread to Sat. Divers (150' to 300')	- - - -	- - - -	- - - -
Sever Leg A1 @ (-)180' El.	2	3	5
Lift Leg A1and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Leg B1 and Associated Braces Between (-)50' to (-)180'	- - - -	- - - -	- - - -
NOTE: Switch Dive Spread to Sat. Divers (0' to 150')	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg B1 @ (-) 50'	1	2	4
Sever Connecting Braces from Row 1 to Row 2 @ Row 2	5	7	12
Sever Leg B1 @ (-)180' El.	2	3	5
Lift Leg B1and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Leg A1 and Associated Braces Between (-)180' to (-)320'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg A1 @ (-) 180'	1	2	4
Sever Connecting Braces from Row 1 to Row 2 @ Row 2, and from Row A to Row B @ Midpoint	9	12	21
NOTE: Switch Dive Spread to Sat. Divers (300' to 700')	- - - -	- - - -	- - - -
Sever Leg A1 @ (-)320' El.	2.5	3	4.5
Lift Leg A1 and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Leg B1 and Associated Braces Between (-)180' to (-)320'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg B1 @ (-) 180'	1	2	4
Sever Connecting Braces from Row 1 to Row 2 @ Row 2	8.5	10	15
Sever Leg B1 @ (-) 320' El.	2.5	3	4.5
Lift Leg B1and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Leg A1 and Associated Braces Between (-)320' to (-)460'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg A1 @ (-) 320'	1	2	4
Sever Connecting Braces from Row 1 to Row 2 @ Row 2, and from Row A to Row B @ Midpoint	10	12	18
Sever Leg A1 @ (-) 460' El.	2.5	3	4.5
Lift Leg A1 and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Leg B1 and Associated Braces Between (-)320' to (-)460'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg B1 @ (-) 320'	1	2	4
Sever Connecting Braces from Row 1 to Row 2 @ Row 2	8.5	10	15
Sever Leg B1 @ (-) 460' El.	2.5	3	4.5
Lift Leg B1and Lay on CB	1	2	4

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Platform Task Min. / Max.
Table A.1.4-1. Eureka In-Situ Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Seafasten	2	4	8
Remove Leg A1 and Associated Braces Between (-) 460' to (-) 610'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg A1 @ (-) 460'	1	2	4
Sever Connecting Braces from Row 1 to Row 2 @ Row 2, and from Row A to Row B @ Midpoint	10	12	18
Sever Leg A1 @ (-) 610' El.	2.5	3	4.5
Lift Leg A1 and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Leg B1 and Associated Braces Between (-) 460' to (-) 610'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg B1 @ (-) 460'	1	2	4
Sever Connecting Braces from Row 1 to Row 2 @ Row 2	8.5	10	15
Sever Leg B1 @ (-) 610' El.	2.5	3	4.5
Lift Leg B1and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Legs A4 and Associated Braces Between (-) 50' to (-) 180'	- - - -	- - - -	- - - -
NOTE: Switch Dive Spread to Divers (0' to 150')	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg A4 @ (-) 50'	1	2	4
Sever Connecting Braces from Row 4 to Row3 @ Row 3, and from Row A to Row B @ Midpoint	8	10	18
NOTE: Switch Dive Spread to Divers (150' to 300')	- - - -	- - - -	- - - -
Sever Leg A4 @ (-)180' El.	2	3	5
Lift Leg A4 and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Legs B4 and Associated Braces Between (-) 50' to (-) 180'	- - - -	- - - -	- - - -
NOTE: Switch Dive Spread to Divers (0' to 150')	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg B4 @ (-) 50'	1	2	4
Sever Connecting Braces from Row 4 to Row3 @ Row 3	5	7	12
NOTE: Switch Dive Spread to Divers (150' to 300')	- - - -	- - - -	- - - -
Sever Leg B4 @ (-)180' El.	2	3	5
Lift Leg B4 and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Legs A4 and Associated Braces Between (-) 180' to (-) 320'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg A4 @ (-) 180'	1	2	4
Sever Connecting Braces from Row 4 to Row3 @ Row 3, and from Row A to Row B @ Midpoint	10	12	18
NOTE: Switch Dive Spread to Divers (300' to 700')	- - - -	- - - -	- - - -
Sever Leg A4 @ (-) 320' El.	2.5	3	4.5
Lift Leg A4 and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Legs B4 and Associated Braces Between (-) 180' to (-) 320'	- - - -	- - - -	- - - -
NOTE: Switch Dive Spread to Divers (150' to 300')	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg B4 @ (-) 180'	1	2	4
Sever Connecting Braces from Row 4 to Row3 @ Row 3	8.5	10	15
NOTE: Switch Dive Spread to Divers (300' to 700')	- - - -	- - - -	- - - -
Sever Leg B4 @ (-) 320' El.	2.5	3	4.5
Lift Leg B4 and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Legs A4 and Associated Braces Between (-) 320' to (-) 460'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg A4 @ (-) 320'	1	2	4
Sever Connecting Braces from Row 4 to Row3 @ Row 3, and from Row A to Row B @ Midpoint	10	12	18
Sever Leg A4 @ (-) 460' El.	2.5	3	4.5
Lift Leg A4 and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Legs B4 and Associated Braces Between (-) 320' to (-) 460'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg B4 @ (-) 320'	1	2	4
Sever Connecting Braces from Row 4 to Row3 @ Row 3	8.5	10	15
Sever Leg B4 @ (-) 460' El.	2.5	3	4.5
Lift Leg B4 and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Legs A4 and Associated Braces Between (-) 460' to (-) 610'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Leg A4 @ (-) 460'	1	2	4
Sever Connecting Braces from Row 4 to Row3 @ Row 3, and from Row A to Row B @ Midpoint	10	12	18
Sever Leg A4 @ (-) 610' El.	2.5	3	4.5
Lift Leg A4 and Lay on CB	1	2	4
Seafasten	2	4	8
Remove Legs B4 and Associated Braces Between (-) 460' to (-) 610'	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Platform Task Min. / Max.
Table A.1.4-1. Eureka In-Situ Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Rig to Leg B4 @ (-) 460'	1	2	4
Sever Connecting Braces from Row 4 to Row3 @ Row 3	10	12	18
Sever Leg B4 @ (-) 610' El.	2.5	3	4.5
Lift Leg B4 and Lay on CB	1	2	4
Seafasten	2	4	8
Cut & Remove Legs & Braces in Rows 2 & 3 Between (-) 50' to (-)110'	- - - -	- - - -	- - - -
NOTE: Switch Dive Spread to Divers (0' to 150')	- - - -	- - - -	- - - -
Sever & Remove Braces & Legs, Row 2 & 3 Between (-) 50' & (-)110'	12	16	28
Remove Jacket Sections Row 2 & Row 3	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Jacket Section Rows 2 & 3 @ (-)110'	2	4	8
NOTE: Switch Dive Spread to Divers (150' to 300')	- - - -	- - - -	- - - -
Sever Jacket Section Rows 2 & 3 Horizontally @ (-) 250'	34	40	60
Lift Rows 2 & 3 Jacket Section & Set on CB	1	2	4
Seafasten	6	8	18
Derig From Rows 2 & 3	2	4	8
Install Lifting Appurtenances	3	4	8
Rig to Jacket Section Rows 2 & 3 @ (-) 250'	2	4	8
NOTE: Switch Dive Spread to Divers (300' to 700')	- - - -	- - - -	- - - -
Sever Jacket Section Rows 2 & 3 Horizontally @ (-) 390'	34	40	60
Lift Rows 2 & 3 Jacket Section & Set on CB	1	2	4
Seafasten	6	8	18
Derig From Rows 2 & 3	2	4	8
Install Lifting Appurtenances	2	4	8
Rig to Jacket Section Rows 2 & 3 @ (-) 390'	2	4	8
Sever Jacket Section Rows 2 & 3 Horizontally @ (-) 530'	34	40	60
Lift Rows 2 & 3 Jacket Section & Set on CB	1	2	4
Seafasten	6	8	18
Derig From Rows 2 & 3	2	4	8
Cut and Remove Connecting Braces from Rows 2 & 3 to Skirt Pile Clusters	- - - -	- - - -	- - - -
Sever and Remove Connecting Braces Row 2 to Skirt Pile Cluster	105	117	153
Remove Row 2 & 3 Jacket Section	- - - -	- - - -	- - - -
Install Lifting Appurtenances	2	4	8
Rig to Rows 2 & 3 @ (-) 530'	8	12	24
Lift Rows 2 & 3 Jacket Section & Set on CB	4	5	12
Seafasten	6	8	18
Derig From Rows 2 & 3 Jacket Section	1	4	8
Remove Skirt Pile Clusters	- - - -	- - - -	- - - -
Sever 24 Skirt Piles with 2 Abrasive Cutting Spreads Working Simultaneously	96	144	240
Install Lifting Appurtenances	2	4	8
Rig to A1 Skirt Pile Cluster @ (-) 610'	6	8	18
Lift A1 Skirt Pile Cluster & Lay on CB	4	6	12
Seafasten	4	4	12
Derig	1	4	8
Install Lifting Appurtenances	2	4	8
Rig to B1 Skirt Pile Cluster @ (-) 610'	6	8	18
Lift B1 Skirt Pile Cluster & Lay on CB	4	6	12
Seafasten	4	4	12
Derig	1	4	8
Install Lifting Appurtenances	2	4	8
Rig to A4 Skirt Pile Cluster @ (-) 610'	6	8	18
Lift A4 Skirt Pile Cluster & Lay on CB	4	6	12
Seafasten	4	4	12
Derig	1	4	8
Install Lifting Appurtenances	2	4	8
Rig to B4 Skirt Pile Cluster @ (-) 610'	6	8	18
Lift B4 Skirt Pile Cluster & Lay on CB	4	6	12
Seafasten	4	4	12
Derig	1	4	8
Total Task Hours	**1,172.50**	**1716**	**2,988.00**
	32% Decrease		**74% Increase**

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.4-2. Eureka In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Platform Removal Prep	----	----	----						
Cleaning/Flushing	120	201	288	1,611	805				2,416
Prepare Modules, Cap Truss, and Jacket for Removal	168	308	504	5,544	1,232				6,776
Platform Removal	----	----	----	----	----				
Platform Inspection									
Set Up DB	2	6	12	228		174			402
Remove Equipment From Top Deck	18	32	48	1,216		928			2,144
Cut Deck	----	----	----	----	----	----			
Cut Deck in Four 4 Leg Sections (as installed, may be cut prior to DB arrival)	12	22	36	836		638			1,474
Remove NW 4 Leg Deck Section	8	13	18	481		367			849
Remove NE 4 Leg Deck Section	8	13	18	481		367			849
Reposition DB	6	13	18	507		387			893
Remove SW 4 Leg Deck Section	8	13	18	481		367			849
Remove SE 4 Leg Deck Section	8	13	18	481		367			849
Remove Bracing Between Rows AI & BI	----	----	----	----	----	----			
Cut & Remove All Braces Between Rows AI & BI (+ 15' to -0')	8	17	24	633	167	483	17		1,300
Cut & Remove All Braces Between Rows AI & BI (0' to -60')	23	35	53	1,343	353	1,025	35		2,756
Remove A & AI Section @ (-)50'	----	----	----	----	----	----	----		
Install Lifting Appurtenances	2	5	8	177	47	135	5		364
Rig to Rows A & AI	3	5	8	190	50	145	5		390
Sever Jacket Section Rows A & AI @ (-) 60'	18	27	41	1,039	273	793	27		2,132
Lift & Set Rows A & AI on CB & Seafasten	10	13	18	507	133	387	13		1,040
Derig From Rows A & AI	2	5	8	177	47	135	5		364
Remove B & BI Section @ (-)50'	----	----	----	----	----	----	----		
Install Lifting Appurtenances	2	5	8	177	47	135	5		364
Rig To Rows B & BI	2	5	8	177	47	135	5		364
Sever Jacket Section Rows B & BI @ (-) 60'	18	27	41	1,039	273	793	27		2,132
Lift & Set B & BI Legs on CB	1	2	4	89	23	68	2		182
Seafasten	8	13	18	481	127	367	13		988
Derig From B & BI Legs	2	5	8	177	47	135	5		364
Remove Leg A1 and Associated Braces Between (-)50' to (-)180'	----	----	----	----	----	----	----		
Install Lifting Appurtenances	2	5	8	177	47	135	5		364
Rig to Leg A1 @ (-) 50'	1	2	4	89	23	68	2		182
Sever Connecting Braces from Row 1 to Row 2 @ Row 2, and from Row A to Row B @ Midpoint	8	12	18	456	120	348	12		936

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.4-2. Eureka In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
NOTE: Switch Dive Spread to Sat. Divers (150' to 300')	----	----	----	----	----	----	----		
Sever Leg A1 @ (-)180' El.	2	3	5	127	30	97		7	260
Lift Leg A1and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Leg B1 and Associated Braces Between (-)50' to (-)180'	----	----	----	----	----	----	----		
NOTE: Switch Dive Spread to Sat. Divers (0' to 150')	----	----	----	----	----	----	----		
Install Lifting Appurtenances	2	5	8	177	47	135	5		364
Rig to Leg B1 @ (-) 50'	1	2	4	89	23	68	2		182
Sever Connecting Braces from Row 1 to Row 2 @ Row 2	5	8	12	304	72	232		16	624
Sever Leg B1 @ (-)180' El.	2	3	5	127	30	97		7	260
Lift Leg B1and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Leg A1 and Associated Braces Between (-)180' to (-)320'	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg A1 @ (-) 180'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 1 to Row 2 @ Row 2, and from Row A to Row B @ Midpoint	9	14	21	532	126	406		28	1,092
NOTE: Switch Dive Spread to Sat. Divers (300' to 700')	----	----	----	----	----	----			
Sever Leg A1 @ (-)320' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg A1 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Leg B1 and Associated Braces Between (-)180' to (-)320'	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg B1 @ (-) 180'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 1 to Row 2 @ Row 2	8.5	11	15	424	101	324		22	871
Sever Leg B1 @ (-) 320' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg B1and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Leg A1 and Associated Braces Between (-)320' to (-)460'	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg A1 @ (-) 320'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 1 to Row 2 @ Row 2, and from Row A to Row B @ Midpoint	10	13	18	507	120	387		27	1,040
Sever Leg A1 @ (-) 460' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg A1 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.4-2. Eureka In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Remove Leg B1 and Associated Braces Between (-)320' to (-)460'	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg B1 @ (-) 320'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 1 to Row 2 @ Row 2	8.5	11	15	424	101	324		22	871
Sever Leg B1 @ (-) 460' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg B1and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Leg A1 and Associated Braces Between (-) 460' to (-) 610'	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg A1 @ (-) 460'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 1 to Row 2 @ Row 2, and from Row A to Row B @ Midpoint	10	13	18	507	120	387		27	1,040
Sever Leg A1 @ (-) 610' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg A1 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Leg B1 and Associated Braces Between (-) 460' to (-) 610'	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg B1 @ (-) 460'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 1 to Row 2 @ Row 2	8.5	11	15	424	101	324		22	871
Sever Leg B1 @ (-) 610' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg B1and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Legs A4 and Associated Braces Between (-) 50' to (-) 180'	----	----	----	----	----	----			
NOTE: Switch Dive Spread to Divers (0' to 150')	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg A4 @ (-) 50'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 4 to Row3 @ Row 3, and from Row A to Row B @ Midpoint	8	12	18	456	108	348		24	936
NOTE: Switch Dive Spread to Divers (150' to 300')	----	----	----	----	----	----			
Sever Leg A4 @ (-)180' El.	2	3	5	127	30	97		7	260
Lift Leg A4 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Legs B4 and Associated Braces Between (-) 50' to (-) 180'	----	----	----	----	----	----			
NOTE: Switch Dive Spread to Divers (0' to 150')	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg B4 @ (-) 50'	1	2	4	89	21	68		5	182

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.4-2. Eureka In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Sever Connecting Braces from Row 4 to Row3 @ Row 3	5	8	12	304	72	232		16	624
NOTE: Switch Dive Spread to Divers (150' to 300')	----	----	----	----	----	----			
Sever Leg B4 @ (-)180' El.	2	3	5	127	30	97		7	260
Lift Leg B4 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Legs A4 and Associated Braces Between (-) 180' to (-) 320'	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg A4 @ (-) 180'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 4 to Row3 @ Row 3, and from Row A to Row B @ Midpoint	10	13	18	507	120	387		27	1,040
NOTE: Switch Dive Spread to Divers (300' to 700')	----	----	----	----	----	----			
Sever Leg A4 @ (-) 320' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg A4 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Legs B4 and Associated Braces Between (-) 180' to (-) 320'	----	----	----	----	----	----			
NOTE: Switch Dive Spread to Divers (150' to 300')	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg B4 @ (-) 180'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 4 to Row3 @ Row 3	8.5	11	15	424	101	324		22	871
NOTE: Switch Dive Spread to Divers (300' to 700')	----	----	----	----	----	----			
Sever Leg B4 @ (-) 320' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg B4 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Legs A4 and Associated Braces Between (-) 320' to (-) 460'	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg A4 @ (-) 320'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 4 to Row3 @ Row 3, and from Row A to Row B @ Midpoint	10	13	18	507	120	387		27	1,040
Sever Leg A4 @ (-) 460' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg A4 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Legs B4 and Associated Braces Between (-) 320' to (-) 460'	----	----	----	----	----	----			

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.4-2. Eureka In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg B4 @ (-) 320'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 4 to Row3 @ Row 3	8.5	11	15	424	101	324		22	871
Sever Leg B4 @ (-) 460' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg B4 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Legs A4 and Associated Braces Between (-) 460' to (-) 610'	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg A4 @ (-) 460'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 4 to Row3 @ Row 3, and from Row A to Row B @ Midpoint	10	13	18	507	120	387		27	1,040
Sever Leg A4 @ (-) 610' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg A4 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Remove Legs B4 and Associated Braces Between (-) 460' to (-) 610'	----	----	----	----	----	----			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Leg B4 @ (-) 460'	1	2	4	89	21	68		5	182
Sever Connecting Braces from Row 4 to Row3 @ Row 3	10	13	18	507	120	387		27	1,040
Sever Leg B4 @ (-) 610' El.	2.5	3	4.5	127	30	97		7	260
Lift Leg B4 and Lay on CB	1	2	4	89	21	68		5	182
Seafasten	2	5	8	177	42	135		9	364
Cut & Remove Legs & Braces in Rows 2 & 3 Between (-) 50' to (-)110'	----	----	----	----	----	----			
NOTE: Switch Dive Spread to Divers (0' to 150')	----	----	----	----	----	----			
Sever & Remove Braces & Legs, Row 2 & 3 Between (-) 50' & (-)110'	12	19	28	709	187	541	19		1,456
Remove Jacket Sections Row 2 & Row 3	----	----	----	----	----	----	----		
Install Lifting Appurtenances	2	5	8	177	47	135	5		364
Rig to Jacket Section Rows 2 & 3 @ (-)110'	2	5	8	177	47	135	5		364
NOTE: Switch Dive Spread to Divers (150' to 300')	----	----	----	----	----	----	----		
Sever Jacket Section Rows 2 & 3 Horizontally @ (-) 250'	34	45	60	1,697	402	1,295		89	3,484
Lift Rows 2 & 3 Jacket Section & Set on CB	1	2	4	89	21	68		5	182
Seafasten	6	11	18	405	96	309		21	832
Derig From Rows 2 & 3	2	5	8	177	42	135		9	364
Install Lifting Appurtenances	3	5	8	190	45	145		10	390

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
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Task & Resource Hours
Table A.1.4-2. Eureka In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Rig to Jacket Section Rows 2 & 3 @ (-) 250'	2	5	8	177	42	135		9	364
NOTE: Switch Dive Spread to Divers (300' to 700')	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -			
Sever Jacket Section Rows 2 & 3 Horizontally @ (-) 390'	34	45	60	1,697	402	1,295		89	3,484
Lift Rows 2 & 3 Jacket Section & Set on CB	1	2	4	89	21	68		5	182
Seafasten	6	11	18	405	96	309		21	832
Derig From Rows 2 & 3	2	5	8	177	42	135		9	364
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Jacket Section Rows 2 & 3 @ (-) 390'	2	5	8	177	42	135		9	364
Sever Jacket Section Rows 2 & 3 Horizontally @ (-) 530'	34	45	60	1,697	402	1,295		89	3,484
Lift Rows 2 & 3 Jacket Section & Set on CB	1	2	4	89	21	68		5	182
Seafasten	6	11	18	405	96	309		21	832
Derig From Rows 2 & 3	2	5	8	177	42	135		9	364
Cut and Remove Connecting Braces from Rows 2 & 3 to Skirt Pile Clusters	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -			
Sever and Remove Connecting Braces Row 2 to Skirt Pile Cluster	105	125	153	4,750	1,125	3,625		250	9,750
Remove Row 2 & 3 Jacket Section	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -			
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to Rows 2 & 3 @ (-) 530'	8	12	24	456	108	348		24	936
Lift Rows 2 & 3 Jacket Section & Set on CB	4	7	12	266	63	203		14	546
Seafasten	6	11	18	405	96	309		21	832
Derig From Rows 2 & 3 Jacket Section	1	4	8	165	39	126		9	338
Remove Skirt Pile Clusters	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -			
Sever 24 Skirt Piles with 2 Abrasive Cutting Spreads Working Simultaneously	96	160	240	6,080	1,440	4,640		320	12,480
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to A1 Skirt Pile Cluster @ (-) 610'	6	11	18	405	96	309		21	832
Lift A1 Skirt Pile Cluster & Lay on CB	4	7	12	279	66	213		15	572
Seafasten	4	7	12	253	60	193		13	520
Derig	1	4	8	165	39	126		9	338
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to B1 Skirt Pile Cluster @ (-) 610'	6	11	18	405	96	309		21	832
Lift B1 Skirt Pile Cluster & Lay on CB	4	7	12	279	66	213		15	572
Seafasten	4	7	12	253	60	193		13	520
Derig	1	4	8	165	39	126		9	338
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to A4 Skirt Pile Cluster @ (-) 610'	6	11	18	405	96	309		21	832

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.4-2. Eureka In-Situ Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Lift A4 Skirt Pile Cluster & Lay on CB	4	7	12	279	66	213		15	572
Seafasten	4	7	12	253	60	193		13	520
Derig	1	4	8	165	39	126		9	338
Install Lifting Appurtenances	2	5	8	177	42	135		9	364
Rig to B4 Skirt Pile Cluster @ (-) 610'	6	11	18	405	96	309		21	832
Lift B4 Skirt Pile Cluster & Lay on CB	4	7	12	279	66	213		15	572
Seafasten	4	7	12	253	60	193		13	520
Derig	1	4	8	165	39	126		9	338
Total Task Hours	**1,173**	**1,956**	**2,988**	**62,134**	**14,160**	**41,958**	**217**	**2,211**	**120,681**
	40% Decrease		**53% Increase**						

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
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Projected Serious Accidents
Table A.1.4-3. Eureka In-Situ Removal

Risk Category*	Average Value Man-hours	Projected Value Serious Accidents
On Deck, High Risk	62,134	0.2071
On Deck, Support	14,160	0.0472
Marine & Other Support	41,958	0.1399
Diving, Air	217	0.4347
Diving, Saturation	2,211	4.4220
Totals	120,681	5.2508

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

Projected Fatalities

Table A.1.4-4. Eureka In-Situ Removal

Risk Category*	Average Value Man-hours	Projected Value Fatalities
On Deck, High Risk	62,134	0.0025
On Deck, Support	14,160	0.0006
Marine & Other Support	41,958	0.0017
Diving, Air	217	0.0013
Diving, Saturation	2,211	0.0133
Totals	120,681	0.0193

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

Figure A.1.4-1. Eureka In-Situ

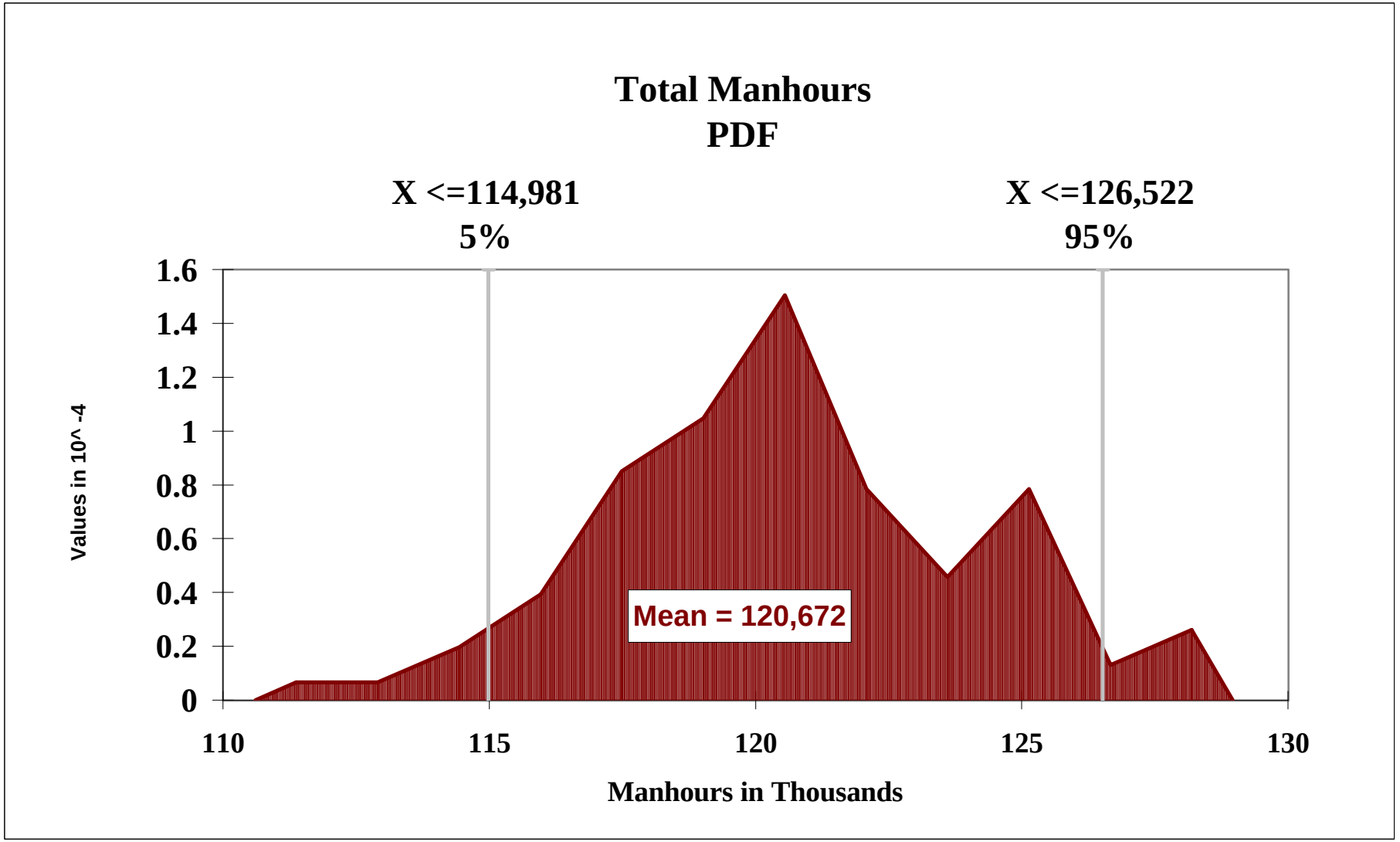


Figure A.1.4-2. Eureka In-Situ

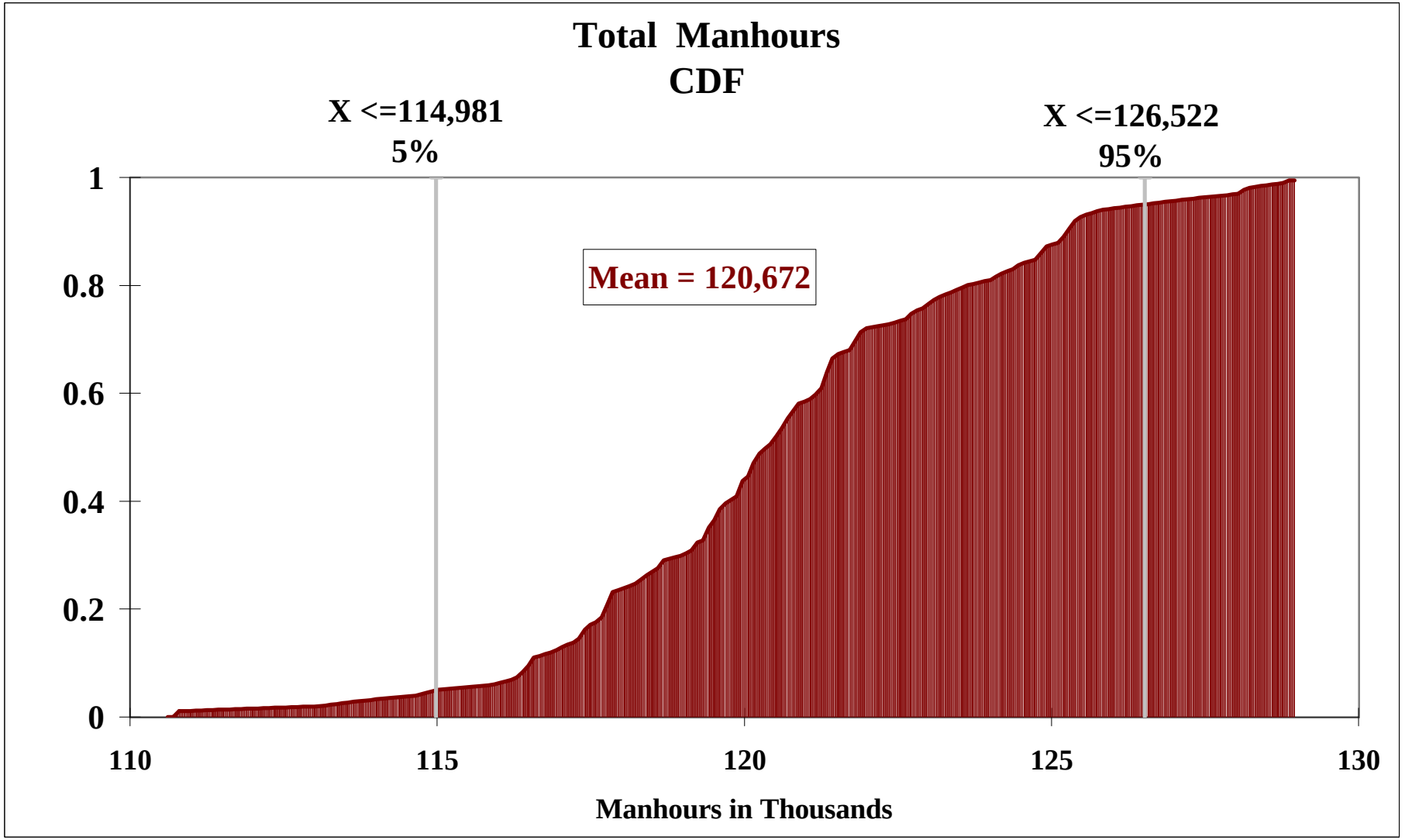


Figure A.1.4-3. Eureka In-Situ

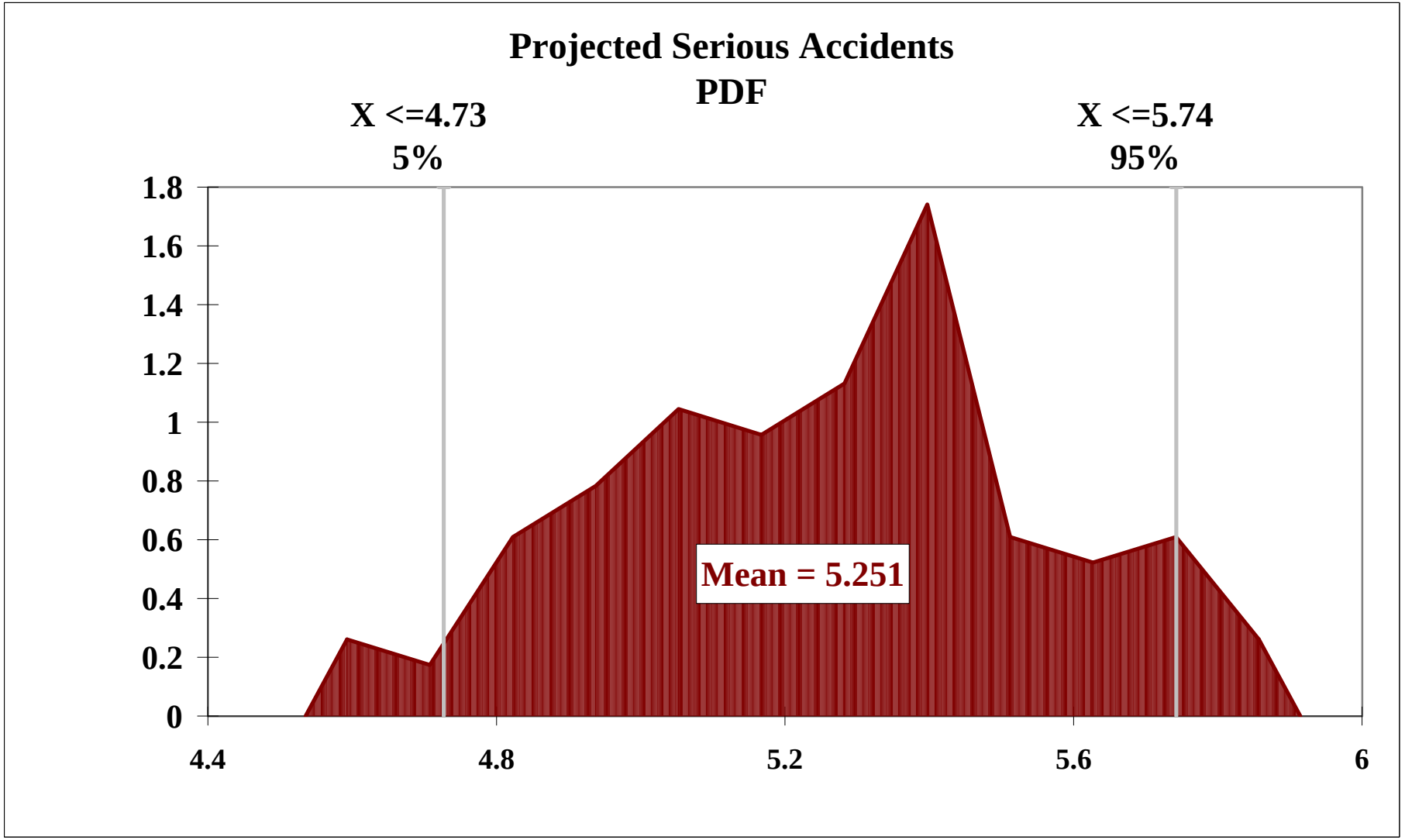


Figure A.1.4-4. Eureka In-Situ

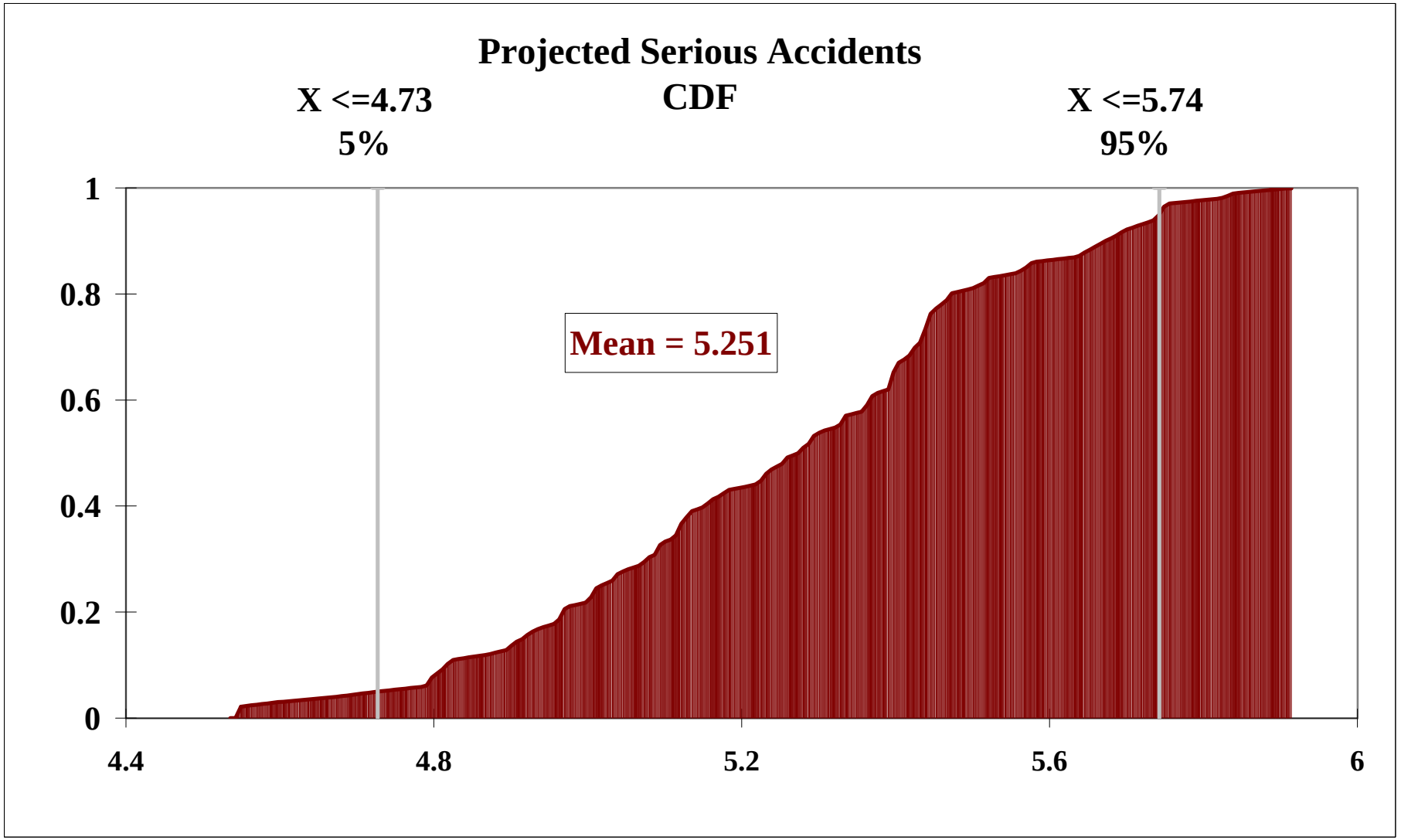


Figure A.1.4-5. Eureka In-Situ

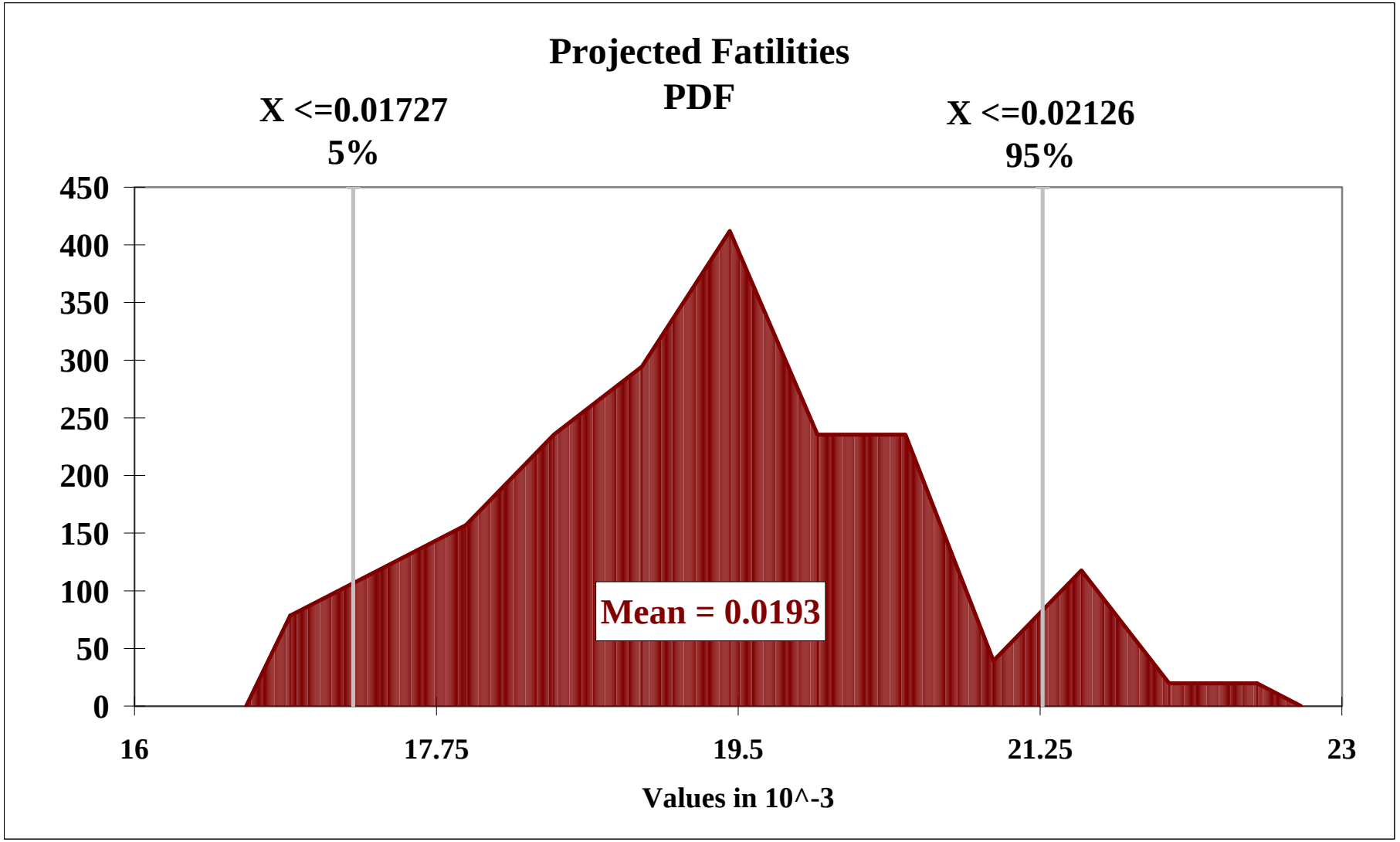
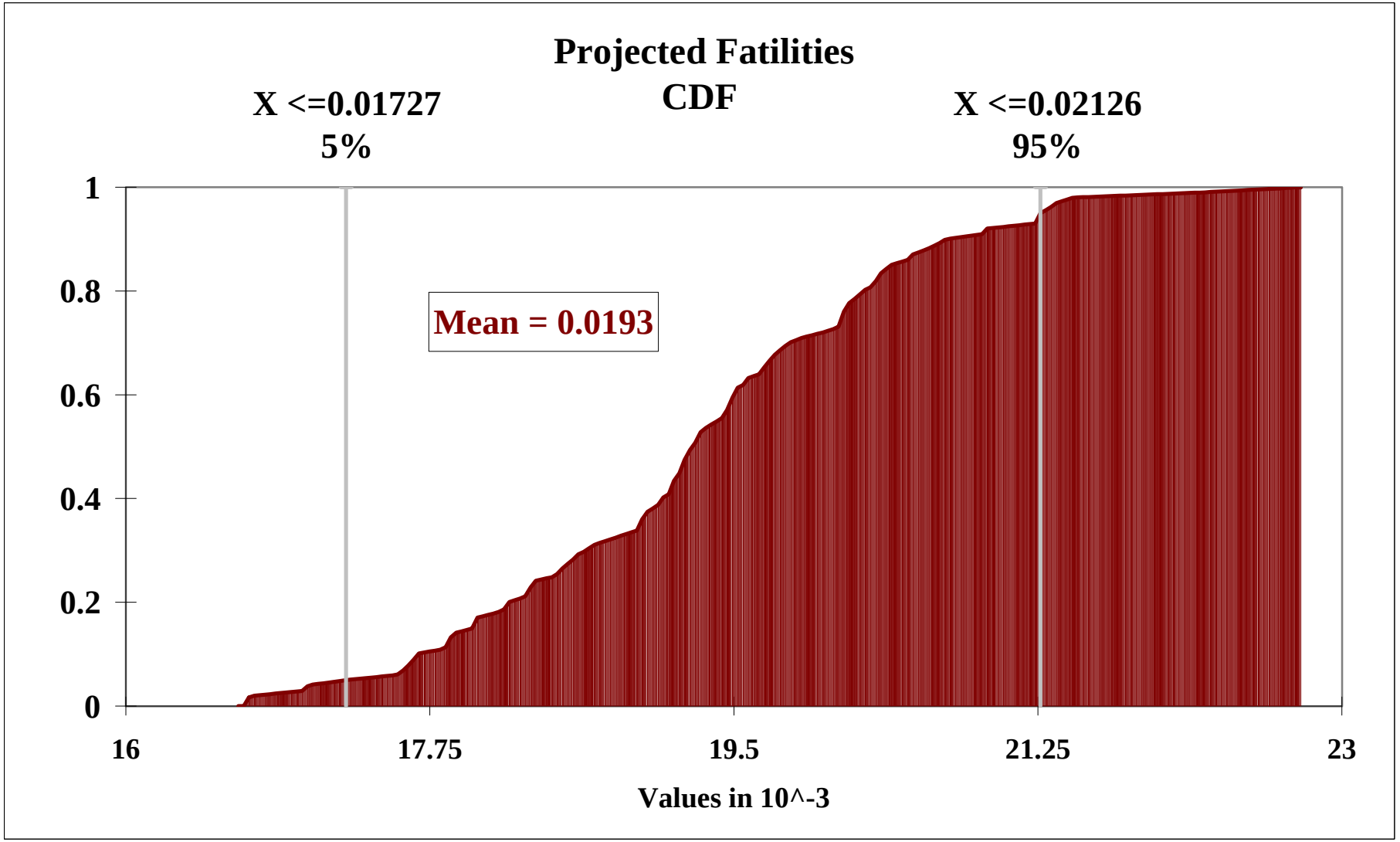


Figure A.1.4-6. Eureka In-Situ



A.1.5. HIDALGO JACKET HOPPING REMOVAL

U. S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

Hidalgo Jacket Hopping

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

HIDALGO
JACKET HOPPING

Assumptions:

- The work is performed utilizing a large twin crane SSCV with DP capability, such as the “Balder”.
- Skirt piles can be capped and deballasted.
- Travel routes to jacket set down locations and set down locations are pre-surveyed and set down locations are buoyed.
- Mud plugs have been removed from skirt piles to a depth of 20' BML prior to arrival of the DB.
- Wells have been plugged and well conductors / casings have been removed to a depth of 15' BML prior to arrival of the DB
- All topside components have been cut loose prior to arrival of the DB
- Divers working above 150' water depth are on deep air.
- Divers working below 150' water depth are in saturation.
- Jacket lifting devices are internal lift tools capable of sealing the legs / piles for deballasting.

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HIDALGO
JACKET HOPPING

Procedures:

1. After the SSCV is positioned at the Hidalgo platform, the topside equipment and the cap truss are removed and secured on cargo barge(s).

2. Abrasively cut the eight (8) piles and eight skirt piles at 20' BML.

3. Cap and deballast the eight (8) main and (8) skirt piles.

4. Rig to and lift jacket with SSCV cranes, secure for travel and move to 310' water depth location and set jacket on bottom.

5. Cut off the jacket section just above the (-)115' elevation, lift with SSCV cranes, place on cargo barge and seafasten.

6. Cap and deballast eight (8) legs, rig to and lift jacket with SSCV cranes, secure for travel and move to 155' water depth location.

7. Cut and remove bracing between Row 2 and Row 4 to just above the (-)270' elevation.

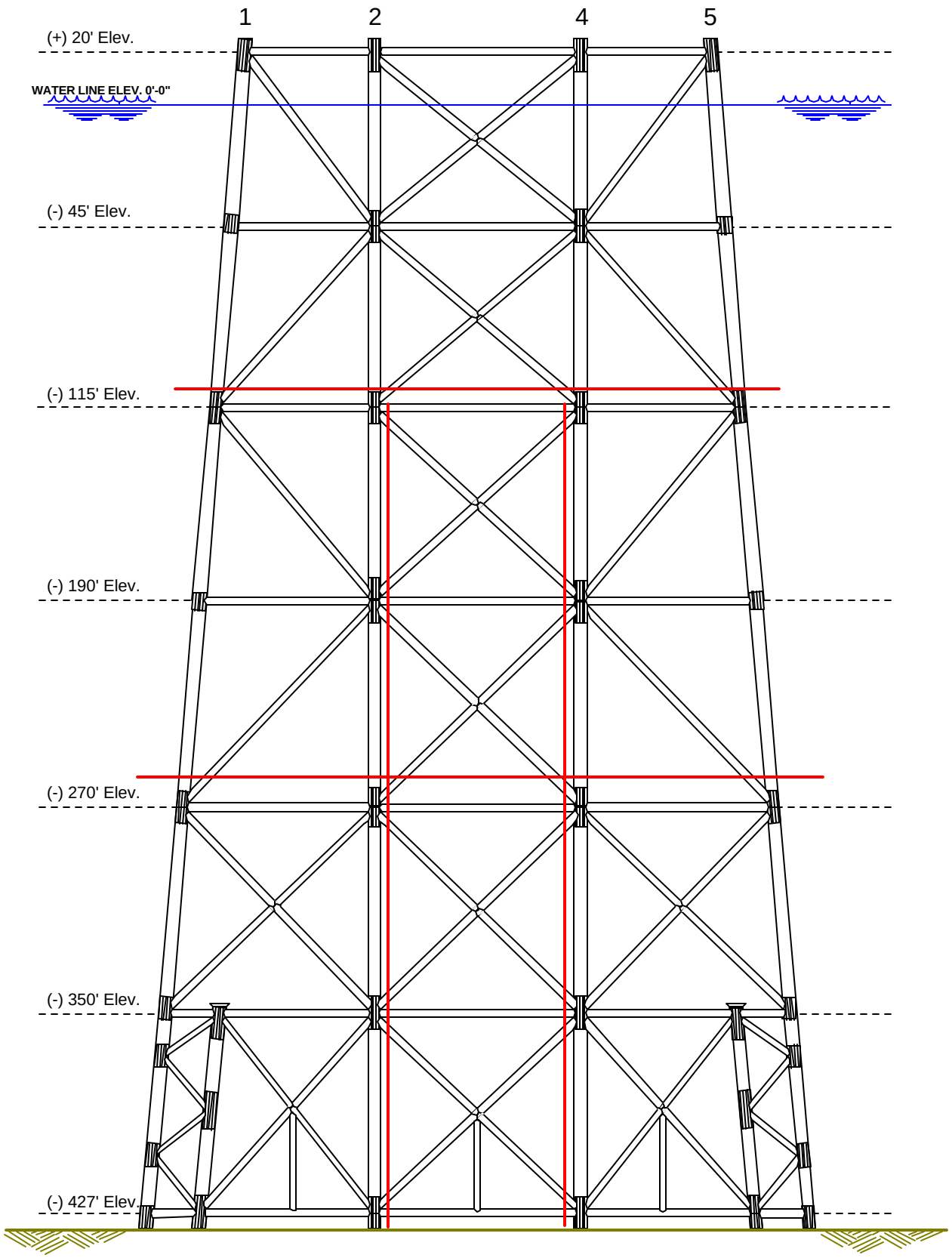
8. Cut off Row 1 – Row 2 jacket section just above the (-)270' elevation, lift with SSCV cranes, place on cargo barge and seafasten.

9. Cut off Row 4 – Row 5 jacket section just above the (-)270' elevation, lift with SSCV cranes, place on cargo barge and seafasten.

10. Cut and remove bracing between Row 2 and Row 4 at the (-)270' elevation and with divers from below (-)270' elevation to the mudline bracing.

11. Rig to and lift the remaining Row 1 – Row 2 jacket section and place on cargo barge and seafasten.

12. Rig to and lift the remaining Row 4 – Row 5 jacket section and place on cargo barge and seafasten.


1
2
4
5
(+) 20' Elev.
WATER LINE ELEV. 0'-0"
(-) 45' Elev.
(-) 115' Elev.
(-) 190' Elev.
(-) 270' Elev.
(-) 350' Elev.
(-) 427' Elev.

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Platform Task Min. / Max.
Hidalgo Jacket Hopping Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Platform Removal Prep	- - - -	- - - -	- - - -
Cleaning/Flushing	120	196	288
Prepare Modules, Cap Truss, and Jacket for Removal	168	252	504
Platform Removal	- - - -	- - - -	- - - -
Platform Inspection			
Setup SSCV	2	4	12
Rig & Remove Modules	18	24	48
Rig & Remove Cap Truss	8	10	18
Abrasively cut 8 main and 8 skirt piles-assuming 2 cutting spreads	64	96	144
1st Cut	- - - -	- - - -	- - - -
Install Lifting Appurtenances (mechanical)	8	8	8
Deballast Piles and Skirt Piles	4	6	12
Rig to, Lift & Secure Jacket for Move	4	6	8
Move to 310' W.D.	1	2	6
Set Jacket on Bottom	1	2	4
Scafffold	12	24	48
Cut Jacket Above the (-) 115' Elevation	4	12	12
Lift Jacket Section and set on Cargo Barge	2	4	8
Seafasten	10	12	24
Derig from Jacket Section	2	4	8
2nd Cut	- - - -	- - - -	- - - -
Install Lifting Appurtenances (mechanical)	4	6	12
Deballast Legs	1	3	6
Rig to, Lift & Secure Jacket for Move	4	6	8
Move to 155' W.D.	1	2	6
Set Jacket on Bottom	1	2	4
Derig from Jacket	1	2	4
Scaffold	18	24	54
Cut & Remove Bracing Between Rows 2 & 4	12	18	30
Install Lifting appurtenances on Rows 1 & 5 (mechanical)	4	6	8
Rig to Rows 1 & 2	1	3	4
Cut Rows 1 & 2 Above the (-) 270' Elevation	8	12	18
Remove Rows 1 & 2	1	4	8
Seafasten	10	12	18
Derig from Rows 1 & 2	1	4	6
Rig to Rows 4 & 5	2	4	8
Cut Rows 4 & 5 Above the (-) 270' Elevation	8	12	18
Remove Rows 4 & 5	1	2	8
Seafasten	10	12	18
Derig from Rows 4 & 5	1	4	6
3rd Cut	- - - -	- - - -	- - - -

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Platform Task Min. / Max.
Hidalgo Jacket Hopping Removal

Task		Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Install Lifting Appurtenances (mechanical)		4	6	12
Cut & Remove Bracing Between Rows 2 & 4		144	196	288
Rig to Rows 1 & 2		2	4	8
Remove Rows 1 & 2		1	2	8
Seafasten		10	12	18
Derig from Rows 1 & 2		1	4	6
Rig to Rows 4 & 5		2	4	8
Remove Rows 4 & 5		1	2	6
Seafasten		12	18	24
Derig from Rows 4 & 5		1	4	6
	Total Task Hours	**695**	**1,052**	**1,780**
		34%		**69%**
		Decrease		**Increase**

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.5-2. Hidalgo Jacket Hopping Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Platform Removal Prep	- - - -		- - - -						
Cleaning/Flushing	120	201	288	1,611	805				2,416
Prepare Modules, Cap Truss, and Jacket for Removal	168	308	504	5,544	1,232				6,776
Platform Removal	- - - -	- - - -	- - - -	- - - -	- - - -				
Platform Inspection				0	0				
Setup SSCV	2	6	12	288	0	210			498
Rig & Remove Modules	18	30	48	1,440	0	1,050			2,490
Rig & Remove Cap Truss	8	12	18	576	0	420			996
Abrasively cut 8 main and 8 skirt piles-assuming 2 cutting spreads	64	101	144	4,864	0	3,547			8,411
1st Cut	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -			
Install Lifting Appurtenances (mechanical)	8	8	8	384	0	280			664
Deballast Piles and Skirt Piles	4	7	12	352	0	257			609
Rig to, Lift & Secure Jacket for Move	4	6	8	288	0	210			498
Move to 310' W.D.	1	3	6	144	0	105			249
Set Jacket on Bottom	1	2	4	112	0	82			194
Scafffold	12	28	48	1,344	0	980			2,324
Cut Jacket Above the (-) 115' Elevation	4	9	12	448	0	327			775
Lift Jacket Section and set on Cargo Barge	2	5	8	224	0	163			387
Seafasten	10	15	24	736	0	537			1,273
Derig from Jacket Section	2	5	8	224	0	163			387
2nd Cut	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -			
Install Lifting Appurtenances (mechanical)	4	7	12	352	0	257			609
Deballast Legs	1	3	6	160	0	117			277
Rig to, Lift & Secure Jacket for Move	4	6	8	288	0	210			498
Move to 155' W.D.	1	3	6	144	0	105			249
Set Jacket on Bottom	1	2	4	112	0	82			194
Derig from Jacket	1	2	4	112	0	82			194
Scaffold	18	32	54	1,536	0	1,120			2,656
Cut & Remove Bracing Between Rows 2 & 4	12	20	30	960	0	700			1,660
Install Lifting appurtenances on Rows 1 & 5 (mechanical)	4	6	8	288	0	210			498
Rig to Rows 1 & 2	1	3	4	128	0	93			221
Cut Rows 1 & 2 Above the (-) 270' Elevation	8	13	18	608	0	443			1,051
Remove Rows 1 & 2	1	4	8	208	0	152			360

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.5-2. Hidalgo Jacket Hopping Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving Average	Sat. Diving Average	Average Labor Manhours
Seafasten	10	13	18	640	0	467			1,107
Derig from Rows 1 & 2	1	4	6	176	0	128			304
Rig to Rows 4 & 5	2	5	8	224	0	163			387
Cut Rows 4 & 5 Above the (-) 270' Elevation	8	13	18	608	0	443			1,051
Remove Rows 4 & 5	1	4	8	176	0	128			304
Seafasten	10	13	18	640	0	467			1,107
Derig from Rows 4 & 5	1	4	6	176	0	128			304
3rd Cut	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -			
Install Lifting Appurtenances (mechanical)	4	7	12	352	0	257			609
Cut & Remove Bracing Between Rows 2 & 4	144	209	288	10,048	2,093	7,327	209		19,677
Rig to Rows 1 & 2	2	5	8	224	0	163			387
Remove Rows 1 & 2	1	4	8	176	0	128			304
Seafasten	10	13	18	640	0	467			1,107
Derig from Rows 1 & 2	1	4	6	176	0	128			304
Rig to Rows 4 & 5	2	5	8	224	0	163			387
Remove Rows 4 & 5	1	3	6	144	0	105			249
Seafasten	12	18	24	864	0	630			1,494
Derig from Rows 4 & 5	1	4	6	176	0	128			304
Total Task Hours	**695**	**1,176**	**1,780**	**39,139**	**4,131**	**23,322**	**209**	**0**	**66,800**
	34% Decrease		**69% Increase**						

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

Projected Serious Accidents
Hidalgo Jacket Hopping

Risk Category*	Average Value Man-hours	Projected Value Serious Accidents
On Deck, High Risk	39,139	0.1305
On Deck, Support	4,131	0.0138
Marine & Other Support	23,322	0.0777
Diving, Air	209	0.4187
Diving, Saturation	0	0.0000
Totals	66,800	0.6406

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

Projected Fatalities
Hidalgo Jacket Hopping

Risk Category*	Average Value Man-hours	Projected Value Fatalities
On Deck, High Risk	39,139	0.0016
On Deck, Support	4,131	0.0002
Marine & Other Support	23,322	0.0009
Diving, Air	209	0.0013
Diving, Saturation	0	0.0000
Totals	66,800	0.0039

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

Figure A.1.5-1. Hidalgo Jacket Hopping

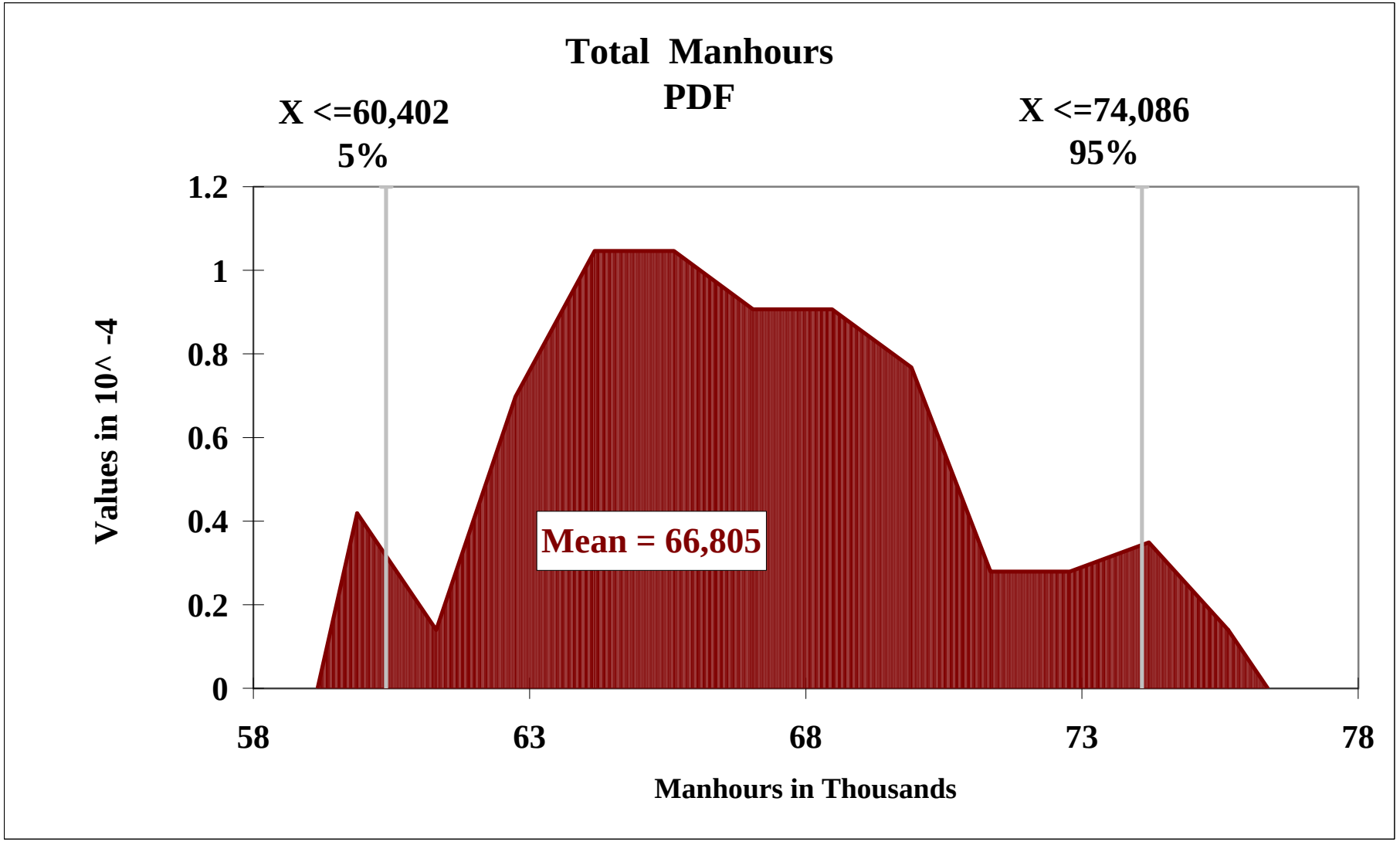


Figure A.1.5-2. Hidalgo Jacket Hopping

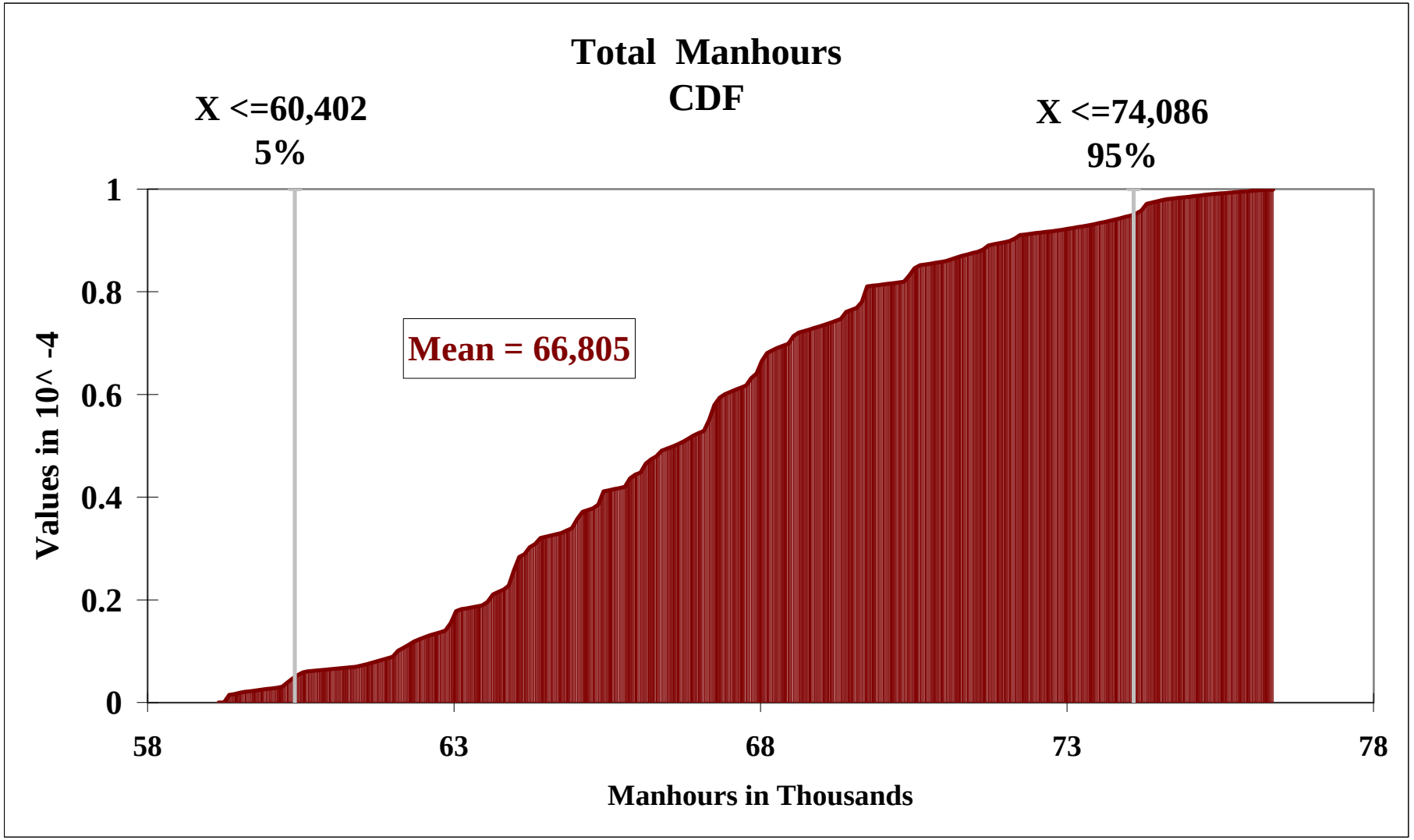


Figure A.1.5-3. Hidalgo Jacket Hopping

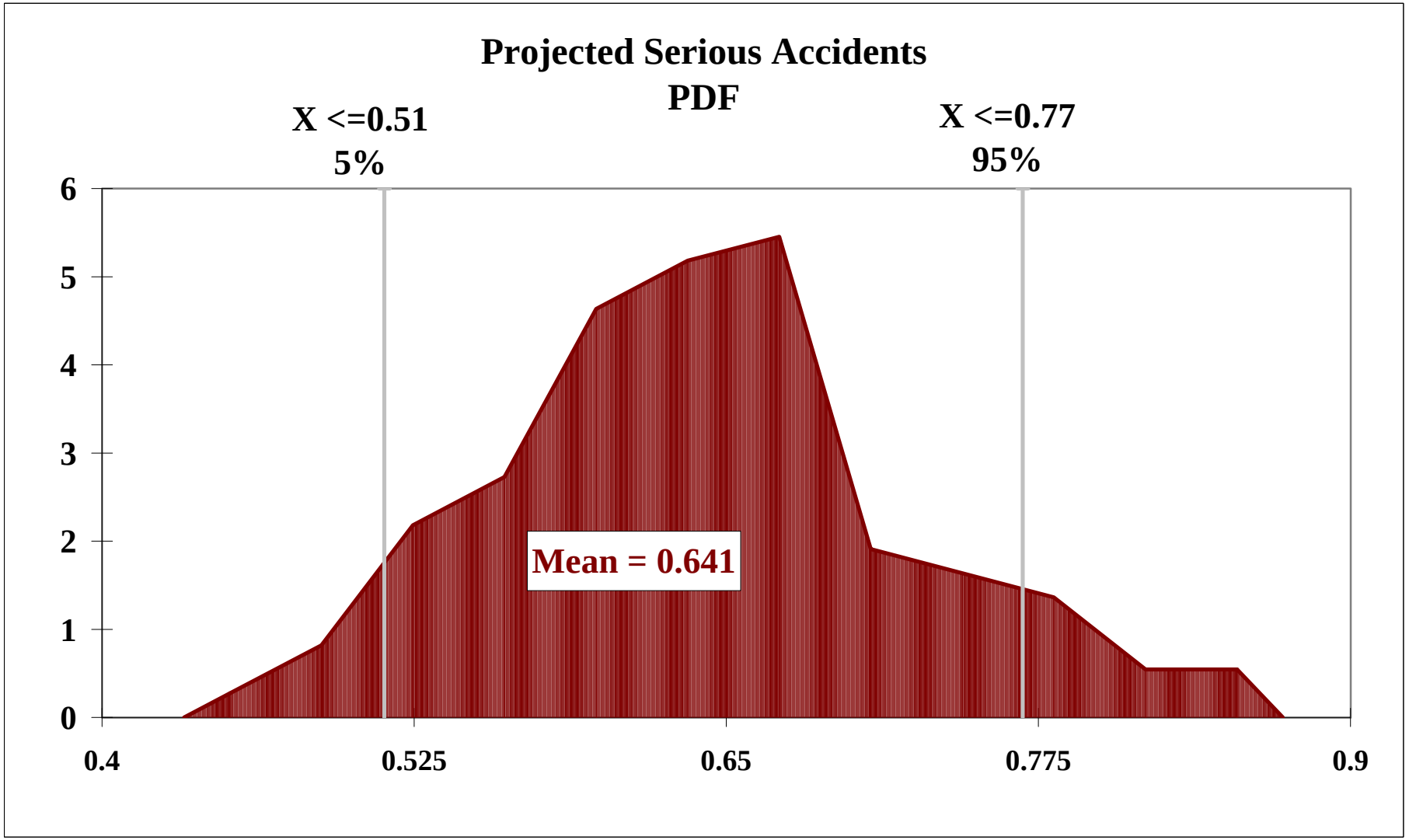


Figure A.1.5-4. Hidalgo Jacket Hopping

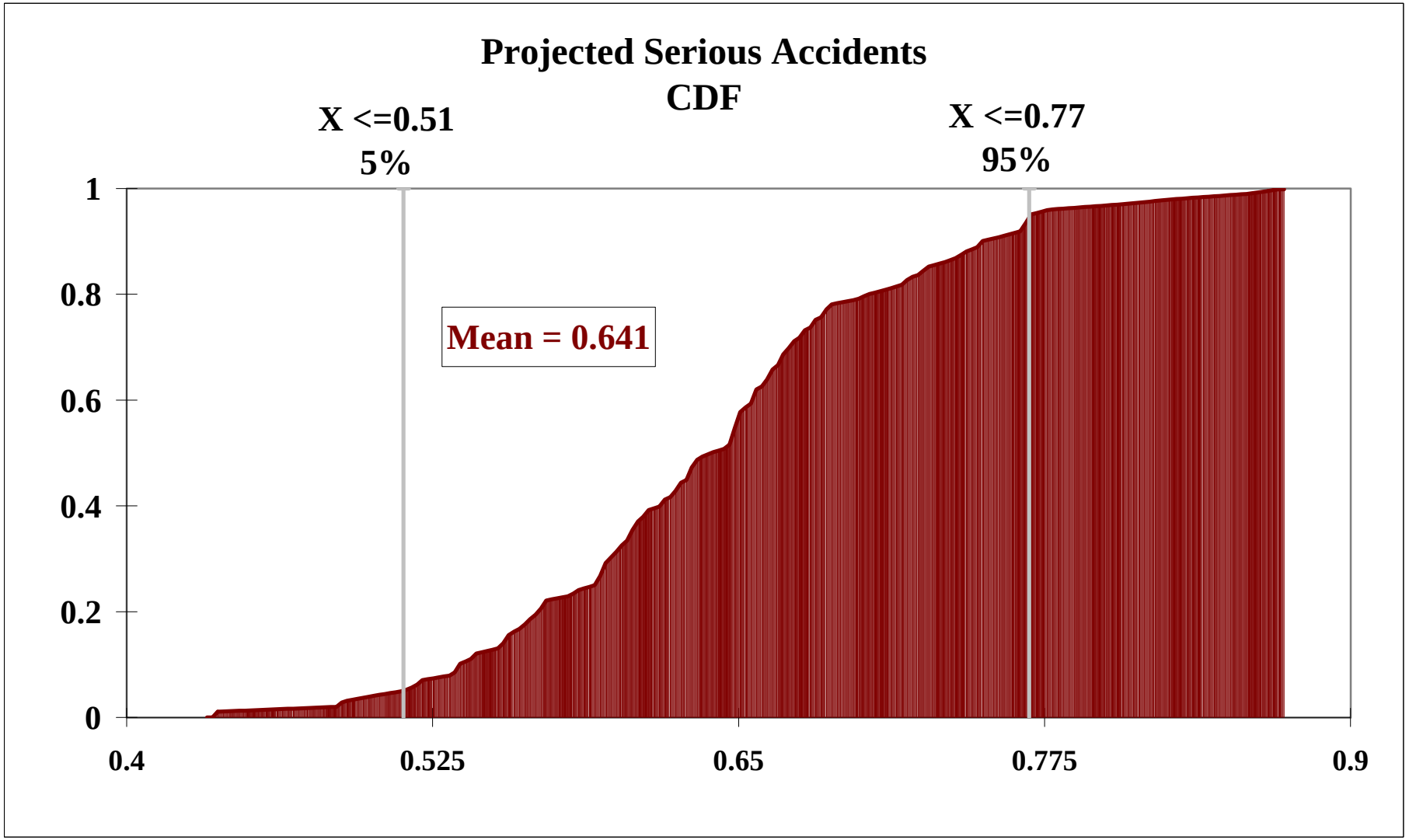


Figure A.1.5-5. Hidalgo Jacket Hopping

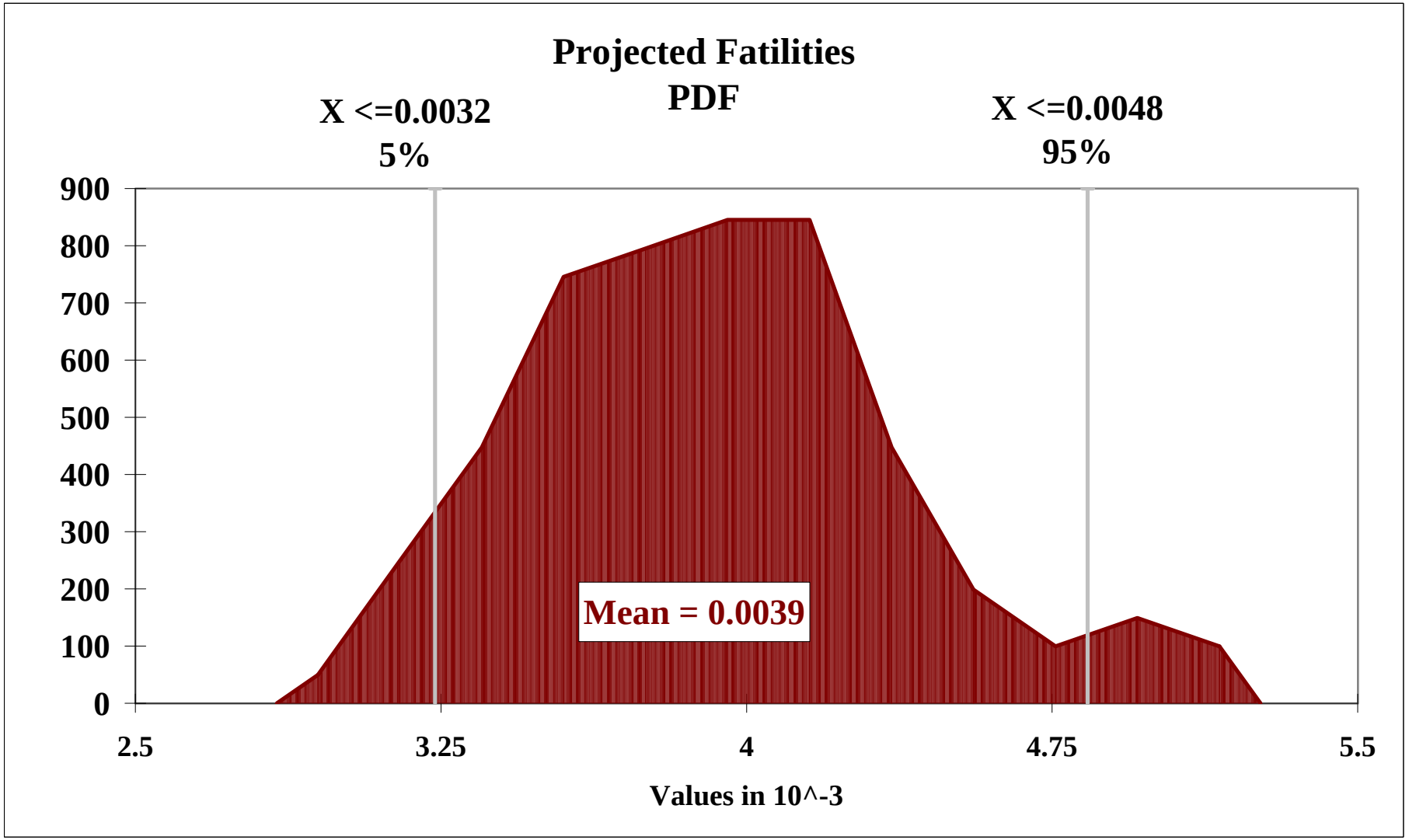
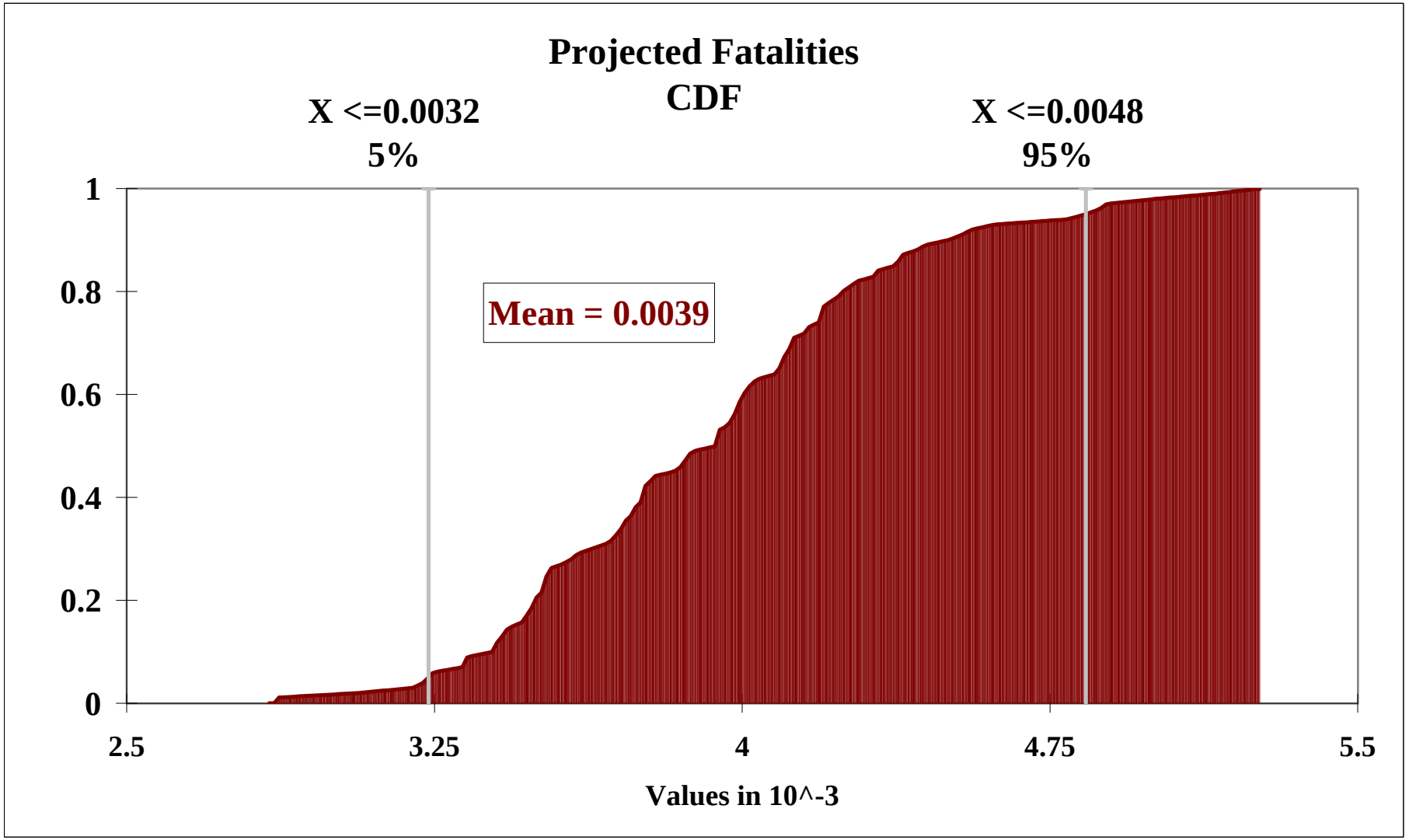


Figure A.1.5-6. Hidalgo Jacket Hopping



A.1.6. EUREKA JACKET HOPPING REMOVAL

U. S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

Eureka Jacket Hopping

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

EUREKA
JACKET HOPPING

Assumptions:

- The work is performed utilizing a large twin crane SSCV with DP capability, such as the "Balder".
- Skirt piles can be capped and deballasted.
- Travel routes to jacket set down locations and set down locations are pre-surveyed and the set down locations are buoyed.
- Mud plugs have been removed from skirt piles to a depth of 20' BML prior to arrival of the SSCV.
- Wells have been plugged and well conductors / casings have been removed to a depth of 15' BML prior to arrival of the SSCV.
- All topside components have been cut loose prior to arrival of the DB.
- Below water cuts are by divers.
- Divers working above 150' water depth are on deep air.
- Divers working below 150' water depth are in saturation.
- Jacket lifting devices are internal lift tools capable of sealing the legs / piles for deballasting.

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EUREKA
JACKET HOPPING

Procedures:

1. After the SSCV is positioned at the Eureka platform the topside equipment and deck are removed and secured on cargo barge(s).

2. Abrasively cut the 24 skirt piles at 15' BML with two (2) abrasive cutting spreads working simultaneously.

3. Cap and deballast the 24 skirt piles and the eight (8) legs.

4. Lift jacket with SSCV cranes, secure for travel and move to (-)567' water depth location and set jacket on bottom.

5. Cut off top of jacket above the (-)120' elevation, lift with SSCV cranes and place on cargo barge and seafasten.

6. Deballast eight (8) legs, lift jacket with SSCV cranes, secure for travel and move to (-)427' water depth location.
7. Cut loose and remove horizontal bracing and conductor guides at the (-)120' and the (-)190' elevations and vertical diagonal braces from just below the (-) 120' elevation to just above the (-)260' elevation between Rows 2 and 3. The braces and conductor guides are removed, placed on a cargo barge and seafastened.

8. Cut loose Row 1 – Row 2 jacket legs and braces above the (-)260' elevation. This jacket section is lifted off by the SSCV cranes, placed on a cargo barge and seafastened.

9. Cut loose Row 3 – Row 4 jacket legs and braces above the (-)260' elevation. This jacket section is lifted off by the SSCV cranes, placed on a cargo barge and seafastened.

10. Deballast eight (8) legs, lift jacket with SSCV cranes, secure for travel and move to (-)287' water depth location.

11. Cut loose horizontal bracing and conductor guides at the (-)260' and (-)330' elevations and vertical diagonal braces from just below the (-)260' elevation to just above the (-)400' elevation between Rows 2 and 3. The braces and conductor guides are removed, placed on a cargo barge and seafastened.

12. Cut loose Row 1 – Row 2 jacket legs and braces above the (-)400' elevation. This jacket section is lifted off by the SSCV cranes, placed on a cargo barge and seafastened.

13. Cut loose Row 3 – Row 4 jacket legs and braces above the (-)400' elevation. This jacket section is lifted off by the SSCV cranes, placed on a cargo barge and seafastened.

14. Deballast eight (8) legs, lift jacket with SSCV cranes, secure for travel and move to (-)147' water depth location.

15. Cut loose horizontal bracing and conductor guides at the (-)400' and (-)470' elevations and vertical diagonal braces from just below the (-)400' elevation to just above the (-)540' elevation between Rows 2 and 3. The braces and conductor guides are removed, placed on a cargo barge and seafastened.

16. Cut loose Row 1 – Row 2 jacket legs and braces above the (-)540' elevation. This jacket section is lifted off by the SSCV cranes, placed on a cargo barge and seafastened.

17. Cut loose Row 3 – Row 4 jacket legs and braces above the (-)540' elevation. This jacket section is lifted off by the SSCV cranes, placed on a cargo barge and seafastened.

18. Cut loose horizontal bracing and conductor guides at the (-)540' elevation and vertical diagonal braces just below the (-)540' elevations between Rows 2 and 3. Divers cut horizontal bracing and conductor guides and vertical diagonal braces at elevations (-)620' and (-)692' between Rows 2 and 3. The braces and conductor guides are removed, placed on a cargo barge and seafastened.

19. The remaining Row 1 – Row 2 jacket section is lifted by the SSCV cranes, placed on a cargo barge and seafastened.

20. The remaining Row 3 – Row 4 jacket section is lifted by the SSCV cranes, placed on a cargo barge and seafastened.

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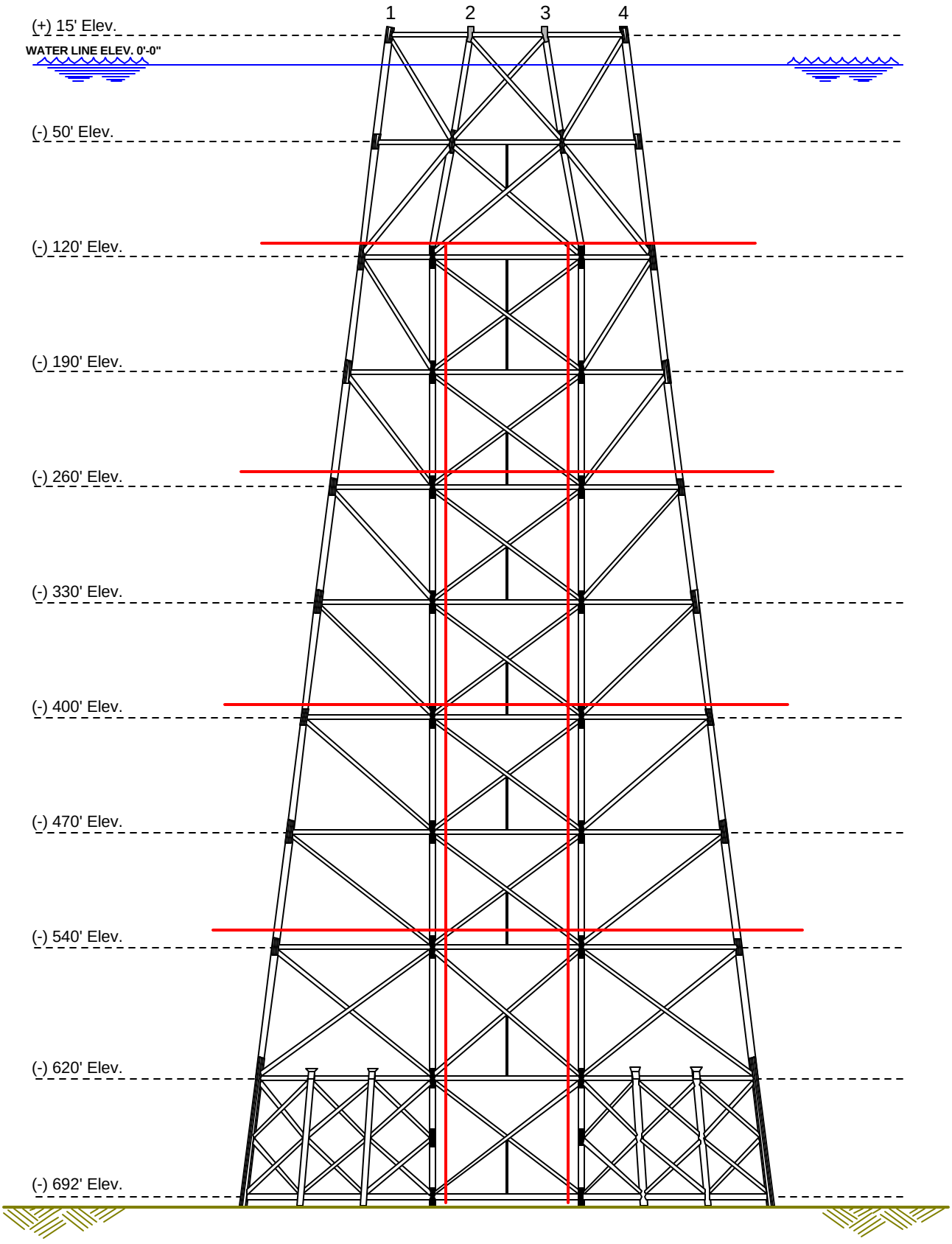

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Platform Task Min. / Max.
Table A.1.6-1. Eureka Jacket Hopping Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Platform Removal Prep	- - - -	- - - -	- - - -
Cleaning/Flushing	120	196	288
Prepare Modules, Cap Truss, and Jacket for Removal	168	252	504
Platform Removal	- - - -	- - - -	- - - -
Platform Inspection			
Set up Heavy Lift Vessel	2	4.00	12
Remove Top Deck Equipment	18	30.00	48
Remove deck (4 pile)	8	12.00	18
Remove deck (4 pile)	8	12.00	18
Remove deck (4 pile)	8	12.00	18
Remove deck (4 pile)	8	12.00	18
Sever 24 Skirt Piles with 2 Abrasive Cutting Spreads Working Simultaneously	96	144.00	240
Install Closures in 8 Legs & 24 Skirt Piles	32	48.00	128
Deballast Legs & Skirt Piles	12	16.00	32
Rig to Jacket (two cranes)	4	6.00	8
Lift Jacket & Secure for Tow	4	6.00	8
Move to 567' Water Depth	2	4.00	8
Set Jacket on Bottom	1	2.00	4
Derig from Jacket Section	2	4.00	8
Scaffold	12	24.00	48
Sever Jacket Horizontally Above (-)120' and Below Leg Transitions	4	6.00	12
Lift #1	- - - -	- - - -	- - - -
Lift top 135' of Jacket, Place Upright on a 540'X140' Cargo Barge (CB #1)	2	4.00	6
Seafasten	12	18.00	30
Derig from Jacket Section	2	4.00	8
Install Lifting Appurtenance/Closures	4	8.00	12
Deballast Legs	2	4.00	8
Lift Jacket & Secure for Tow	4	6.00	12
Move to 427' Water Depth	2	4.00	8
Set Jacket on Bottom	1	2.00	4
Derig from Jacket Section	2	4.00	8
Scaffold (-)260'	12	24.00	48
Sever & Secure Conductor Guides & Braces Between Rows 2&3 (-)120' to (-)260' & Lay on CB #1	8	10.00	24
Rig to 140' Section, Row 1&2	3	4.00	8
Sever Roes 1&2 Legs Above (-)260'	2	2.00	8
Lift #2	- - - -	- - - -	- - - -
Lift & Set Rows 1&2 Jacket Section Upright on CB #1	1	2.00	4
Seafasten	8	12.00	18
Derig from Row 1&2 Jacket Section	2	4.00	8
Rig 140' Jacket Section, Rows 3&4	3	4.00	8

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Platform Task Min. / Max.
Table A.1.6-1. Eureka Jacket Hopping Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Sever Rows 3&4 Above (-)260'	2	2.00	8
Lift #3	- - - -	- - - -	- - - -
Lift & Set Rows 3&4 Jacket Section Upright on CB #1	1	2.00	4
Seafasten	8	12.00	18
Derig From Row 3&4 Jacket Section	2	4.00	8
Install Lifting Appurtenance/Closures	2	4.00	8
Deballast Legs	2	3.00	8
Lift Jacket & Secure for Tow	4	6.00	8
Move to 287' Water Depth	2	4.00	8
Set Jacket on Bottom	1	2.00	4
Derig from Jacket Section	2	4.00	8
Scaffold (-)400'	12	24.00	48
Sever & Secure Conductor Guides & Braces Between Rows 2&3 (-)260' to (-)400' & Lay on CB #2 (400X100)	8	11.00	24
Rig to 140' Section, Row 1&2	3	4.00	8
Sever Rows 1&2 Jacket Section Above (-)400'	2	2.00	8
Lift #4	- - - -	- - - -	- - - -
Lift & Set Rows 1&2 Jacket Section Upright on CB #2	1	2.00	4
Seafasten	8	12.00	18
Derig From Rows 1&2 Jacket Section	2	4.00	8
Rig to 140' Section, Row 3&4	3	4.00	8
Sever Rows 3&4 Legs Above (-)400'	2	2.00	8
Lift #5	- - - -	- - - -	- - - -
Lift & Set Rows 3&4 Jacket Section Upright on CB #3 (300X100)	1	2.00	4
Seafasten	8	12.00	18
Derig From Rows 3&4 Jacket Section	2	4.00	8
Install Lifting Appurtenance/Closures	2	4.00	8
Deballast Legs	1	2.00	5
Lift Jacket & Secure for Tow	4	6.00	8
Move to 147' Water Depth	2	4.00	8
Set Jacket on Bottom	1	2.00	4
Derig from Jacket Section	2	4.00	8
Scaffold (-)540'	18	30.00	60
Sever & Remove Conductor Guides & Braces Between Rows 2&3 From (-)400' to (-)540' and Lay on CB #4 (400X100)	9	12.00	24
Rig to 140' Section Rows 1&2	4	4.00	8
Sever Rows 1&2 Jacket Section Above (-)540'	2	2.00	8
Lift #6	- - - -	- - - -	- - - -
Lift & Set Rows 1&2 Jacket Section Upright on CB #4	1	2.00	4
Seafasten	8	12.00	18
Derig From Rows1&2 Jacket Section	2	4.00	8

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
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Platform Task Min. / Max.
Table A.1.6-1. Eureka Jacket Hopping Removal

Task	Minimum Hours (P5)	Most Probable Hours	Maximum Hours (P95)
Rig to 140' Section Rows 3&4	2	4.00	8
Sever Rows 3&4 Legs Above (-)540'	2	2.00	8
Lift #7	- - - -	- - - -	- - - -
Lift & Set Rows 3&4 Jacket Section Upright on CB #5 (300X100)	1	2.00	4
Seafasten	8	12.00	18
Derig From Rows 3&4 Jacket Section	2	4.00	8
Sever & Remove Conductor Guides & Braces at (-)540' and Lay on CB #6 (400X110/120)	4	6.00	10
Sever & Remove Conductor Guides & Braces Below (-)540' to Bottom El. and Lay on CB #6	192	295.00	384
Rig 160' Section Jacket Section Rows 1&2	2	4.00	8
Lift #8	- - - -	- - - -	- - - -
Lift Rows 1&2 Jacket Section and Set Upright on CB #6	2	3.00	8
Seafasten	12	18.00	24
Derig From Rows 1&2 Jacket Section	2	4.00	8
Lift #9	- - - -	- - - -	- - - -
Rig to 160' Section Rows 3&4	2	4.00	8
Lift Rows 3&4 Jacket Section and Set Upright on CB #7 (400X110/120)	2	3.00	8
Seafasten	12	18.00	24
Derig from Jacket Section	2	4.00	8
Total Task Hours (Derrick Barge & Inspection)	**960.00**	**1,503.00**	**2,595.00**
	36% Reduction		**73% Increase**

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.6-2. Eureka Jacket Hopping Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving	Sat. Diving	Average Labor Manhours
Platform Removal Prep	- - - -	- - - -	- - - -						
Cleaning/Flushing	120	201	288	1,611	805				2,416
Prepare Modules, Cap Truss, and Jacket for Removal	168	308	504	1,540	1,232				2,772
Platform Removal	- - - -	- - - -	- - - -						
Platform Inspection									
Set up Heavy Lift Vessel	2	6	12	288		210			498
Remove Top Deck Equipment	18	32	48	1,536		1,120			2,656
Remove deck (4 pile)	8	13	18	608		443			1,051
Remove deck (4 pile)	8	13	18	608		443			1,051
Remove deck (4 pile)	8	13	18	608		443			1,051
Remove deck (4 pile)	8	13	18	608		443			1,051
Sever 24 Skirt Piles with 2 Abrasive Cutting Spreads Working Simultaneously	96	160	240	7,680		5,600			13,280
Install Closures in 8 Legs & 24 Skirt Piles	32	69	128	3,328		2,427			5,755
Deballast Legs & Skirt Piles	12	20	32	960		700			1,660
Rig to Jacket (two cranes)	4	6	8	288		210			498
Lift Jacket & Secure for Tow	4	6	8	288		210			498
Move to 567' Water Depth	2	5	8	224		163			387
Set Jacket on Bottom	1	2	4	112		82			194
Derig from Jacket Section	2	5	8	224		163			387
Scaffold	12	28	48	1,344		980			2,324
Sever Jacket Horizontally Above (-)120' and Below Leg Transitions	4	7	12	352		257			609
Lift #1	- - - -	- - - -	- - - -	- - - -		- - - -			
Lift top 135' of Jacket, Place Upright on a 540'X140' Cargo Barge (CB #1)	2	4	6	192		140			332
Seafasten	12	20	30	960		700			1,660
Derig from Jacket Section	2	5	8	224		163			387
Install Lifting Appurtenance/Closures	4	8	12	384		280			664
Deballast Legs	2	5	8	224		163			387
Lift Jacket & Secure for Tow	4	7	12	352		257			609
Move to 427' Water Depth	2	5	8	224		163			387
Set Jacket on Bottom	1	2	4	112		82			194
Derig from Jacket Section	2	5	8	224		163			387
Scaffold (-)260'	12	28	48	1,344		980			2,324
Sever & Secure Conductor Guides & Braces Between Rows 2&3 (-)120' to (-)260' & Lay on CB #1	8	14	24	672		490			1,162
Rig to 140' Section, Row 1&2	3	5	8	240		175			415

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.6-2. Eureka Jacket Hopping Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving	Sat. Diving	Average Labor Manhours
Sever Roes 1&2 Legs Above (-)260'	2	4	8	192		140			332
Lift #2	----	----	----	----		----			
Lift & Set Rows 1&2 Jacket Section Upright on CB #1	1	2	4	112		82			194
Seafasten	8	13	18	608		443			1,051
Derig from Row 1&2 Jacket Section	2	5	8	224		163			387
Rig 140' Jacket Section, Rows 3&4	3	5	8	240		175			415
Sever Rows 3&4 Above (-)260'	2	4	8	192		140			332
Lift #3	----	----	----	----		----			
Lift & Set Rows 3&4 Jacket Section Upright on CB #1	1	2	4	112		82			194
Seafasten	8	13	18	608		443			1,051
Derig From Row 3&4 Jacket Section	2	5	8	224		163			387
Install Lifting Appurtenance/Closures	2	5	8	224		163			387
Deballast Legs	2	4	8	208		152			360
Lift Jacket & Secure for Tow	4	6	8	288		210			498
Move to 287' Water Depth	2	5	8	224		163			387
Set Jacket on Bottom	1	2	4	112		82			194
Derig from Jacket Section	2	5	8	224		163			387
Scaffold (-)400'	12	28	48	1,344		980			2,324
Sever & Secure Conductor Guides & Braces Between Rows 2&3 (-)260' to (-)400' & Lay on CB #2 (400X100)	8	14	24	688		502			1,190
Rig to 140' Section, Row 1&2	3	5	8	240		175			415
Sever Rows 1&2 Jacket Section Above (-)400'	2	4	8	192		140			332
Lift #4	----	----	----	----		----			
Lift & Set Rows 1&2 Jacket Section Upright on CB #2	1	2	4	112		82			194
Seafasten	8	13	18	608		443			1,051
Derig From Rows 1&2 Jacket Section	2	5	8	224		163			387
Rig to 140' Section, Row 3&4	3	5	8	240		175			415
Sever Rows 3&4 Legs Above (-)400'	2	4	8	192		140			332
Lift #5	----	----	----	----		----			
Lift & Set Rows 3&4 Jacket Section Upright on CB #3 (300X100)	1	2	4	112		82			194
Seafasten	8	13	18	608		443			1,051
Derig From Rows 3&4 Jacket Section	2	5	8	224		163			387
Install Lifting Appurtenance/Closures	2	5	8	224		163			387
Deballast Legs	1	3	5	128		93			221
Lift Jacket & Secure for Tow	4	6	8	288		210			498

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021
Task & Resource Hours
Table A.1.6-2. Eureka Jacket Hopping Removal

	AVERAGE TASK HOURS			AVERAGE LABOR HOURS					TOTAL
Task	Minimum Hours (P5)	Average Hours	Maximum Hours (P95)	On Deck High Risk	On Deck Support	Marine & Other Support	Air Diving	Sat. Diving	Average Labor Manhours
Move to 147' Water Depth	2	5	8	224		163			387
Set Jacket on Bottom	1	2	4	112		82			194
Derig from Jacket Section	2	5	8	224		163			387
Scaffold (-)540'	18	36	60	1,728		1,260			2,988
Sever & Remove Conductor Guides & Braces Between Rows 2&3 From (-)400' to (-)540' and Lay on CB #4 (400X100)	9	15	24	720		525			1,245
Rig to 140' Section Rows 1&2	4	5	8	256		187			443
Sever Rows 1&2 Jacket Section Above (-)540'	2	4	8	192		140			332
Lift #6	----	----	----	----		----			
Lift & Set Rows 1&2 Jacket Section Upright on CB #4	1	2	4	112		82			194
Seafasten	8	13	18	608		443			1,051
Derig From Rows1&2 Jacket Section	2	5	8	224		163			387
Rig to 140' Section Rows 3&4	2	5	8	224		163			387
Sever Rows 3&4 Legs Above (-)540'	2	4	8	192		140			332
Lift #7	----	----	----	----		----			
Lift & Set Rows 3&4 Jacket Section Upright on CB #5 (300X100)	1	2	4	112		82			194
Seafasten	8	13	18	608		443			1,051
Derig From Rows 3&4 Jacket Section	2	5	8	224		163			387
Sever & Remove Conductor Guides & Braces at (-)540' and Lay on CB #6 (40	4	7	10	320		233			553
Sever & Remove Conductor Guides & Braces Below (-)540' to Bottom El. and	192	290	384	13,936	2,903	10,162	290		27,291
Rig 160' Section Jacket Section Rows 1&2	2	5	8	224		163			387
Lift #8	----	----	----	----		----			
Lift Rows 1&2 Jacket Section and Set Upright on CB #6	2	4	8	208		152			360
Seafasten	12	18	24	864		630			1,494
Derig From Rows 1&2 Jacket Section	2	5	8	224		163			387
Lift #9	----	----	----	----		----			
Rig to 160' Section Rows 3&4	2	5	8	224		163			387
Lift Rows 3&4 Jacket Section and Set Upright on CB #7 (400X110/120)	2	4	8	208		152			360
Seafasten	12	18	24	864		630			1,494
Derig from Jacket Section	2	5	8	224		163			387
Total Task Hours (Derrick Barge & Inspection)	**960**	**1,686**	**2,595**	**59,631**	**4,941**	**41,183**	**290**	**0**	**106,045**
	36% Decrease		**73% Increase**						

U.S. Minerals Management Service
Risk Assessment Platform Decommissioning Phase 2
TSB Project No. 23021

Projected Serious Accidents
Eureka Jacket Hopping Removal

Risk Category*	Average Value Man-hours	Projected Value Serious Accidents
On Deck, High Risk	59,631	0.1988
On Deck, Support	4,941	0.0165
Marine & Other Support	41,183	0.1373
Diving, Air	290	0.5807
Diving, Saturation	0	0.0000
Totals	106,045	0.9332

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

U.S. Minerals Management Service
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Projected Fatalities
Eureka Jacket Hopping Removal

Risk Category*	Average Value Man-hours	Projected Value Fatalities
On Deck, High Risk	59,631	0.0024
On Deck, Support	4,941	0.0002
Marine & Other Support	41,183	0.0016
Diving, Air	290	0.0017
Diving, Saturation	0	0.0000
Totals	106,045	0.0060

* Risk Category	Personnel
On Deck High Risk	Riggers, Welders, Clean Tech. Riggers, X-Ray Hand
On Deck Support	Dive Support, Project Mgmt., Foremen, Crane Operator
Marine & Other Support	Marine and Other Support
Air Diving	Air Divers
Saturation Diving	Saturation Divers

Figure A.1.6-1. Eureka Jacket Hopping

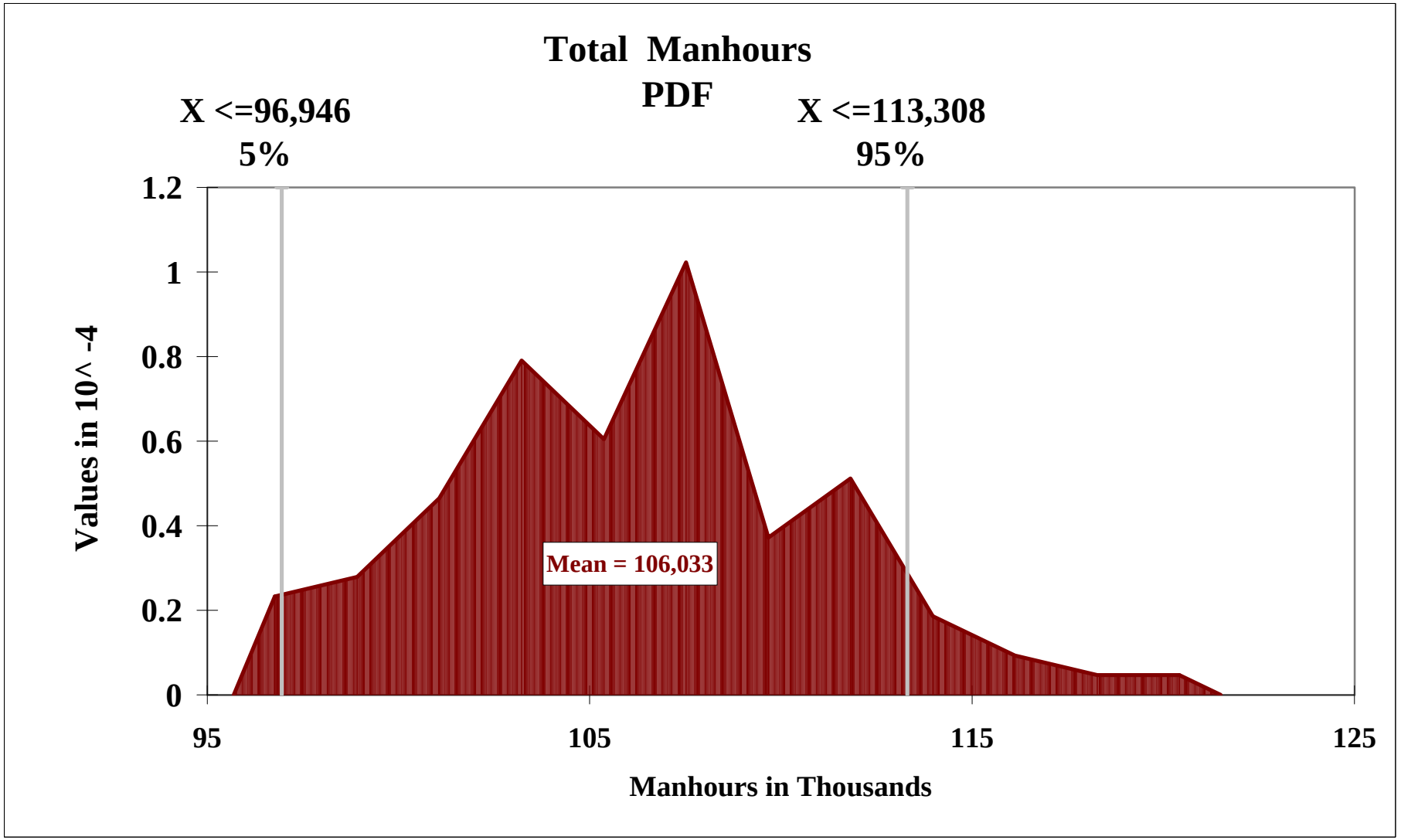
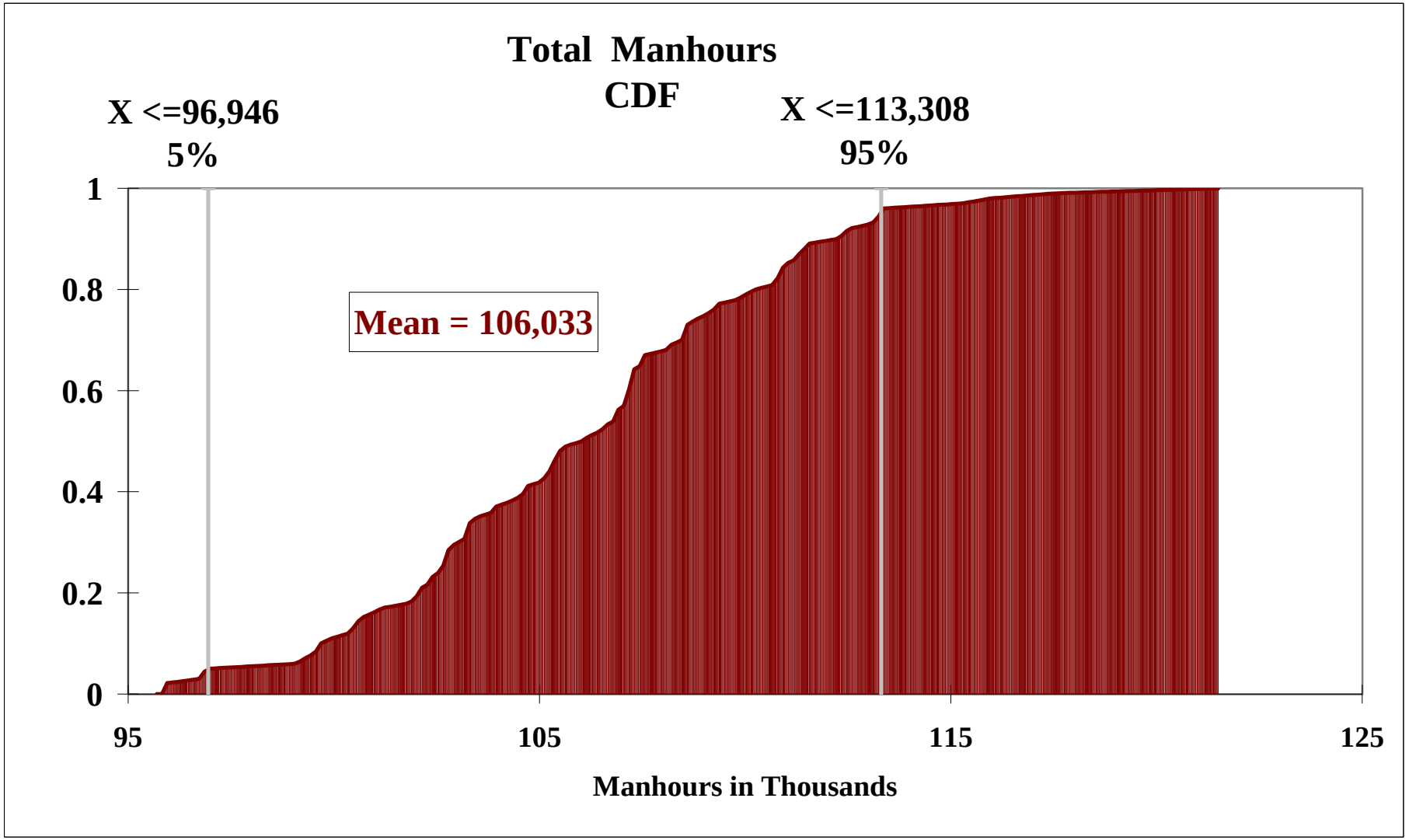


Figure A.1.6-2. Eureka Jacket Hopping



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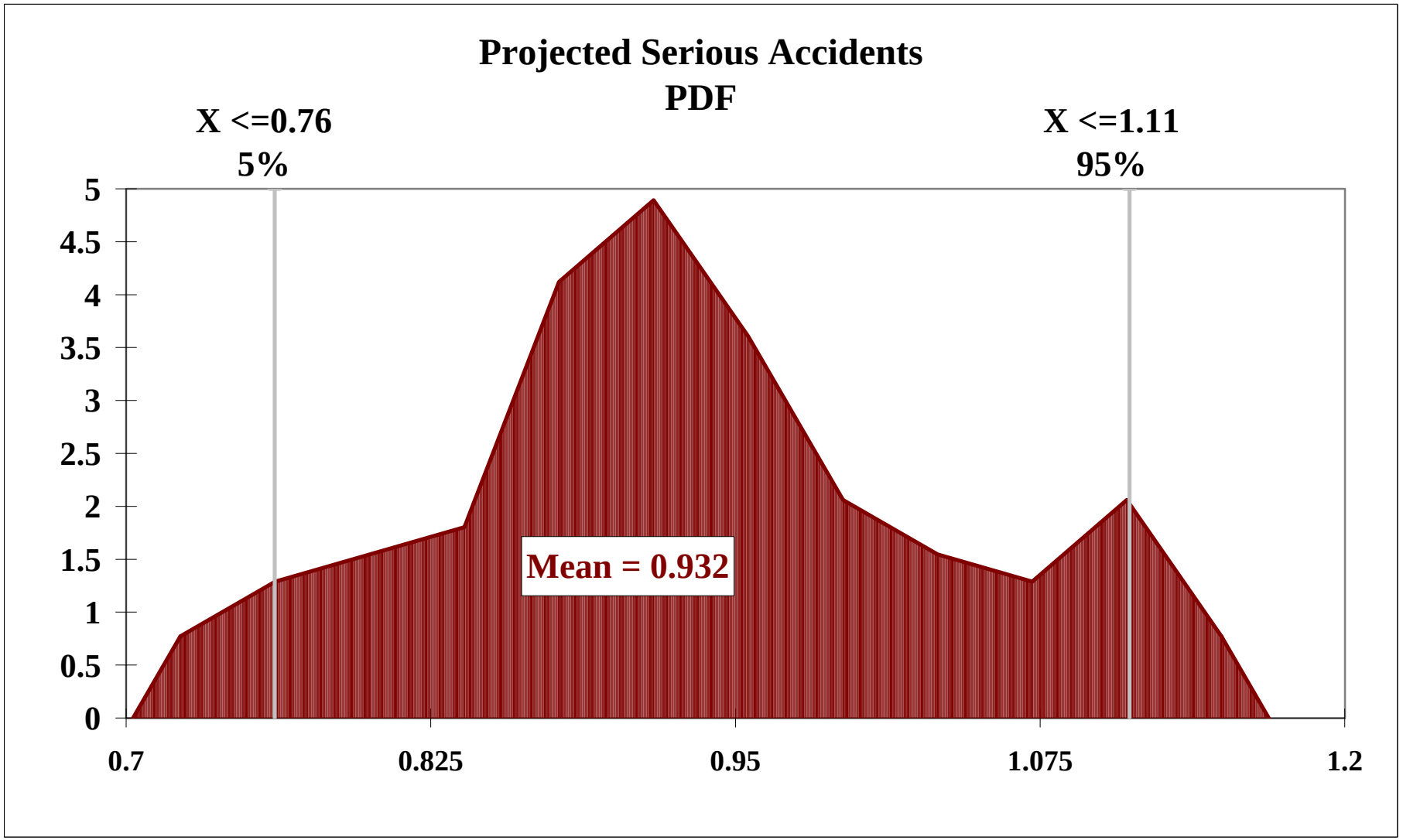


Figure A.1.6-4. Eureka Jacket Hopping

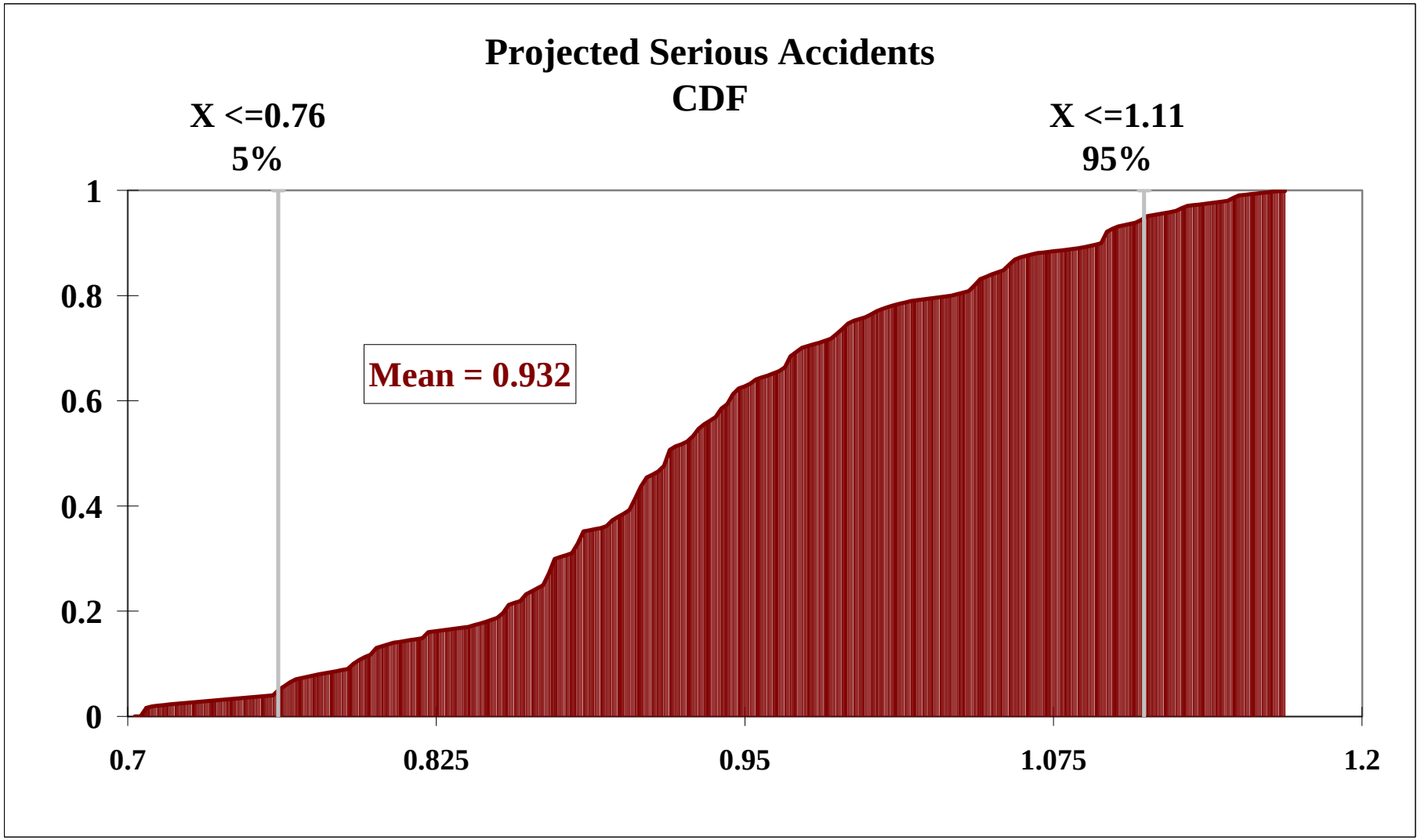


Figure A.1.6-5. Eureka Jacket Hopping

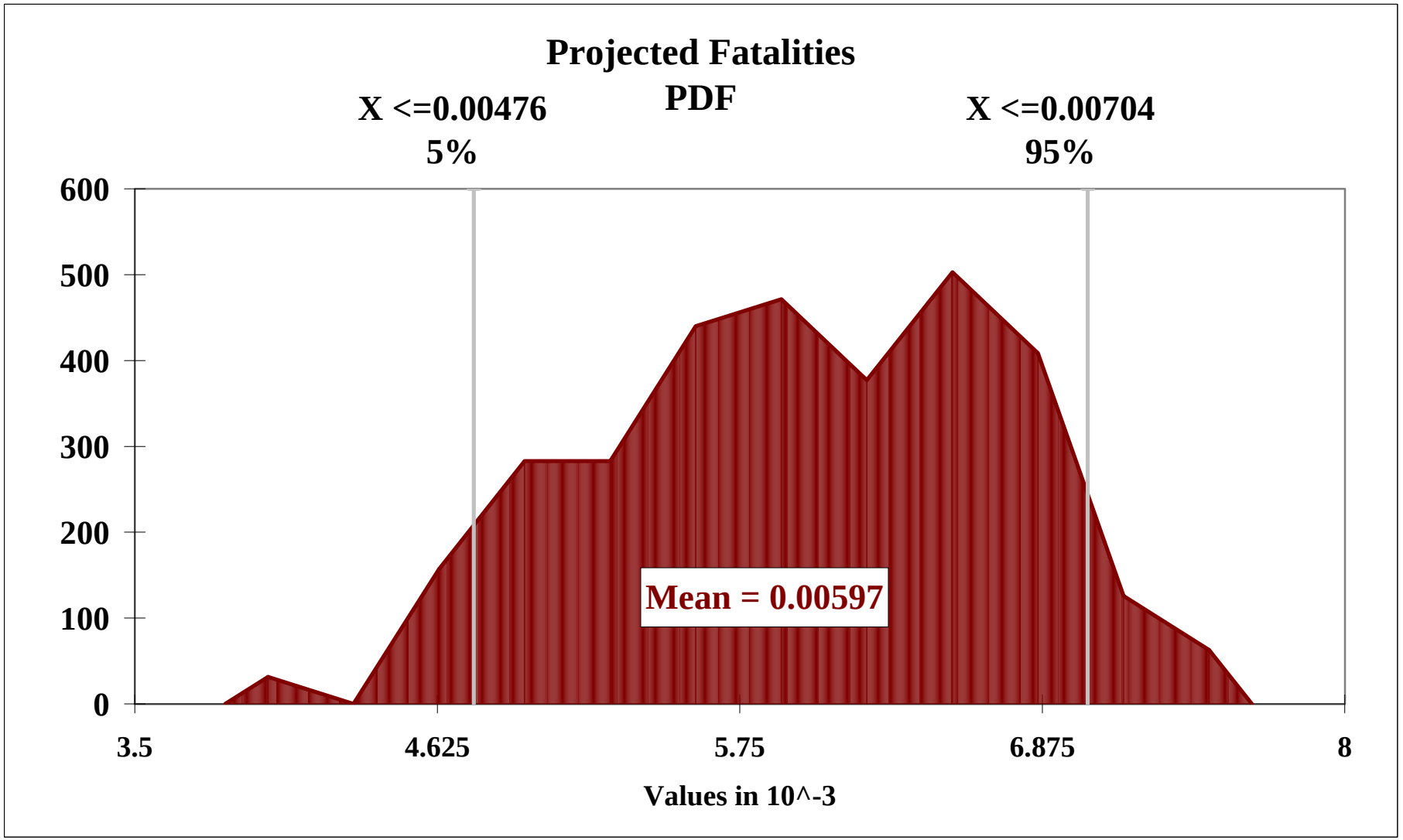
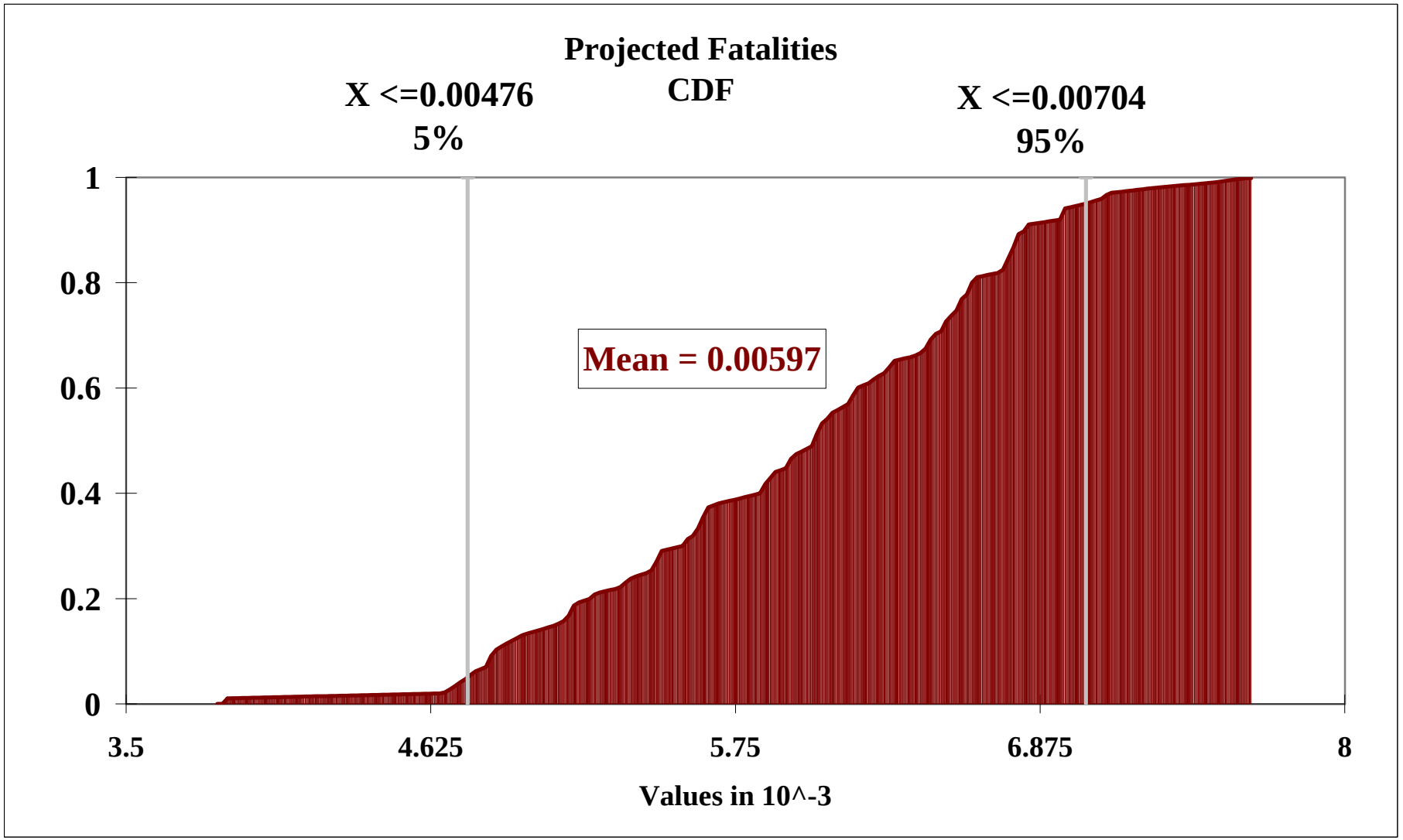


Figure A.1.6-6. Eureka Jacket Hopping



APPENDIX B. Summary of Industry Accident Statistics

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B.1 Introduction

The objective of the work documented in this Appendix is to develop probabilistic characterizations of human serious injuries and fatalities per hour of exposure to specified work activities that could be used in a study of decommissioning options for three platforms in the Pacific OCS region.

B.2 Background

Serious injuries are defined as those that required more than three days absence from work. The Serious Injury Rate (SIR) is defined as the number of serious injuries per 10E6 hours of exposure to a particular type of work. Both onshore and offshore heavy construction work SIR were used as a reference in this study. When possible, oil and gas industry construction work, onshore and offshore SIR also were referenced.

The Fatal Accident Rate (FAR) is defined as the number of fatalities per 10E8 hours of exposure to a particular type of work. Both onshore and offshore heavy construction work FAR were used as a reference in this study. When possible, oil and gas industry construction work, onshore and offshore FAR were referenced.

The probabilistic characterizations were based on a triangular distribution that could be defined with three parameters: 1) a lower bound value (LB), 2) a most probable value (MP), and 3) an upper bound value.

These probabilistic characterizations were based on worker exposure per hour of work in three offshore working conditions: 1) deconstruction above water, 2) deconstruction below water – air diving, and 3) deconstruction below water – saturation diving.

Assessment of the potential human serious injuries and fatalities associated with each of the options considered for each of the three platforms would be based on the product of the probabilistic characterizations of worker exposure per hour of work in a specific work category and the probabilistic characterizations (also triangular) of hours of specified work required for the three categories of offshore working conditions.

B.3 Information Sources

The following information sources were used in this work:

Australian Petroleum Production & Exploration Association (APPEA), Safety and Health Performance Report 1998; http://www.appea.com.au/safety_section/pdfs/1998_Safety_Health.pdf

Bea, RG (2002), Human and Organizational Factors: Risk Assessment & Management of Engineered Systems, CE / OE 290A, Vick Copy Publishers, 1879 Euclid, Av., Berkeley, California, www.vickcopy.com.

Department of Energy, Development of the Oil and Gas Resources of the United Kingdom, HMSO, London, 1990.

Det Norske Veritas Technica, Update of the UKCS Risk Overview, Heath and Safety Executive Offshore Technology Report OTH 94 458, HMSO, 1995.

Exploration and Production (E&P) Forum, Accident Data, 1992, Report 6.33/200, E&P Forum, London.

E&P Forum, Quantitative Risk Assessment Datasheet Directory, Report 11.8/250, E&P Forum, London.

Gibson, SB, "Risk Criteria in Hazard Analysis," Chemical Engineering Progress, V9ol. 72, No. 2, 1990.

Health and Safety Executive (HSE), Accident Statistics for Fixed Offshore Units on the UK Continental Shelf 1991-1999.

Health and Safety Executive, Employer Incident Analysis 1991 – 1998, Offshore Technology Report – OTO 2000 002.

Health and Safety Executive, Offshore Injury, Ill Health and Incident Statistics Report 1999 / 2000, Offshore Technology Report OTO 2000 111, http://www.hse.gov.uk/research/otopdf/2000/oto00111.pdf

Health and Safety Executive, Statistics of Fatal Injuries to Workers 2001/02.

International Association of Drilling Contractors (IADC); http://www.iadc.org/dcpi/dc-julyaug01/ja-safety.pdf, http://www.iadc.org/dcpi/dc-septoct00/s-safety.pdf

Mayes, M., "Review of OGP/IADC Incident Reports," Report to U.S. Minerals Management Service, Herndon, VA, September 2002.

Minerals Management Service (MMS), Accidents Associated with Oil and Gas Operations, Outer Continental Shelf, 1956-1990, OCS Report MMS 92-0058, Herndon, VA, 1992.

Norwegian Petroleum Directorate, Annual Report, Stavanger, Norway, 1996.

Occupational Safety and Health Administration (OSHA); Bureau of Labor Statistics (BLS), http://www.osha.gov/oshstats/work.html

International Association of Oil & Gas Producers, Safety Performance of the Global E&P Industry-2001 data; http://www.ogp.org.uk/pubs/330.pdf

These information and data sources provided substantial data to evaluate deconstruction SIR and FAR for above water operations. There was little data available to evaluate deconstruction SIR and FAR for below water operations associated with oil and gas field activities. The data on oil and gas field activity diving operations that was available came from U.K. and Norwegian sources. No data that would permit determination of SIR and FAR appropriate for U.S. oil and gas field operations could be located.

B.4 Serious Injury Rates Data

Onshore SIRs are summarized in Figure B.1 for the information sources accessed during this study. For the period 1998 – 2000, the OSHA statistics for heavy construction work in the U.S. indicates the highest SIR ˜ 25. The IADC statistics for heavy construction type work indicates SIR ˜ 10. The Global E&P statistics indicates SIR ˜ 2.

It is apparent that SIR statistics for general industry heavy construction work should not be used to infer SIR probabilistics for oil and gas related heavy construction type work. The SIR for oil and gas related construction work are much lower than for general onshore construction work.

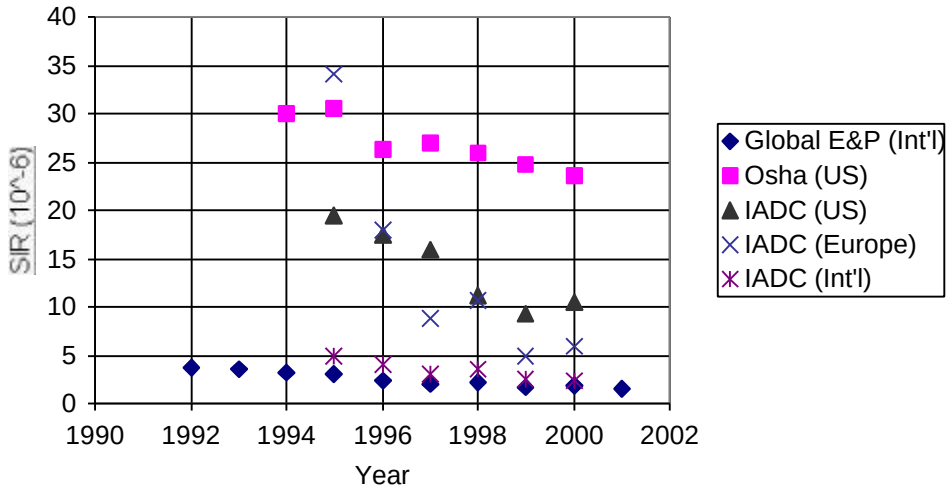

Figure B.1 – Onshore serious injury rates for the period 1992 - 2001

Offshore SIRs are summarized in Figure B.2 for the information sources accessed during this study. For the period 1998 – 2000, the IADC statistics for heavy construction type work in the U.S. and U.K. indicates SIR ˜ 2.5 and 4.5, respectively. The Global E&P statistics indicates SIR ˜ 3.

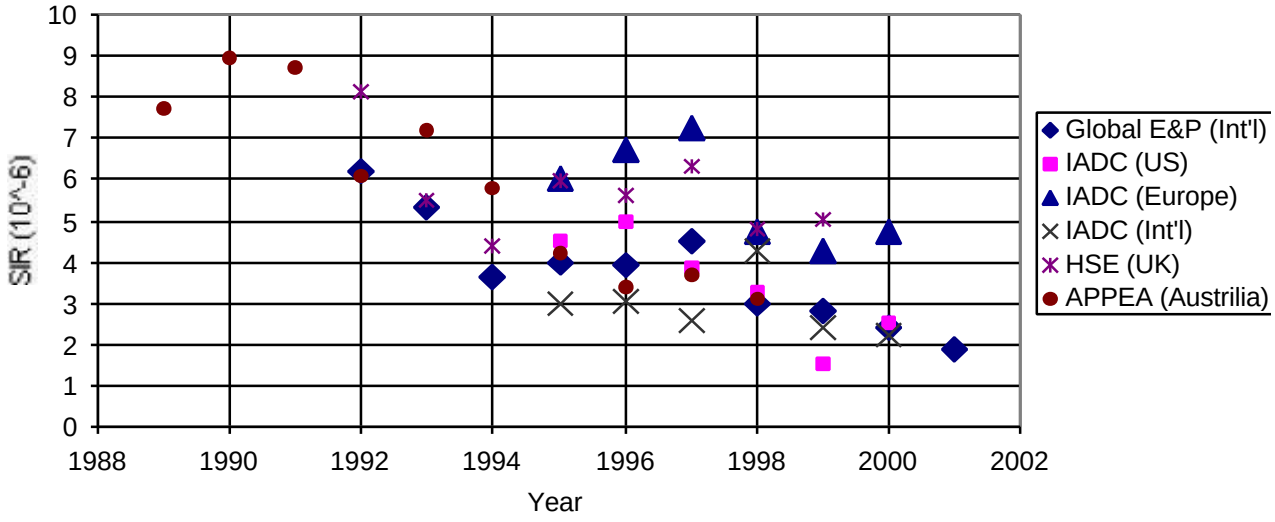

Figure B.2 – Offshore serious injury rates (SIR) for the period 1989 - 2001

No data could be located during this study that could be used to directly determine underwater air / gas and saturation diving SIR that would be appropriate for oil field operations.

B.5 Fatal Accident Rate Data

Figure B.3 summarizes FAR for general activities in the UK during the 1980s. Manufacturing FAR are in the range of 4 to 8 (chemical, steel). Higher risk commercial activities such as construction, rail work, mining, and fishing have FAR in the range of 40 to 80. Very high risk commercial activities such as air travel, boxing, and horse racing have FAR in the range of 250 to 50,000.

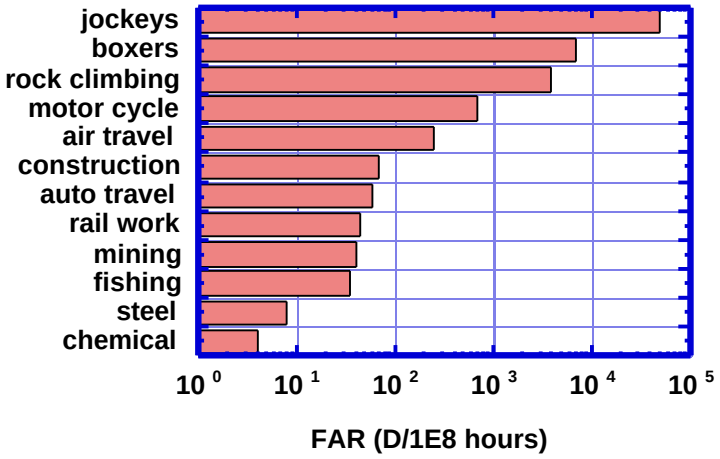

Figure B.3 – General activity FAR in the UK during the 1980s

Figure B.4 summarizes FAR statistics for the period 1992 – 2001 for onshore U.S. heavy construction and global exploration and production type operations. For the period 1997 – 2000,

the OSHA data indicate an average FAR of about 9 compared with an about equal global E&P average FAR of about 9. The range in the global E&P FAR is 5 to almost 15.

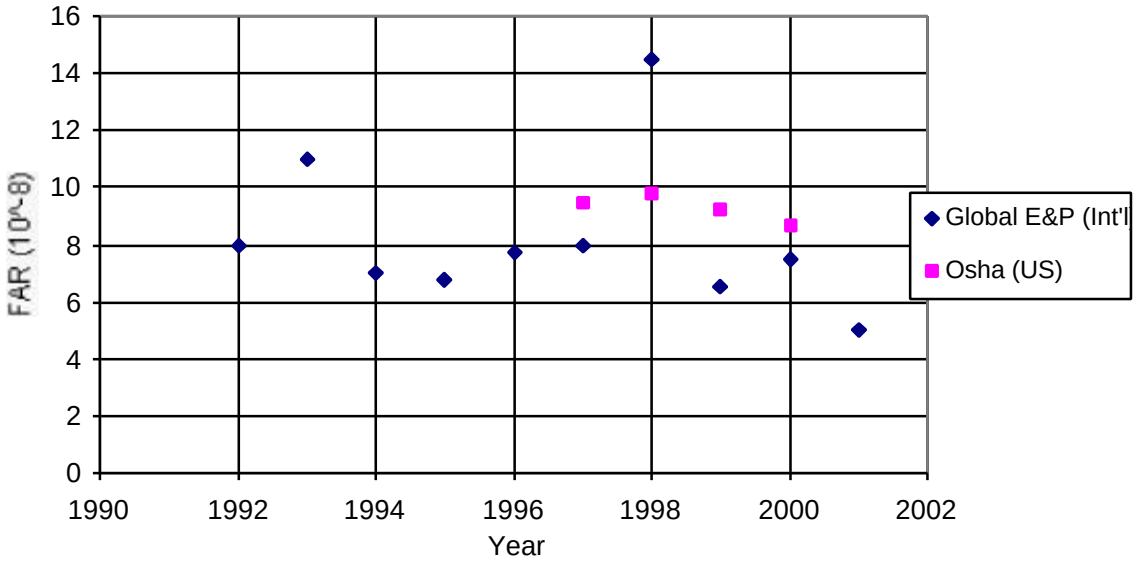

Figure B.4 – U.S. onshore heavy construction and global E&P FAR 1992 – 2001

Figure B.5 summarizes the available information on FARs for offshore oil and gas activities based on global E&P operations, those in the UK sector of the North Sea, and offshore Australia. For the period 1998 – 2000, the average FAR is about 6 with a range of 2 to 10. This information indicates that the general offshore E&P operations and construction operations have FAR that are somewhat less than those for comparable onshore operations.

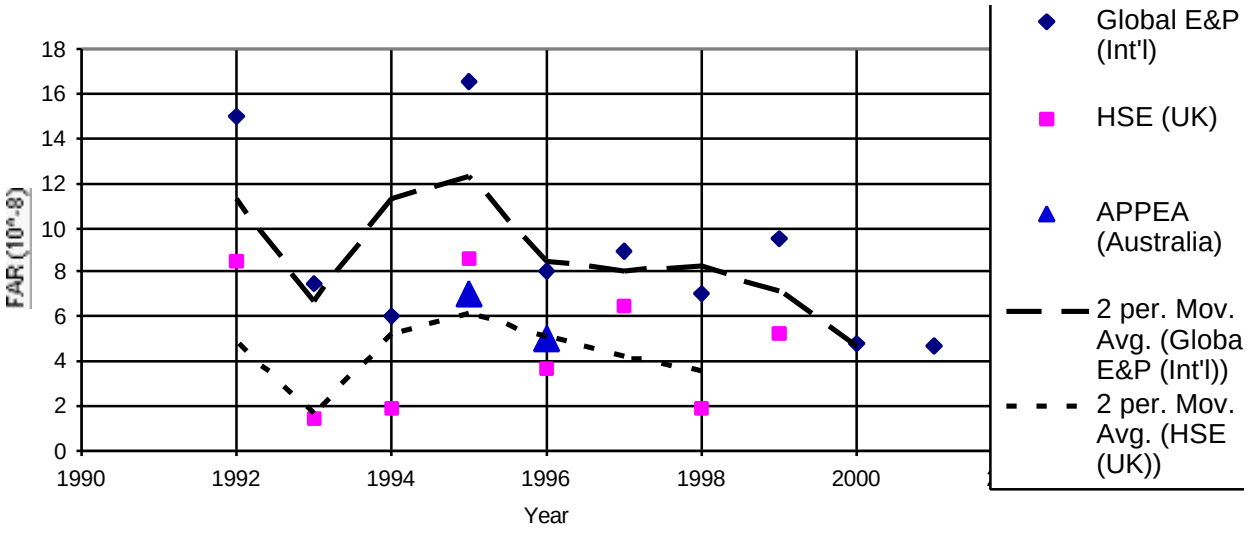

Figure B.5 – Offshore construction and oil and gas activities FAR 1992 – 2001

Figure B.6 summarizes the average, high, and low FAR for global E&P offshore operations for the period 1988 – 1992. The U.S. has an average FAR that is somewhat less than that for the

North Sea (5 versus 6) with a range of 4 to 8. The average FAR and range of FAR are substantially greater for other parts of the offshore world.

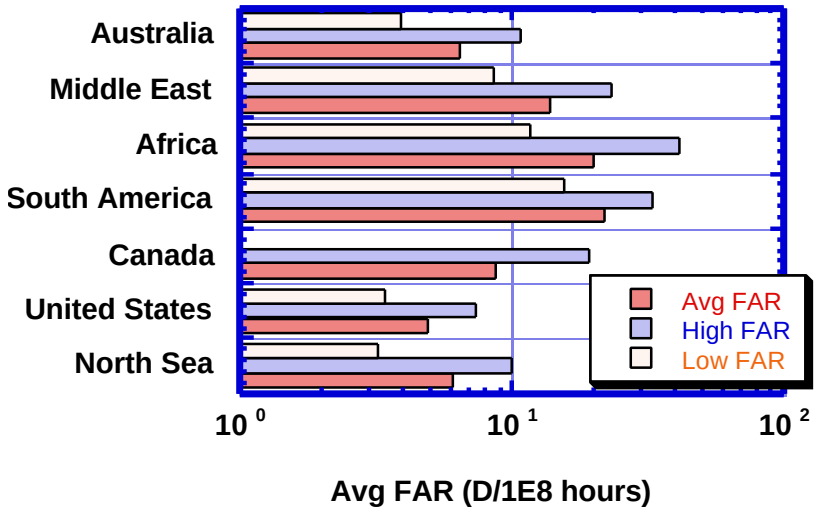

Figure B.6 – Global E&P offshore activities FAR 1988 – 1992, average, high, low

Figure B.7 summarizes FAR data on onshore and offshore North Sea based construction as developed by the E&P Forum (1996). Construction activities for fabrication, assembly, and installation are shown for the period 1987 – 1991. Offshore installation is indicated to be the highest with an average FAR of 12 followed by offshore assembly FAR of 10. All onshore construction related average FAR are less than the offshore construction related average FAR.

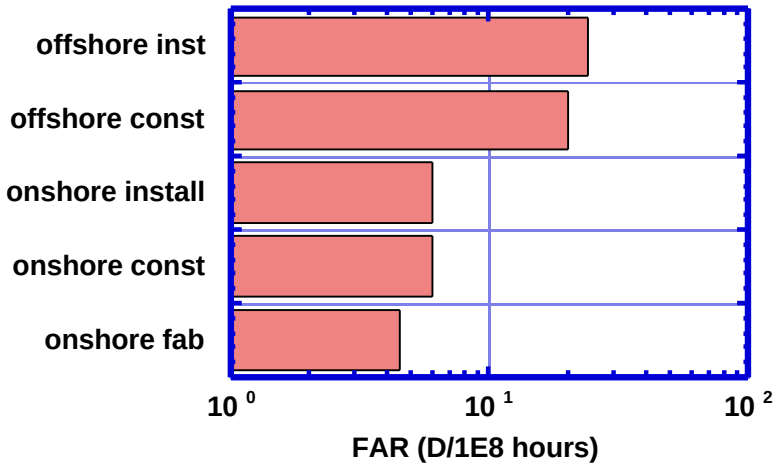

Figure B.7 – North Sea construction related mean FAR for onshore and offshore activities 1987 - 1991

Figure A.8 summarizes mean FARs for 1991-1998 for UK sector offshore activities. The highest mean FAR is that associated with air diving operations (21) followed by maintenance operations (5.5). The air diving FAR is not considered to be reliable because there was no estimate provided for the hours of diving exposure, only for the number of divers employed in offshore operations.

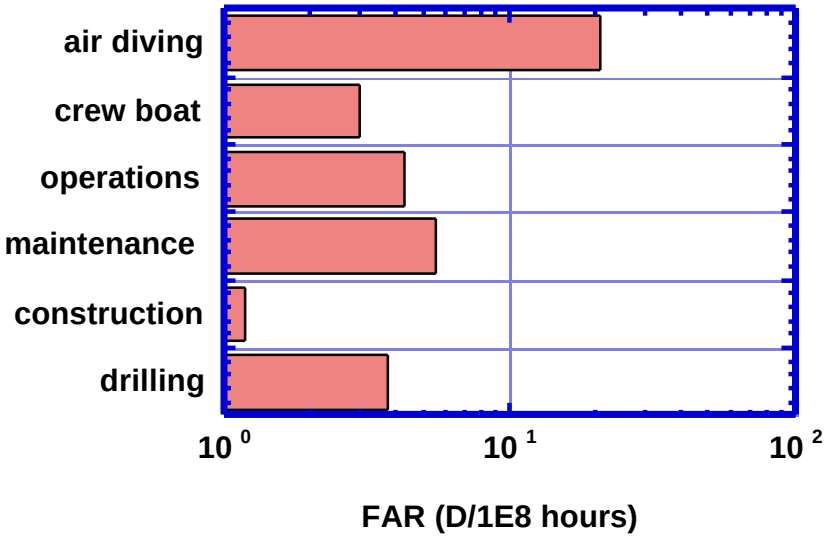

Figure B.8 – UK offshore operations mean FAR 1991 - 1996

The U.K. oil and gas operations Employer Incident Analysis report provided the best data that could be located during this study regarding diving accidents. This report provided information on diving fatalities and very serious injuries (single category) and serious injuries (over 3 days lost work). During this 8 year period, there was a total of 16 fatalities and very serious injuries and 43 serious injuries associated with diving accidents.

The number of divers working in the UK offshore oil and gas operations during the period 1991 – 1998 ranged from 900 to 1300. However, no data was provided on the time divers spent offshore nor on the time they spent in underwater operations. The DNV Technica report covering UK offshore operations during this time period indicated that there were on the average about 17,000 to 18,000 air dives per year. If the figure of 18,000 air dives per year and 3 hours of exposure during each of these dives, the FAR plus very serious incident rate would be 3,700E-8 per hour and the SIR would be 100E-6 per hour.

The DNV Technica report indicated an estimate of diving fatalities associated with UK oil and gas operations of about 0.3 per year. Using the same figures for dives per year and hours per dive would result in an FAR = 556 E-8 per hour of air diving exposure. This figure agrees well with that provided by the E&P forum of FAR = 580 E-8 per hour.

If the average figure of 0.3 diving fatalities per year were used for the 8 year period 1991 – 1998, of the total 16 fatalities and very serious injuries, it could be estimated that there would be about 3 fatalities with the remainder 13 being very serious injuries. If these 13 very serious injuries were added to the 43 serious injuries reported during this same time period, there would be 56 serious injuries based on the definition previously used. This would equate to an SIR of 1980 E-6 per hour.

No data could be located to allow direct assessment of saturation diving SIR or FAR associated with oil field operations. Based on information provided from discussions with experienced

saturation divers working in oil field operations, the SIR and FAR associated with saturation diving were taken to be the same as those associated with air / gas diving.

B.6 SIR and FAR Probability Distributions

Based on the information that was developed during this study, Table B.1 summarizes the proposed probability distributions for SIR (serious injuries per 10E6 hours exposure) associated with four categories of decommissioning – deconstruction operations for the Pacific OCS region.

Table B.2 summarizes the proposed probability distributions for FAR (fatalities per 10E8 hours of exposure) associated with four categories of decommissioning – deconstruction operations for the Pacific OCS region.

Table B.1 – Proposed low bound, most probable, and high bound SIR (injuries per 10E6 hours of exposure) for decommissioning operations

Decommissioning activity	Low bound SIR	Most probable SIR	High bound SIR
Onshore	2.0	5.0	10.0
Offshore above water	2.0	3.0	5.0
Air diving	1700	2000	2300
Saturation diving	1700	2000	2300

Table B.2 – Proposed low bound, most probable, and high bound FAR (injuries per 10E8 hours of exposure) for decommissioning operations

Decommissioning activity	Low bound FAR	Most probable FAR	High bound FAR
Onshore	5.0	6.0	9.0
Offshore above water	2.0	4.0	6.0
Air diving	500	600	700
Saturation diving	500	600	700