



Commercial Diving Operations

Notice of Proposed Rulemaking

Preliminary Regulatory Analysis and Initial Regulatory Flexibility Analysis

USCG-2006-24797

December 2014

Prepared by:

United States Coast Guard

Office of Standards Evaluation and Development

Standards Evaluation and Analysis Division

United States Coast Guard Headquarters

Washington, DC

Contents

Executive Summary.....	7
1.0 Introduction	11
1.1 Statutory Authority	11
1.2 Background.....	11
1.2.1 Justification of this Proposed Rule	12
1.3 Proposed Regulatory Action.....	12
1.3.1 Proposed Implementation	12
1.3.2 Use of Consensus Standards Where Feasible	12
1.3.3 Baseline and Proposed Changes	12
1.4 Need for Federal Regulatory Action.....	19
1.5 Alternatives Considered.....	19
1.6 Organization of the RA.....	21
2.0 Affected Population	22
2.1 Industry Profile	22
2.2 Number of ADCI Diving Firms.....	23
2.3 Number of Affected Commercial Divers.....	24
2.4 Number of Divers and Dive Teams by Type	24
2.5 Number of Non-ADCI Commercial Diving Firms	25
2.6 Number of Third Party Organizations	26
3.0 Costs	27
3.1 Baseline	27
3.2 NPRM Cost Methods.....	28
3.3 Industry Requirements and Cost.....	28
3.3.1 Personnel Operational Requirements §197.290.....	28
3.3.1.1 Surface-Supplied Air: No Decompression.....	28
3.3.1.2 Total Manning Costs.....	30
3.3.2 Medical Requirements §197.250	31
3.3.3 Medical Training§197.240	32
3.3.4 Audits §197.210-213	33
3.3.5 Drills Requirement §197.220.....	36
3.3.6 Reporting and Recordkeeping Costs.....	38
3.3.7 Government Cost.....	41
3.3.8 Third Party Organizations.....	42
3.3.8.1 §197.209(d) Obtaining Initial Approval as a Third-Party Auditor	42
3.3.8.2 §197.209 (e): Notifying Coast Guard of Changes in Auditor	43
3.3.8.3 §197.213: Audit Reporting	43
3.3.8.4 Total Third Party Auditor Costs	43
3.3.9 Summary of Cost Impact on a Per Firm Basis	44
3.3.10 Total Cost	45
4.0 Benefits.....	49
4.1 Background.....	49
4.1.1 Description of Activities.....	49
4.1.2 Risks Faced During Commercial Diving.....	50
4.2 Baseline	50
4.2.1 Baseline Risk	50
Exhibit 4-1 provides a trend analysis of the ten year period.....	54
4.2.2 Baseline Damages.....	54
4.2.2.1 Value of Statistical Life and Monetization of Fatalities	55
4.2.2.2 Monetization of Injuries	55
4.2.3 Total Damages.....	57
4.3 Beneficial Impacts of Proposed Rule.....	57
4.4 Potential Impacts of Rule on Risk of Casualties.....	63
4.5 Quantified Incremental Benefits.....	66

4.5.1 Identifying SSA Fatal Casualties	66
4.5.2 Identifying SSA Injury Casualties	72
4.5.4 Total Benefits	75
5.0 Initial Regulatory Flexibility Analysis	77
5.1 Summary of Findings	77
5.1.1 Preliminary Initial Regulatory Flexibility Analysis.....	78
5.2 IRFA Requirements.....	79
5.2.1 Descriptions of reasons why action of by the agency is being considered	79
5.2.2 Objectives of, and Legal Basis for , the Proposed Rule.....	79
5.2.3 Description and Estimate of the Number of Small Entities to Which the Proposed Rule Will Apply	80
5.2.3.1 Data Development	80
5.2.3.2 Industries Affected by the Proposed Rule	81
5.2.3.3 Census Data by NAICS	83
5.2.3.4 Revenue Impact on Small Entities.....	83
5.2.4 Description of the Projected Reporting, Recordkeeping, and Other Compliance Requirements of Small Entities.....	84
5.2.5 Duplication with Other Federal Rules	84
5.2.6 Description of any Significant Alternatives to the Proposed Rule.....	84
6.0 Collection of Information	85
6.1 Background.....	85
6.2 Collection of Information Requirements – Private Industry.....	86
6.3 Compliance Burdens – Government.....	89
Appendix A - Population Calculations: In-Scope Commercial Diver and Diving Firms Population.....	91
Appendix B - IRFA Calculations	97
Appendix C - Benefits: Casualty Data and Breakeven Calculation.....	98
Appendix D - ADCI Audit Requirements	118
Appendix E - Rig 12 Report Recommendations.....	129
Appendix F - NOSAC Report Recommendations	132
Appendix G - ADCI and IOGPA information.....	134

List of Tables

Table ES-2 Revenue Impacts on Small Entities	10
Table 1-1: Treatment of current 46 CFR part 197 subpart B subject matter in proposed regulations.	13
Table 1-2: Proposed new or amended regulations, 46 CFR.	14
Table 1-3 Description of Alternatives	21
Table 2-1 Total Commercial Divers in U.S., 2009	24
Table 2-2 Number of Divers and Dive Teams by Type.....	24
Table 2-3 USCG Regulated Commercial Diving Firms by Type	25
Table 2-4 Diving Manning by Dive Mode/Type	26
Table 3-1 Hourly Wage by Labor Category	28
Table 3-2 NPRM Team Member Requirements	29
Table 3-3 Comparison of Commercial Diving Manning Requirements	30
Table 3-4a ADCI Commercial Diving Personnel Cost Increment.....	30
Table 3-4b Non-ADCI Commercial Diving Personnel Cost Increment	31
Table 3-4c Total Commercial Diving Personnel Cost Increment	31
Table 3-5 Commercial Diving Medical Examination Costs*	32
Table 3-6 Commercial Diving Medical Training Annual Cost	33
Table 3-7a Commercial Diving Rule Annual Internal Audit Costs	34
Table 3-7b Commercial Diving Rule Annual External Audit Costs*	34
Table 3-7c Commercial Diving Rule Vessel Annual Internal Audit Costs	35
Table 3-7d Commercial Diving Rule Vessel Annual External Audit Costs*	35
Table 3-8 Section 197.220(d) – Drill requirements.	36
Table 3-9a Commercial Diving Proposed Drill Costs	37
(Standard Operations Review).....	37
Table 3-9b Commercial Diving Proposed Drill Costs	37
(Diver recovery)	37
Table 3-9c Commercial Diving Proposed Drill Costs	38
(Emergency Rescue).....	38
Table 3-9d Commercial Diving Total Proposed Drill Costs.....	38
Table 3-10 Private Sector Records and Documentation Costs	39
Table 3-11 Government Records and Documentation Costs.....	42
Table 3-12 Total Third Party Auditor Costs (\$)	44
Table 3-13 Average Cost per Firm: Commercial Diving NPRM	45
Table 3-14c Total Cost (\$) of Commercial Diving Rule	48
Table 4-1a All MISLE Fatality Incidents: Baseline	52
Table 4-1b All MISLE Injury Incidents: Baseline.....	53
Table 4-2: Commercial Diving Incidents by Year.....	54
Exhibit 4-1 Trends in USCG Regulated Commercial Diving Fatalities and Injuries	54
Table 4-3: Abbreviated Injury Scale (AIS).....	55
Table 4-4: Commercial Diving Accident Injuries and AIS Scores.....	55
Table 4-5: AIS and Percent of Willingness to Pay (WTP)	56
Table 4-6: Total Cost per Injury from Accidents.....	56
Table 7a RIG 12 Report Crosswalk with NPRM Regulatory Text.....	58
TABLE 7b NOSAC Recommendation Crosswalk with NPRM Regulatory Text.....	61
Table 4-8. Incident Links to the Proposed Rule	63
Table 4-9a: - Surface Supplied Air Fatalities Baseline with Manning Issues as Potential Causal Factor	67
Table 4-9b: - Effectiveness Factors for Surface Supplied Air Fatalities Baseline with Manning Issues as Potential Causal Factor	69
Table 4-10 Benefit Calculations for Fatality Mitigation.....	72
Table 4-11 - Surface Supplied Air Injuries Baseline with Manning Issues as Potential Causal Factor.....	73
Table 4-12 - Effectiveness Factors for Surface Supplied Air Injuries Baseline with Manning Issues as Potential Causal Factor	74

Table 4-13 Benefit Calculations from Injury Mitigation	75
Table 4-14 – Incremental Breakeven Analysis of Proposed Rule	76
Table 5-1 Firm Data Development	80
Table 5-2 Small Entities by NAICS Codes with SBA Size Standards	81
Table 5-3 Distribution of Firms by Revenue	83
Table 5-4 Revenue Impacts On Small Entities	84
Table 6-1 Private Sector Records and Documentation Costs	86
Table 6-2 Government Records and Documentation Costs	89
Table A-1	91
Table A-2 Total Commercial Divers in U.S. from BLS	91
Table A-3 ADCI Diver Population.....	92
Table A-4 Distribution of Mixed-Gas and Surface-Supplied Air Divers	93
Table A-5 Estimated Commercial Dive Teams and Firms	93
Table A-6 Estimated ADCI and Non-ADCI Commercial Dive Teams and Firms	94
Table A-7 Development of ADCI and Non-ADCI Firms and Divers*	94
Table B-1 Marine Commercial Diving Firms from ADCI 2012 Directory USA	97

ACRONYMS

ADCI	Association of Diving Contractors International
AIS	Abbreviated Injury Scale
ANPRM	Advance Notice of Proposed Rulemaking
ASTM	American Society for Testing and Materials
BLS	Bureau of Labor Statistics
CDO	Commercial Diving Operations
CFR	Code of Federal Regulations
CGRCS	Coast Guard Recognized Consensus Standards
COI	Certificate of Inspection
DHS	Department of Homeland Security
DS	Dive Supervisor
EO	Executive Order
IMCA	International Marine Contractors Association
IMO	International Maritime Organization
TRFA	Threshold Regulatory Flexibility Analysis
MISLE	Marine Inspection, Safety, and Law Enforcement database
NAICS	North American Industry Classification System
NPRM	Notice of Proposed Rulemaking
NOSAC	National Offshore Safety Advisory Committee
NPV	Net Present Value
OCS	Outer Continental Shelf
OGP	International Association of Oil and Gas Producers
OSHA	Occupational Safety and Health Administration
OSV	Offshore supply vessel
PD	Primary Diver
RA	Regulatory Analysis
RFA	Regulatory Flexibility Act
SCUBA	Self-contained underwater breathing apparatus
SD	Standby Diver
SDT	Standby Diver Tender
STCW	Standards of Training, Certification, and Watchkeeping
TPO	Third-party organization
USCG	United States Coast Guard
VSL	Value of statistical life
WTP	Willingness to pay

Executive Summary

This preliminary Regulatory Analysis (RA) provides an assessment of the impacts to industry of the proposed Commercial Diving Operations Notice of Proposed Rulemaking (NPRM). In the NPRM, the Coast Guard (USCG) is proposing to update 46 CFR parts 8 and 197 to add clarity and increase safety standards of Commercial Diving Operations. The regulation focuses on commercial divers and commercial diving operations.

Under Section 6(a)(3)(c) of Executive Order (EO) 12866, “Regulatory Planning and Review,” USCG is required to conduct an analysis of the costs, benefits, and other impacts of a significant rulemaking where the impacts of the rule have an annual effect on the economy of \$100 million or more as defined in Section 3(f)(1) of the Order. USCG does not expect this proposed rule to be economically significant, but has conducted the analysis in support of the proposed rule.

Currently, the commercial diving industry operating under U.S. Coast Guard jurisdiction includes:

- Operations outside the 3-mile limit, and
- Within 3 miles including inland waters, operations off of Coast Guard-certificated vessels.

Commercial diving services are available on all U.S. coasts as well as within the inland waterways, including the Great Lakes. The Coast Guard estimates that the population of interest is approximately 811 divers working for an estimated 85 firms. Much of the commercial diving activity impacted by the proposed rule takes place in the Gulf of Mexico and involves specialized services to oil and natural gas exploration, production, and transportation (pipelines). The remainder of commercial diving activity supports heavy construction and ship husbandry.

Coast Guard is proposing to update the commercial diving regulations to incorporate current industry protocols that have advanced faster than USCG regulations and to address safety concerns from various fatal and non-fatal accidents over the last 15 years. The new requirements would include more stringent standards consistent with advanced industry standards that are the result of the work of the industry association, the Association of Diving Contractors International (ADCI). ADCI is a nonprofit organization that was formed in 1968 to establish industry-wide standards for commercial diving in the U.S. In 2011, ADCI published its 6th edition of Standards for Commercial Diving and Underwater Operations. The 6th edition was ratified in 2011 and provides the best practice safety standard for a large portion of the industry.

USCG expects costs to consist primarily from requirements for additional dive personnel, audits, medical exams, drills, and reporting and recordkeeping requirements as proposed. These costs will be split between firms which are not known to follow ADCI protocols and best practices (hereafter referred to as “non-ADCI”), and those in compliance with ADCI standards (hereafter referred to as “ADCI firms”).

Cost Summary

The proposed rule would require commercial diving operations and commercial divers to take several actions. These actions include:

- Manning each dive with a new minimum number of personnel, depending on the dive mode, but especially Surface Supplied Air (SSA);
- Conducting diving drills to ensure ability to perform adequately in both routine and emergency operations,
- Documenting activities;

- Requiring medical exams for divers;
- Requiring CPR and first aid training for divers, and;
- Requiring commercial dive firm and vessel audits.

In addition, costs to third party organizations (auditors) have also been calculated.

USCG estimates that the total 10-year private sector cost of the proposed rule is \$17.8 million (undiscounted). We estimate the annualized cost of the proposed rule to the private sector to be about \$1.78 million at a 7-percent discount rate. We expect the government to incur an annual cost of \$28,530 per year in reporting and recordkeeping review. The total cost of the proposed rule, including government reporting and recordkeeping related annual costs, is \$18.1 million (undiscounted) over a 10-year period and \$1.81 million annualized at a seven percent discount rate (Table ES-1).

ES-1 Total Cost (\$) of Commercial Diving Rule (w USCG costs)

Year	Drills	Dive Manning	Audits	Recordkeeping & Documentation/1	Medical Issues	Third Party	Total /2	Disc @7%	Disc @ 3%
1	43,729	1,460,554	42,589	233,625	31,260	3,220	1,818,277	1,699,324	1,765,317
2	43,729	1,460,554	42,589	233,625	25,500	1,296	1,807,292	1,578,559	1,703,546
3	43,729	1,460,554	42,589	233,625	31,260	1,296	1,813,052	1,479,991	1,659,200
4	43,729	1,460,554	42,589	233,625	25,500	1,296	1,807,292	1,378,775	1,605,756
5	43,729	1,460,554	42,589	233,625	31,260	1,296	1,813,052	1,292,681	1,563,955
6	43,729	1,460,554	42,589	233,625	25,500	1,296	1,807,292	1,204,275	1,513,579
7	43,729	1,460,554	42,589	233,625	31,260	1,296	1,813,052	1,129,078	1,474,177
8	43,729	1,460,554	42,589	233,625	25,500	1,296	1,807,292	1,051,860	1,426,693
9	43,729	1,460,554	42,589	233,625	31,260	1,296	1,813,052	986,180	1,389,554
10	43,729	1,460,554	42,589	233,625	25,500	1,296	1,807,292	918,736	1,344,795
Total	437,287	14,605,544	425,886	2,336,249	283,800	14,881	18,106,946	12,719,458	15,446,571
Annualized								1,810,965	1,810,809

Source: USCG Calculations

1) Includes \$28,530 in annual reporting and record keeping costs for USCG

2) Includes \$3,300 cost to purchase ADCI 6 in year 1

Benefits Summary

The Coast Guard designed the proposed regulation to help ensure that the affected operating companies and divers have and use best safety practices, and are adequately staffed and prepared for safe operations, with compliance verified by a combination of third parties and the Coast Guard. The primary benefits of this rulemaking would be the reduction in the number of accidents in the commercial diving industry and the minimization of adverse impacts in the event that an accident occurs.

We reviewed the Marine Information for Safety and Law Enforcement (MISLE) data set for commercial diving fatalities from 2002-2011. During this 10-year period, there were 12 commercial diving fatalities and 8 injuries listed in MISLE. From these 12 fatalities, we identified 4 SSA fatalities that the proposed rule could have impacted by mitigating the risk of the incident. We applied a value of a statistical life (VSL) of \$9.1 million¹ along with an assessment of mitigation effectiveness to monetize the fatalities. The value of the four fatalities mitigated is estimated at \$2.4 million. In addition, we identified 3 injury casualties in the SSA that would be impacted if the NPRM rule was in place, and worth \$117 thousand. The total potential benefits of this rule are the monetization of the above avoided casualties or about \$2.5 million.

We used a breakeven analysis approach to represent the potential benefits of the other rule segments of the proposed rule. This proposed rule could result in a constant reduction in the risk of fatality to the entire commercial marine diving industry, and in particular to the portion of the industry that does not have ADCI membership (which requires and verifies use of the ADCI standard). We compare the various non-manning annualized costs at a 7-percent discount rate over a 10-year period (\$0.295 million) with the value of a statistical life, \$9.1 million. At a 7-percent discount rate, this proposed rule would need to prevent anywhere from 1 fatality in 44 years to 1 fatality in 3,056 years to breakeven depending on the NPRM regulatory provision.²

Initial Regulatory Flexibility Act

This RA includes the Initial Regulatory Flexibility Act (5 U.S.C. §§ 601-612) analysis where we have considered whether this rule has a significant economic impact on a substantial number of small entities. As a result of our analysis, we concluded that small entities make up approximately 86 percent of the total affected marine population ((37 known small firms + 12 estimated and likely small firms + 26 firms with no revenue data)/87 total marine firms). The typical commercial diving firm will incur \$50,153 of additional annual regulatory costs as a result of this proposed rule. Of the small entities with available data (37), 32 percent were determined to have an annual revenue impact of less than 1 percent. Further, we estimated that the impact on another 41 percent of these small entities would be between 1 and 3 percent of annual revenue as shown in Table ES-2. The remaining 27 percent would have an impact of 3 percent or greater.

¹ The VSL approach is used to monetize the value of fatalities prevented. The VSL does not represent the dollar value of a person's life, but the amount society would be willing to pay to reduce the probability of death. See: U.S. Department of Transportation Memorandum, Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses, available at <http://www.dot.gov/sites/dot.dev/files/docs/VSL%20Guidance%202013.pdf>

² See Appendix C for Breakeven Calculations.

Table ES-2 Revenue Impacts on Small Entities

Impact	Sample	Percentage
$0\% \leq \text{Impact} \leq 1\%$	12	32%
$1\% > \text{Impact} < 3\%$	15	41%
$\geq 3\% \text{ Impact}$	10	27%
Total	37	100%

Collection of Information

This proposed rule would require a new collection of information since there is no existing collection of information under the Paperwork Reduction Act (44 U.S.C. 3501-3520) for commercial diving activities covered by the proposed requirements. Several items of information, such as reports on the status of various types of equipment will be required to be collected annually. USCG estimates the Collection of Information Burden of this proposed rule to be 6,191 hours per year. The Collection of Information chapter provides more detail on each item along with the annual burden estimate.

1.0 Introduction

This preliminary Regulatory Analysis (RA) provides an assessment of the impacts to industry of proposed changes detailed in the Commercial Diving Operations Notice of Proposed Rulemaking (NPRM). In that NPRM, the Coast Guard is proposing to update 46 CFR parts 8 and 197 to add clarity and increase safety standards of Commercial Diving Operations.

1.1 Statutory Authority

The statutory authorities for this notice of proposed rulemaking (NPRM) is 33 U.S.C. 1509(b), which requires safety regulations for deepwater ports; 43 U.S.C. 1333(d)(1), which permits safety regulations for Outer Continental Shelf (OCS) facilities and their equipment; 46 U.S.C. 3306, which requires regulations to implement subtitle II of Title 46 of the U.S. Code with respect to inspected vessels, including offshore supply vessels and their equipment; 46 U.S.C. 3703, which requires safety and environmental protection regulations for liquid bulk dangerous cargo carriers and their equipment, to be issued after consultation with Federal, State, and local governments and with private sector entities; and 46 U.S.C. 6101, which requires regulations for reporting and investigating marine casualties. The Secretary of Homeland Security's authority under all of these statutes has been delegated to the Coast Guard by Department of Homeland Security Delegation No. 0170.1(75), (90), and (92). In addition, we are conducting this rulemaking in accordance with a December 19, 1979, Memorandum of Understanding between the Coast Guard and the Occupational Safety and Health Administration (OSHA). OSHA regulates commercial diving operations conducted near shore or in U.S. internal waters unless the operation is conducted off of a vessel required to have a Coast Guard certificate of inspection.

1.2 Background

The existing Coast Guard commercial diving regulations were issued in 1978. Those regulations apply to all the modes of commercial diving (saturation, scuba, surface-supplied air and mixed-gas diving). The regulations also apply to diving operations that are conducted on oil and natural gas extraction operations in the Gulf of Mexico, deepwater ports (such as offshore liquefied natural gas facilities), and OCS facilities and on vessels that are required to have a Coast Guard certificate of inspection.³

For this update of those regulations, we issued our first Advance Notice of Proposed Rulemaking (ANPRM) in 1998 (63 FR 34840, Jun. 26, 1998), and noted that our regulations did not reflect the latest safety and technology standards and industry practices. In 2009, a second ANPRM (74 FR, Jan. 6, 2009) discussed in detail the public comments we received on the 1998 ANPRM, recounted the early history of the rulemaking, and summarized developments between 1998 and 2009.

³ 46 CFR 197.202 (a) This subpart applies to commercial diving operations taking place at any deepwater port or the safety zone thereof as defined in 33 CFR part 150; from any artificial island, installation, or other device on the Outer Continental Shelf and the waters adjacent thereto as defined in 33 CFR part 147 or otherwise related to activities on the Outer Continental Shelf; and from all vessels required to have a certificate of inspection issued by the Coast Guard including mobile offshore drilling units regardless of their geographic location, or from any vessel connected with a deepwater port or within the deepwater port safety zone, or from any vessel engaged in activities related to the Outer Continental Shelf; except that this subpart does not apply to any diving operation— (1) Performed solely for marine scientific research and development purposes by educational institutions; (2) Performed solely for research and development for the advancement of diving equipment and technology; or (3) Performed solely for search and rescue or related public safety purposes by or under the control of a governmental agency.

1.2.1 Justification of this Proposed Rule

The specific requirements of the proposed rule are based on a comprehensive evaluation of the changes in diving technology and operations, as well as causal factors for commercial diving accidents over the last 15 years. In particular, two reports were developed in response to a series of commercial diving accidents that gained major public attention starting with one in 1996. The first report, titled “Investigation into the Circumstances Surrounding the Commercial Diving Accident Onboard the Mobile Offshore Diving Unit Cliff’s Drilling Rig No. 12 on March 4, 1996 with the Loss of Life” focused the Coast Guard on improving its regulations for commercial diving.⁴ That report, released in March 2001 and also known as the RIG 12 Report, identified our 1978 regulations as needing update.

We have also been guided by the 2008 National Offshore Safety Advisory Committee (NOSAC) report titled NOSAC Diving Subcommittee, General Revision Recommendations, which provided the Coast Guard with additional appropriate guidance regarding the industry and its safety efforts.⁵ NOSAC was composed of industry participants with commercial diving experience as well as diving contractors, large and independent oil producers, and diving associations such as ADCI and the International Marine Contractors Association (IMCA). Collectively, they advised us of the changes industry has made to its standard practice over the past 16 years, with the large majority of the commercial diving industry now operating in accordance with ADCI standards. The remaining firms that are not yet meeting these standards are the focus of this analysis.

1.3 Proposed Regulatory Action

1.3.1 Proposed Implementation

The Coast Guard proposes to amend its commercial diving regulations, updating them to reflect technological developments and advancements in operations since 1978. Newer industry-developed standards would be codified as part of the proposed rule. Other existing requirements would be clarified. The proposal would allow the Coast Guard to approve third-party organizations to assist in ensuring regulatory compliance. The proposed amendments enhance safety and promote the Coast Guard’s strategic goal of maritime safety.

1.3.2 Use of Consensus Standards Where Feasible

The development of this rulemaking required the use of various voluntary and technical standards. Voluntary consensus standards are technical standards (e.g. specifications of materials, performance, design, or operation; test methods; sampling procedures; and related management systems practices) that are developed or adopted by voluntary consensus standard bodies. In general, where the Coast Guard found consensus standards existing in commercial diving organizations that well represent industry, it incorporated them.

1.3.3 Baseline and Proposed Changes

⁴ U.S. Coast Guard, *Investigation into the Circumstances Surrounding the Commercial Diving Accident Onboard the Mobile Offshore Diving Unit Cliff’s Drilling Rig No. 12 on March 4, 1996 with the Loss of Life*, March 15, 2001. Accessed at: https://homeport.uscg.mil/cgi-bin/st/portal/uscg_docs/MyCG/Editorial/20100914/2001%20-%20CLIFF_S%20DRILLING%20RIG%20NBR%202_3.pdf?id=225f4a713d9a020e652d7b0716db8ea5f72b2bcb&user_id=a4966d78ade674bfbfc22da2bfe41dd8

⁵ U.S. Coast Guard, NOSAC Diving Subcommittee, 46 CFR 197 Sub Part B, General Revision Recommendations, April 28, 2008, Accessed at <http://www.thediversassociation.com/index.php?/files/download/29-nosac-diving-subcommittee-recommendations-2008/>

To estimate the effect of the NPRM on industry and society as a whole, a baseline was developed from which to measure this effect. The baseline accounts for current conditions (i.e., pre-proposed regulation implementation) and projects forward based on these conditions. The baseline provides a framework to determine the changes in industry behavior and conditions that would be likely to result from the rules. The baseline for this analysis is:

- Full industry compliance with currently existing Federal commercial diving regulations.
- Industry compliance with standards set by industry associations and contracting firms of which they are a member
- Current industry practices or standards that exceed current regulations to the extent that they can be observed.

It is believed that there is significant overlap between the standards set by industry associations, the requirements set by firms contracting commercial diving operations, and the requirements of the proposed regulation. In particular, ADCI (a not-for-profit organization formed in 1968 to establish industry-wide standards for commercial diving in the United States) published its sixth edition of Standards for Commercial Diving and Underwater Operations in 2011.⁶

Contractual arrangements have also evolved so that specific industry association protocols are specified in these legal documents for doing work with oil and natural gas firms. For example, based on discussions with industry, a commercial diving firm will not be able to obtain a contract with an oil and natural gas firm unless they have the proper manning for the dive mode specified in the proposed work that corresponds with ADCI and OGP (International Association of Oil and Gas Producers) best practices or protocols.

The baseline conditions based on current industry practice are reflected in the cost analysis, in that many regulated firms already meet many requirements associated with the proposed commercial diving regulations and therefore do not incur the full cost of complying with this rule.

Table 1-1 compares requirements in the current rules versus those in the proposed rule, which codifies components of ADCI 6th edition. As is evident from Tables 1-1 and 1-2, the majority of the proposed rule changes are clarifying or editorial changes incorporating current industry standard practice or adopting by reference. For those proposed rule changes requiring adjustments to labor procedures, cost implications are also noted.

Table 1-1: Treatment of current 46 CFR part 197 subpart B subject matter in proposed regulations.

Current 46 CFR part 197 subpart B	Proposed 46 CFR part 197 subpart B	Discussion
General, 197.201—197.210.	General, 197.201—197.206.	General provisions would be revised and reorganized with no change in substance. Current 197.200 (Purpose of subpart) would be removed as unnecessary. Current 197.203 (Right of appeal) would be removed as unnecessarily duplicative of 46 CFR subpart 1.03. Current 197.208 (designation of person in charge) and

⁶ http://www.adc-int.org/documents/ADCICS_000.pdf

Current 46 CFR part 197 subpart B	Proposed 46 CFR part 197 subpart B	Discussion
		197.210 (designation of diving supervisor) would be replaced by new 197.220. New costs for audits and drills
Equipment, 197.300—197.346.	Equipment, 197.270—197.286.	Equipment provisions would be substantively revised.
Operations, 197.400—197.420.	Operations, 197.260—197.262.	Operations provisions would be substantively revised.
Specific Diving Mode Procedures, 197.430—197.436.	See Discussion column.	Specific diving modes would be addressed under the relevant category. For example, SCUBA-specific operational requirements would be addressed under “Operations,” in 197.262.
Periodic Tests and Inspections of Diving Equipment, 197.450—197.462.	Equipment, 197.270—197.286.	Testing and inspection requirements for a specific item of equipment would appear in the section providing overall equipment requirements for that item. General testing and inspection requirements would appear under “Operational Duties” (197.220—197.226) and “Operations.”
Records, 197.480—197.488.	See Discussion column.	Logbook requirements would appear in 197.221. Casualty record requirements would appear in 197.224.

Table 1-2: Proposed new or amended regulations, 46 CFR.

46 CFR Section	Proposed version	Comment on proposed version
<i>46 CFR Part 8, Subpart C – International Convention Certificate Issuance</i>		
8.320	Classification society authorization to issue international certificates.	Amend this section to add IMO Diving Safety Certificate to the list of certificates.
<i>46 CFR Part 197, Subpart B – Commercial Diving Operations</i>		
<i>197.200 – 197.204 General</i>		
197.200	Applicability.	Current 197.202, rewritten for improved clarity without changing scope.

46 CFR Section	Proposed version	Comment on proposed version
197.201	Definitions.	Current 197.204 definitions with some revision and supplementing to reflect other proposed changes.
197.202	Incorporation by reference.	Current 197.205 updated to conform to Office of Federal Register requirements and to reflect other proposed changes.
197.203	Equivalents.	Current 197.206 dealing with acceptable regulatory substitutes, revised for clarity without changing the public’s ability to use approved substitutes (equivalents) for regulatory standards.
197.204	Commercial diving operations conducted in foreign waters.	New provisions requiring certain operations to comply with the International Code of Safety for Diving Systems and to possess valid diving system safety certificates.
197.205	Enforcement.	New provisions giving the Coast Guard and TPOs additional enforcement authority, requiring certain vessels to document compliance with the International Code of Safety for Diving Systems, and authorizing TPOs to audit diving-related operations.
197.210 – 197.213 Audits		
197.209	Third-party audits.	New provisions for the internal and external auditing of diving-related operations. Costs will be incurred in these audits.
197.210	Internal audits.	
197.211	External audits.	
197.212	Pre-audit notification.	
197.213	Audit reporting.	
197.220 – 197.224 Operational Duties		
197.220	Commercial diving operators.	Places specific regulatory responsibilities on CDOs to ensure full organizational accountability. Current regulations provide specific responsibilities only for the person in charge and dive supervisor.
197.221	Persons in charge.	Retains several responsibilities that persons in charge have under current 197.402, but adds new responsibilities for improved

46 CFR Section	Proposed version	Comment on proposed version
		safety.
197.222	Dive supervisors.	Retains several responsibilities that dive supervisors have under current 197.404, but adds new responsibilities for improved safety.
197.223	Operations manual.	Largely unchanged from current 197.420, but revised for clarity.
197.224	Operational duties in the event of casualty, accident, or serious marine incident.	Substantively identical to requirements in current 197.484—197.488; revised for clarity.
197.225	Safety management system.	New provisions establishing operations under a safety management system.
197.240 – 197.244 Personnel Training and Qualifications		
197.240	General requirement.	New provisions to set minimum standards, generally and for each dive team position
197.241	Standby divers.	
197.242	Dive supervisor qualifications.	
197.243	Divers and dive tenders.	
197.244	Life-support technicians	
197.245	Saturation technicians	
197.246	Individuals conducting underwater burning, welding, or exothermic cutting.	
197.250 – 197.252 Health and Medical Requirements		
197.250	Medical examinations.	New minimum health and medical standards. . Certain costs will be incurred for medical training and for medical exams.
197.251	Pre-operational verification.	
197.252	Work hours.	
197.260 – 197.262 Specific Operations		

46 CFR Section	Proposed version	Comment on proposed version
197.260	Operations with potential for differential pressures in adjacent areas.	New minimum standards for specific operations.
197.261	Operations from a dynamic positioning vessel.	
197.262	Operations conducted from a vessel that is liveboating.	
197.263	Operations involving SCUBA.	
197.264	Operations involving multiple dives by a diver.	
197.265	Operations in which a diver's decompression is required, but has been omitted.	
197.266	Operations in contaminated water.	
197.267	Operations involving underwater welding and burning.	
197.270 – 197.286 Equipment		
197.270	General requirements.	New minimum equipment standards.
197.271	Commercial diving operator’s general equipment duties.	
197.272	Person in charge’s equipment duties.	
197.273	Dive supervisor’s equipment duties.	
197.274	Diver’s equipment duties.	
197.275	Volume tanks.	
197.276	Compressed gas cylinders.	Covers same topic as current 197.338, but adds new industry standard requirement.
197.277	Pressure vessels for human	Covers same topic as current 197.328 –

46 CFR Section	Proposed version	Comment on proposed version
	occupancy.	197.332, but adds new industry standard requirement.
197.278	Pressure piping.	Similar to current 197.336, but proposes updated industry standard.
197.279	First aid and treatment equipment.	Covers same topic as current 197.454, but adds new industry standard requirement and greater detail.
197.280	Diving ladders and stages.	Covers same topic as current 197.320, but adds new industry standard requirement.
197.281	Surface-supplied air helmets and masks.	Covers same topic as current 197.322, but adds new industry standard requirement.
197.282	Diver's safety harness.	Covers same topic as current 197.324, but adds new industry standard requirement.
197.283	Buoyancy-changing devices.	Identical to current 197.342.
197.284	Inflatable flotation devices.	Identical to current 197.344.
197.285	Oxygen safety.	Substantively identical to current 197.326 and 197.452.
197.286	Miscellaneous equipment requirements.	See discussion for specific items.
	-Breathing gas supply, diver-carried reserve.	Similar to current 197.340(e), but adds detail for unused ports.
	-Breathing gas supply, primary.	Substantively identical to current 197.340(a).
	-Breathing gas supply, secondary.	Substantively identical to current 197.340(b).
	-Oxygen.	Substantively identical to current 197.340(f).
	-Nitrogen.	Substantively identical to current 197.340(g).
	-Helium.	Substantively identical to current 197.340(h).
	-Compressed air.	Substantively identical to current 197.340(i).
	-Diving system power.	New minimum equipment standards.
	-Equipment to which a manufacturer's service life	

46 CFR Section	Proposed version	Comment on proposed version
	specification applies.	
	-Equipment used with oxygen mixture greater than 23.5 percent by volume.	
	-Gasses.	
	-Gauges and timekeeping devices.	Substantively identical to current 197.318, but adds readability requirement for devices for monitoring diver exposure time under pressure.
	-Oxygen system, pressure greater than 125 psi(g).	Substantively identical to current 197.326.
	-Pressure piping repairs.	Covers same topic as current 197.462, but adds new industry standards requirement.
	-Pressure vessel repairs.	Covers same topic as current 197.462, but adds new industry standards requirement.
<i>197.290 Dive Team Staffing</i>		
197.290	Dive team staffing requirements.	New minimum team size and composition standards. Cost increase for SSA mode of diving

1.4 Need for Federal Regulatory Action

The proposed rule addresses life safety risk associated with commercial diving activities, by codifying protocols contained in the ADCI 6th edition International Consensus Standards for Commercial Diving and Underwater Operations (ADCI Standards) as well as the Standards for International Oil and Gas Producers Association (OGP Standards).⁷

1.5 Alternatives Considered

USCG considered several alternatives when developing this proposed rule. Within these alternatives, USCG considered a “do-nothing” option (e.g., preserving the current regulation). Executive Order 12866 directs Federal agencies to assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating.

Additionally, OMB Circular A-4 is designed to assist regulatory agencies by defining good regulatory analysis. The Circular provides guidance to standardize the way benefits and costs of Federal regulatory

⁷ International Consensus Standards for Commercial Diving and Underwater Operations 6th Edition, Association of Diving Contractors International, Inc., Houston, TX 2010; and OGP Diving Recommended Practice, International Oil and Gas Production Association, Report No. 411, London, U.K., 2008.

actions are measured and reported. As guided by Circular A-4, Executive Order 12866 and the Regulatory Flexibility Act, USCG also considered if there were any alternatives which could minimize any significant economic impact of the rule on small entities beyond the proposed rule.

The alternatives considered by USCG included:

Alternative One – No Action: The Coast Guard considered the no action alternative, which would leave the existing regulations in place without updating them. A notice of withdrawal would be published in the Federal Register to terminate the rulemaking approved in 1998. The commercial diving industry and the civil court system would continue to be the primary drivers of improvements in commercial diver safety. The Coast Guard does not believe these drivers are adequate to achieve improvements in diver safety for the entire commercial marine diving industry, as evidenced by the casualty history.

Alternative Two – Development of International Code: The Coast Guard considered and rejected this alternative, which is to seek development and implementation of a “Code of Safety for Diving Operations” through the International Maritime Organization (IMO). Used in conjunction with the existing IMO “Code of Safety for Diving Systems 1995,” and modified to include temporary diving systems, such a code would promote diver safety. However, an international convention likely would involve significantly more development time than an amendment to existing Coast Guard regulations, and could have limited application to purely domestic U.S. diving operations until/unless incorporated by a rulemaking.

Alternative Three – Development of USCG Unique Regulations: We considered and ultimately rejected this alternative, which would have required the Coast Guard in many ways to duplicate the ADCI Guidelines (6th edition). This would not necessarily have resulted in more effective regulations, but is expected to result in greater burden to industry as the compliance regime would affect the full industry, and not just the non-ADCI subset. ADCI firms, in fact, likely would face duplicative costs of enforcement.

Alternative Four – Adopting Industry Standards without Manning Changes: We considered and rejected this alternative, which entails proposing regulations that incorporate accepted industry consensus standards (e.g. ADCI International Consensus Standards for Commercial Diving and Underwater Operations, 6th edition) without an increase in manning. This would codify many current consensus industry standards and provide enforcement capability. CG would incorporate all or most of what is in the ADCI consensus standards. However, CG could not incorporate it in total because some of the items in our existing regulations are not included in the ADCI standard. Much of what is written in the proposed regulations is written to augment the consensus standards to ensure previous requirements are not lost. CG ultimately rejected this approach, although less expensive, because of the lack of direct manning benefits in reducing fatalities and injuries

Alternative Five - Current Rulemaking that updates the current USCG Regulations: Coast Guard considered and accepted this alternative that entails adopting the rules that are very similar to the ADCI guidelines (6th edition). This will codify many current consensus industry standards. CG incorporated most of what is in the ADCI consensus standards. CG could not incorporate it in total because some of the items in our existing regulations are not included in the ADCI standard. Much of what is written in the proposed regulations is written to augment the consensus standards to ensure previous requirements are not lost. CG used our existing regulations as a baseline and incorporated ADCI mostly based on that and the recommendations we got from industry on certain topics. These requirements also include an increase in manning (by one person) for the Surface Supplied Air no decompression mode.

Table 1-3 summarizes these alternatives.

Table 1-3 Description of Alternatives

Alternative	Costs	Benefits	Evaluation
Take No Action	None	None	Not preferred because of risks that appear to still exist within the industry in spite of ADCI protocols
Develop an International Code	Likely Costlier and less Timely than best approach due to Increased No of Parties Involved	Reduce Remaining Risk	Not preferred because of timely expense of having many parties involved that would have slowed progress in getting a rule out expeditiously
Develop Unique Coast Guard Regulations	Might be Costlier due to Duplication with ADCI rules	Reduce Remaining Risk	Not preferred because of high risk of duplication of many of ADCI protocols that already exist
Proposed ADCI Duplicative Rule in NPRM without Manning	\$400,000	Reduce Remaining Risk	Marginal Approach especially given ADCI standards that still would not cover all CG desired requirements
Proposed Rule in NPRM with Manning	\$1.81 million	\$2.4 million	Best Approach consistent with comprehensive, extensive and timely approach that gives the best bang for the buck

Source: USCG

1.6 Organization of the RA

This regulatory analysis (RA) evaluates the costs, benefits, and other economic impacts associated with implementing the proposed rulemaking for commercial diving requirements. The following summarizes the chapters of the RA:

- Chapter 2 presents the population of commercial diving operations affected by the proposed rule.
- Chapter 3 presents the estimated cost of the NPRM along with a detailed discussion of the underlying assumptions of the cost estimates.
- Chapter 4 presents the benefits analysis of the NPRM.
- Chapter 5 contains an analysis estimating the impact of the NPRM on small entities.
- Chapter 6 discusses the collection of information requirements under the proposed rule.

2.0 Affected Population

The proposed requirements apply to diving undertaken in connection with commercial operations conducted from (1) deepwater ports (such as offshore liquefied natural gas facilities), (2) Outer Continental Shelf (OCS) activities, and (3) from vessels that are required to have a Coast Guard certificate of inspection⁸. The affected population for the proposed rule consists of commercial diving operations conducted outside of the 3 mile limit and those conducted within the 3 mile limit from vessels required to have a Coast Guard certificate of inspection.⁹

The Marine Information Safety and Law Enforcement (MISLE) database does not provide the industry detail necessary to estimate the population of commercial diving operations affected by the proposed rule. Therefore, we examined the data of the Bureau of Labor Statistics (BLS) and industry associations such as ADCI in order to develop an estimate of commercial diving operations impacted by this proposed rule.

2.1 Industry Profile

Commercial diving firms are either: 1) members of ADCI or 2) they are non-members or non-ADCI firms and generally focus on smaller diving operations.¹⁰ Members of ADCI must meet the Association's standard or face a suspension of their membership and potential loss of contracts. For example, ADCI members who fail an ADCI audit inspired by a complaint or a random audit exercise, are given time to correct the deficiency. If the deficiency is not corrected in a reasonable time, ADCI will (and has in the past) disenroll the offending member. Members generally know this is a dangerous route to take as the re-enrollment process is very expensive, requiring complete audits of every facet of their operation. In general, not having the ADCI certification will likely result in fewer work opportunities particularly with the oil and natural gas industries.¹¹

Commercial diving services are available on all U.S. coasts as well as within the inland waterways including the Great Lakes. Diving services typically are arranged through companies that employ or contract with divers and their associated equipment (which typically includes vessels of various types). Independent commercial divers may hire themselves out as contractors to diving companies and use the company's equipment (except for helmets, which typically are diver-specific).

There are four diving modes addressed in this regulation and accounted for in our analysis: saturation diving, scuba diving, mixed-gas, and surface-supplied air diving. The last mode can be further divided into three sub-categories: surface-supplied air (decompression), surface-supplied air (no decompression), and surface-supplied air less than 100 feet.

Dive mode definitions are as follows:

⁸ 46 CFR 197.202

⁹ Commercial diving operations near shore or in U.S. internal waters that are not from vessels required to have a Coast Guard certificate of inspection are regulated by OSHA in accordance with a December 19, 1979, Memorandum of Understanding between the Coast Guard and OSHA.

¹⁰ As will be described elsewhere herein, we segment the industry into that group that by contract (typically the oil and gas industry), have to abide by ADCI and OGP protocols, and the other group that works on other tasks that have fewer contract restrictions.

¹¹ Conclusions based upon various USCG conversations with industry participants.

Saturation diving means saturating a diver's tissues with the inert gas in the breathing mixture to allow an extension of bottom time without additional decompression.

SCUBA (Self-contained underwater breathing apparatus) means a dive mode in which the diver is supplied with a compressed breathing mixture from diver-carried equipment.

Mixed-gas dive means a dive mode in which the diver in the water is supplied with a breathing gas other than air.

Surface-supplied air diving means a dive mode in which the diver is supplied in the water from the surface with air to breathe. This mode is further divided among diving less than 100 feet, decompression diving, and no decompression diving.

Much of the commercial diving activity is centered in the Gulf of Mexico and around oil and natural gas exploration, production, and transportation (pipelines) activities. This requires very specialized services unique to these industries. The remainder of the industry regulated by the Coast Guard is ship husbandry with diving off of USCG-inspected vessels as well heavy construction (non-oil and gas) beyond the 3-mile limit. This activity is mainly found on the Atlantic and Pacific coasts, as well as on the inland waterways and Great Lakes. Typical industries represented include those in NAICS (North American Industry Classification System) codes 236220, Commercial & Inst. Building Construction; 237990, Other Heavy and Civil Engineering Construction; and 541330, Marine Engineering and Naval Architecture, among others (see Chapter 5 for more detail).

Depending on the level of economic activity, commercial divers in the heavy construction industry are potentially active for 220 days annually. ADCI rules require divers to have 12 hours off per 24 hour period. Similarly, the amount of activity for divers engaged in ship husbandry is dependent on the economy. These divers also are subject to time off requirements as well.

Given the institutional nature of the oil and natural gas industry relative to ADCI and OGP protocols discussed in Chapter 1, much of the operations from ADCI members are in compliance with the majority of the proposed regulation. This is especially true for the those members that do offshore work for the oil and gas industry where not only ADCI standards prevail but other international bodies and OGP apply as well. Contracts to clients in the oil and gas industry are only let to commercial diving firms that subscribe and practice ADCI and OGP standards and protocols. Furthermore, ADCI has in place an audit system to ensure compliance with the standards by members and enforcement measures that include termination of membership in ADCI (and loss of the ability to work on contracts that require ADCI).

2.2 Number of ADCI Diving Firms

Based on publicly available information, 175 U.S.-based commercial diving operations are listed as members of ADCI, adjusted to 171 firms when accounting for mergers and non-diving companies such as manufacturing, research, etc.¹² However, not all ADCI members conduct operations under USCG jurisdiction nor are all dive firms really commercial operations subject to USCG or OSHA jurisdiction. We reviewed websites of ADCI members and identified 75 marine-oriented diving firms operating under Coast Guard jurisdiction that are 43.9 percent of the total number of ADCI OSHA /USCG jurisdiction firms.

¹² Available online at: <http://www.adc-int.org/>

2.3 Number of Affected Commercial Divers

We estimate the number of affected commercial divers by reviewing BLS Commercial Diving population numbers, which account for all commercial diving in the U.S., including not only USCG regulated activity, but also OSHA regulated activity. The key sub segments are presented in Table 2-1.¹³

Table 2-1 Total Commercial Divers in U.S., 2009

Other Support Services	900
Support Activities for Mining	610
Other Heavy and Civil Construction	340
Total	1850
Commercial Divers Under US Coast Guard Jurisdiction*	811

Source: U.S. Bureau of Labor Statistics, Occupations and Wages, May, 2009

* 1,850 divers X 43.9 percent firms under US jurisdiction

Next we estimate that number of commercial divers under Coast Guard jurisdiction using the distribution of ADCI diving firms as a proxy. Based on the review of the ADCI U.S.-based member firms, 43.9 percent of the firms are marine-oriented firms subject to Coast Guard jurisdiction. Applying this to the number of divers shown in Table 2-1, we estimate that there are 811 commercial marine divers under Coast Guard jurisdiction (1,850 divers from BLS X 43.9 percent).

2.4 Number of Divers and Dive Teams by Type

We use the number of commercial divers by type of activity (Saturation, SCUBA, Mixed-Gas Diving and SSA) and an average number of divers per dive team to derive the number of dive teams operating in the domestic marine environment. Please refer to Appendix A for details.

Table 2-2 Number of Divers and Dive Teams by Type

	Divers	Dive Team Size	Dive Teams**
Total Marine Commercial Divers	811		
Saturation	336	14	24
SCUBA	40	4	10
Mixed-Gas Diving and SSA	435		
Surface Supplied Air (No Decompression)	113	4	28
Surface Supplied Air (Other)	226	5	45
Mixed-Gas Diving	96	5	19
Total	811		126

* Saturation diving involved 12 vessel/firms with 2 teams of 14 divers each. See details above.

** Total may not add due to rounding

¹³ U.S. Bureau of Labor Statistics, Occupation and Wages, May, 2009, <http://bls.gov/oes/2009/may/oes499092.htm>

2.5 Number of Non-ADCI Commercial Diving Firms

Based on the information in Table 2-2, we derived an estimate of 127 dive teams under Coast Guard jurisdiction. If we assume that each ADCI firm has only 1 dive team each, we are left with 40 dive teams that are not accounted for and are either part of multiple dive team firms or are single dive team non-ADCI firms.

In order to allocate dive teams into ADCI and non-ADCI firms, we reviewed revenue and employment information for ADCI firms to determine the number of dive teams that could fit into a firm's revenue stream, knowing also (without detail) that the revenue stream would also account for equipment rental (vessels and sundry equipment). The annual revenue that could be generated by 1 dive team will vary from about \$350,000 (SSA 5 man team) to \$1.3 million for a saturation dive team (14 man team). Obviously the firm's revenue stream will also include equipment rental, with higher fees accruing to more complex diving equipment (SSA being the simplest to the extremely complex saturation diving mode). Of the 75 ADCI firms, 41 have revenues that support 1 dive team each or do not have publicly available revenue estimates (these latter we assume to be small and to have just 1 dive team). Of the remaining firms, 19 have revenue that would need 2 dive teams to support their revenue stream. The remaining 15 firms have revenues that would support multiple dive teams and large equipment rentals (especially large saturation diving vessels). Coast Guard estimates that 36 dive teams would be supported by these firms. Thus, we estimate that the ADCI firms account for 115 dive teams, with the remaining 12 teams distributed to non-ADCI firms. As the non-ADCI firms are expected to be smaller and involved in less complex diving operations, we assume that non-ADCI firms have one team per firm, resulting in an estimate of 12 non-ADCI dive teams (127-115). Therefore, we estimate there are 87 total commercial diving firms that would be impacted by the proposed rule (75 ADCI and 12 non-ADCI). See Appendix A for a detailed tabular presentation

Table 2-3 USCG Regulated Commercial Diving Firms by Type

Item	Type of Diving*					Total
	Sat ¹⁴	Scuba	Surface-Supplied Air		Mixed-Gas	
			100fsw ¹⁵ /(No Decompression)	Other		
ADCI Marine Firms	12	10	13	21	19	75
Inferred Marine Firms	0		5	7	0	12
Total Firms	12	10	18	28	19	87

Source: USCG Calculations

* See Appendix A Calculations

¹⁴ Saturation

¹⁵ feet seawater

Table 2-4 Diving Manning by Dive Mode/Type

Item	Population of Divers by Type					Totals*
	Sat**	Scuba***	Surface-Supplied Air		Mixed-Gas	
			100fsw/(No Decompression)	Other		
ADCI Divers	336	40	93	191	96	756
Non-ADCI Divers	0	0	20	35	0	55
Total	336	40	113	226	96	811

*See Appendix A for detailed calculations

**Number of Saturation vessels*14 crewmen*2

***5 percent of total diver population (USCG program estimate)

2.6 Number of Third Party Organizations

The total number of Third Party Organizations (TPO) is expected to be 12. The TPO population includes 10 current auditors and the two additional estimated to be required by the non-ADCI firms.

3.0 Costs

In this chapter, we present the costs associated with the implementation of the proposed commercial diving regulations. As described in the previous section, this rule would impact owners and operators of commercial diving operations that take place beyond 3 miles (such as those undertaken from deepwater ports, outer continental shelf (OCS)), or from vessels that are required to have a Coast Guard Certificate of Inspection (COI) under 46 CFR 197.202 and operate within 3 miles.

The proposed rule is comprised of six primary cost elements:

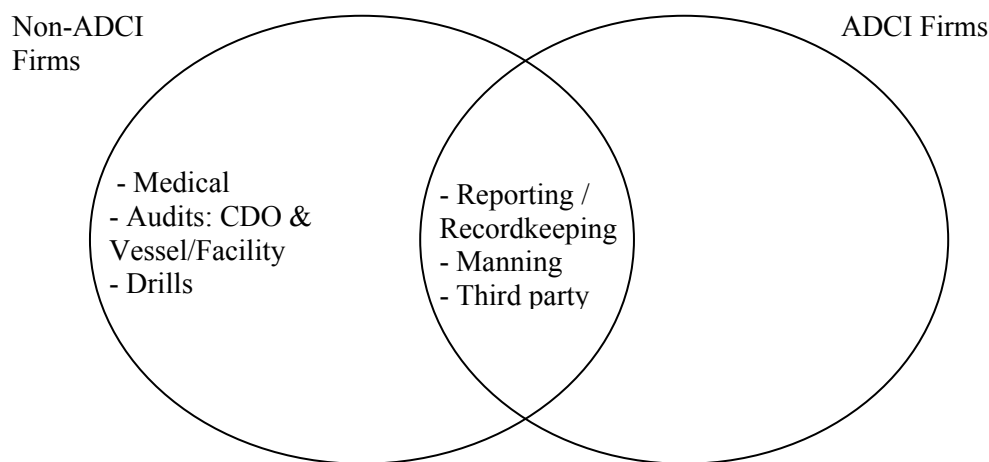
1. Personnel operational requirements
2. Medical requirements;
3. Audits;
4. Drills, and;
5. Reporting and recordkeeping.

In addition, potential third party organization costs are also calculated.

3.1 Baseline

As discussed in Chapter 2, the Coast Guard has found that a significant portion of the commercial diving industry currently is complying with several of the proposed provisions. The Coast Guard has determined there are an estimated 12 firms that are not ADCI members and therefore may not be in compliance with the majority of the proposed rule. Additionally, the entire population of 75 ADCI firms and 12 non-ADCI firms would incur the reporting and recordkeeping requirements and some manning impacts associated with this proposal. However, 12 non-ADCI firms would incur impacts from all five cost components. Please see Figure 3-1 which follows for a breakdown of cost impact by population.

Figure 3-1 Cost Impact by Population



3.2 NPRM Cost Methods

We derived cost estimates for each element by using a function of three parameters: affected population, annual unit costs of the proposed requirements, and baseline level of compliance within the industry. Baseline compliance may result from other existing regulations, industry standards, or requirements from the companies that contract out commercial diving operations.

We based other cost inputs such as labor hours and paperwork costs on discussions with Coast Guard subject matter experts. We derived wage estimates from the Bureau of Labor Statistics using North American Industry Classification System (NAICS) codes that best fit the skill set of the commercial diving industry. We use a load factor of 1.47¹⁶, developed from Quarter 1, 2004 through Quarter 1, 2012 Total and Salary Compensation data, to provide the fully loaded wage rates presented in the table which follows. In Table 3-1, we list the labor categories used in this analysis.

Table 3-1 Hourly Wage by Labor Category

Labor Category	Wage Estimate Percentile	Hourly Wage Rate	Loaded Wage
Apprentice (Diver Tender)	25th	\$17.06	\$25.08
Median Experience Diver	50th	\$22.54	\$33.13
Experienced Diver (Saturation)	90th	\$45.15	\$66.37

Source: <http://bls.gov/oes/2012/may/oes499092.htm> * 1.47 load factor

3.3 Industry Requirements and Cost

In this section, we describe the proposed requirements and their respective cost estimates: personnel operational requirements, medical requirements, audits, drills, and reporting and recordkeeping requirements

3.3.1 Personnel Operational Requirements §197.290

The operations requirements listed in section § 197.290 would be the primary cost-drivers in this analysis. This provision would require a minimum number of personnel for each dive operation. Based on the aforementioned baseline assumptions, we expect this provision would result in cost increases to only the following dive mode¹⁷: surface-supplied air. That mode would be required to add one new member to their dive team and would apply to both ADCI and non-ADCI firms. The purpose of increasing the size of the dive teams is to increase safety by further defining the roles and responsibilities on dive teams.

3.3.1.1 Surface-Supplied Air: No Decompression

For surface-supplied air: no decompression, we propose to add a dive team member to increase the dive team size from four to five. The current dive team is composed of a dive team supervisor, primary diver, a tender and a standby diver. The proposed dive team will be composed of a dive supervisor, a primary diver, a tender, a standby diver, and a standby diver tender. The net addition is the dive team tender. A standby diver must be fully dressed and either in the water as a safety diver, or capable of entering the water within 1 minute, at the dive supervisor's direction, to support a diver in distress. The tender's only duty is to support the working diver. Please see the table below for additional details on team members.

¹⁶ Derived using the average of the most recent 33 quarters of total compensation/salary compensation.
<http://data.bls.gov/cgi-bin/dsrv>

¹⁷ Dive modes are defined in section 2.1 Industry Profile

Table 3-2 NPRM Team Member Requirements

Team Member	Personnel for Surface-Supplied Air No Decompressed Mode	Role
Dive Supervisor (DS)	1	Supervise overall dive operation
Primary Diver (PD)	1	Main diver
Tender (T)	1	Support working diver and perform other duties directly supporting dive in progress (e.g. tend umbilical power and air lines).
Standby Diver (SD)	1	Support diver in distress. Be fully dressed and either in the water as a safety diver, or capable of entering the water within one minute, at DS direction.
Standby Diver Tender (SDT)	1	May perform other duties directly supporting dive in progress, with the exception of when the tender's SD is deployed. When the SD is deployed, the SDT must attend to SD only (e.g. tend umbilical power and air lines).

The USCG current dive team manning requirements are also consistent with current ADCI requirements and the proposed rule increment in Table 3.3. Since we have emulated ADCI requirements throughout much of this rulemaking, we thought a comparison necessary. As can be seen, the manning requirements proposed in this rulemaking match current industry practice as delineated in ADCI requirements with the exception of Surface Supplied Air: No Decompression, where the Coast Guard adds one member. Coast Guard also adds seven members to Saturation dive teams from the current number. However, the new number equals the current ADCI number so there effectively is no net gain (nor costs) over current protocols in the industry.

Table 3-3 Comparison of Commercial Diving Manning Requirements

Current	Diving Type					
	Saturation	SCUBA	Surface-Supplied Air 0- 100* fsw	Surface-Supplied Air Decompression 01-100 fsw	Surface-Supplied Air Decompression 101-190 fsw	Mixed-Gas
USCG Current	7	4	4	5	5	5
USCG Proposed	14	4	5	5	5	5
USCG Delta	7	0	1	0	0	0
ADCI Current	14	4**	4**	5	5	5

Source: CFR 46§197.430, 432, and 434, USCG Proposed Rule, ADCI 6th Edition Standards

*No Decompression.

** For complex dives, ADCI recommends a minimum of 4 personnel.

3.3.1.2 Total Manning Costs

We describe costs for the changes to surface-supplied air diving (no decompression) in the table below. To calculate total annual cost impact, we multiply the hourly wage rate by the number of working hours per year, which gives us the annual cost per diver (their totally loaded annual wage). We then multiply the annual cost per diver by the additional number of divers proposed in this rule.¹⁸ The key to this calculation is the estimation of the incremental divers affected. Using BLS and ADCI data, we estimated the incremental divers for both the ADCI marine dive firms and the non-ADCI marine dive firms (see Appendix A and Ch. 2 write up of population development). While it is likely some divers are hired on a per-job basis, especially for the smaller firms, we have assumed that all additional divers are full-time equivalent employees. That assumption likely results in a higher industry cost than what is likely current practice. The industry annual impact is presented in Table 3-4a, b, and c. We estimate the total annual incremental cost from increased manning requirements at \$1.46 million.

Table 3-4a ADCI Commercial Diving Personnel Cost Increment

Item	Dive Mode		
	Surface Supplied Air	0-100 fsw No Decompression	Total
Loaded Annual Wage	No. Divers	Cost	
\$52,163	23	\$1,199,741	\$1,199,741

Source: USCG Calculations, Appendix A Tables 2.3 and 2.4

No. divers truncated average

¹⁸ See Appendix A for calculation details

Table 3-4b Non-ADCI Commercial Diving Personnel Cost Increment

Item	Type of Diving		
	Surface Supplied Air	0-100 fsw No Decompression	Total
Loaded Annual Wage	No. Divers	Cost	
\$52,163	5	\$260,813	\$260,813

Source: USCG Calculations, Appendix A Tables 2.3 and 2.4

No. divers truncated average

Table 3-4c Total Commercial Diving Personnel Cost Increment

Item	Type of Diving		
	Surface Supplied Air	0-100 fsw No Decompression	Total
Loaded Annual Wage	No. Divers	Cost	
\$ 52,163	28	\$1,460,554	\$1,460,554

Source: USCG calculations, Appendix A. See Tables 2.3 and 2.4

No. divers truncated average

3.3.2 Medical Requirements §197.250

Medical fitness for commercial diving has become an important safety issue in recent years. There have been fatalities directly attributed to medical issues. The proposed rule would require the diver to complete medical examinations and to demonstrate compliance to the dive supervisor. The dive supervisor must ensure all divers have met the required medical fitness exams and must maintain a copy of those records for 5 years.

A medical exam is required every year. In this exam, the diver must demonstrate both physical and mental capacity to work in a hyperbaric environment. In order to estimate the costs of the medical exam requirements, we analyzed two sources of information: interview with a commercial diver, and an interview with a medical staff member specializing in commercial diver health. The average cost of a medical exam (\$400), was then multiplied by the estimate of commercial divers at risk (60) for an annual medical cost of \$24,000. We include medical storage costs (\$25) per diver which increases the total annual cost to \$25,500¹⁹. We present the cost details in the table below that average to be \$2,125 per firm.

Table 3-5 Commercial Diving Medical Examination Costs*

item	Cost (\$)	AverageCost (\$)	No. Divers Affected	Industry Segment Cost (\$)	Affected Firms
GoM Source 1	350				
GoM Source 2	450				
Industry Segment Total		400	60	24,000	12
Annual Medical Record Storage	25		60	1,500	12
Total				25,500	
Cost per Firm				2,125	

Source: USCG Calculations

*Estimated using BLS and ADCI membership information and discussions with Commercial Diving operators and diving support staff.

As mentioned above, this cost applies to the 12 firms that we cannot confirm as meeting current industry practice. The costs per company to complete the required medical examinations, including records maintenance, are estimated at \$1,984

3.3.3 Medical Training§197.240

First aid preparedness for commercial diving has become an important safety issue in recent years. Fatalities have occurred in the last ten years that may have been averted if prompt medical attention was available. Section 197.240 (b) requires all divers to have cardiopulmonary resuscitation (CPR) and first aid training.

The proposed regulation codifies ADCI 6th edition regarding first aid preparedness. According to their protocols, all dive team members, except for 4 members associated with saturation diving (life support technician and saturation technician, 2 each), already require this training. The proposed regulation requires that all dive team members, in all dive team modes, are required to have CPR and first aid certification. This ensures the remaining 4 dive team members are also properly trained.

¹⁹ Storage costs are DVD costs and computer time.

This proposal requires initial training and biennial training updates in order to maintain a constant certification. Those dive team members required by ADCI protocols to have this certification are not included in our cost analysis since they are already required to have this training and the corresponding updates. According to the American Red Cross, OSHA level CPR and First Aid training is done initially for certification and then updated every two years thereafter. The initial certification costs \$60/person. The biennial updating also costs \$60/person.²⁰ Given that only 4 of the 14 members of a saturation diving team are required to meet this USCG regulation (all other team members are doing this now as part of their ADCI membership requirements), with 2 teams per boat, and 12 boats estimated to populate saturation diving in the U.S. (mostly Gulf of Mexico), the total biennial cost is \$5,760 as shown in Table 3-6.

Table 3-6 Commercial Diving Medical Training Annual Cost

	Crew at Risk	No. Boats	Crews/Boat	Total
Saturation Crews	4 of 14	12	2	96
American Red Cross Training Cost			\$ 60	
Biennial Cost	Total Crew at Risk * Cost		\$ 5,760	

Source: USCG Calculations

3.3.4 Audits §197.210-213

The proposed rule requires internal audits as well as third-party, commercial diving auditors utilizing universally recognized auditing methodologies to serve as Coast Guard-approved entities for auditing purposes.²¹ Section 197.209 proposes auditing to be done internally as well as by third parties. The auditing will be of the commercial diving operations (CDO) as well as any vessels or facilities involved with the CDO.

We calculate the two sets of audits (CDO and vessels/facilities) separately. We estimate a CDO audit could take up to five working days. The cost of each audit is based on its complexity with expected fees or labor cost charged by the auditor. The rule proposes two types of audits that are expected to have similar labor and time requirements.

The proposed rule requires an internal audit to be accomplished once a year according to Section 197.210. Section 197.211 of the proposed rule requires an external audit to be conducted twice in a 5-year period.

Tables 3-7a and 3-7b provide the CDO audit cost components including the labor hours needed by the commercial diving operation as well as the fee charged by the lead auditor. We estimated that a commercial diving auditor or commercial diving operator with equivalent experience to an auditor can command a 25 percent higher rate than the median experienced diver (see Table 3.1) and so applied a

²⁰ Conversation with ADCI management reveals their understanding of this oversight which will be corrected in an updating of the sixth edition at some unspecified future time.

²¹ See Appendix D for ADCI audit requirements

1.25 factor to the loaded wage rate of a median experienced diver (See Table 3.1) to represent the auditor rate of \$41.42 per hour. We then factored in an additional 25 percent of overhead that the auditor would charge a vessel or facility owner/operator.²² As a result, we estimate the total cost of an audit to the commercial diving firm is equivalent to \$51.77 per hour (\$41.42*1.25). The total auditor cost of \$51.77/hour is then multiplied by 5 working days or 40 hours (estimated duration of audit). The rule requires at least one internal audit per year for a total company cost of \$2,096 plus two external audits every 5 years. Since the external audits can occur anytime within a 5-year period, we distribute the costs evenly across a 5-year period. The total annual cost for the external audits is \$10,060, while the total annual cost for an internal audit is \$25,150. As discussed above for external and internal audits,, we estimate 12 firms (non-ADCI) will be impacted by this provision for a total industry cost of \$35,210 per year.

Table 3-7a Commercial Diving Rule Annual Internal Audit Costs

Wage Rate (Median Experienced Diver)	\$22.54
Hourly Loaded Rate	\$33.13
Auditor Rate	\$41.42
Total Company Labor Rate for Audit	\$51.77
Annual Data Storage	\$25.00
Hours (Days) to Complete Audit	40 (5)
Per Firm Audit Cost	\$2,096
Industry Cost (12 non-ADCI firms)	\$25,150

Source: USCG Calculations

Total Company Labor Cost (\$51.77)*Hours to Complete (40) + Data Storage Cost (\$25) = \$2,096 per Firm

Table 3-7b Commercial Diving Rule Annual External Audit Costs*

Wage Rate (Median Experienced Diver)	\$22.54
Hourly Loaded Rate	\$33.13
Auditor Rate	\$41.42
Total Company Labor Rate for Audit	\$51.77
Annual Data Storage	\$25.00
Hours (Days) to Complete Audit	40 (5)
Per Firm Audit Cost	\$838
Industry Cost (12 non-ADCI firms)	\$10,060

Source: USCG Calculations

*Note: Two audits every five years, .4 of an audit annually (\$2,096 * .4 = \$838 per Firm

²² Physical overhead is all office expenses including desk, computer, supplies, etc.

As previously stated, the rule requires both internal and external vessel or facility audits. Internal audits are to be conducted once per year, while external audits, by an impartial third-party auditor, are to be conducted twice in a 5-year period. Since vessel or facility audits are less complex than a commercial diving operation audits, we expect the audit to last 8 hours compared to 40 hours for the CDO audit. Using the same assumptions as for the CDO audit, we calculate the cost of both an internal and external audit for an associated vessel or facility. Similar resource requirements are necessary, including an auditor with equivalent maritime experience. As before, the costs (\$7,378 annually) of internal and external audits are estimated as presented in Tables 3-7c and d. The total annual cost of the internal and external auditors for vessels/facilities and CDOs is estimated at \$42,589.

Table 3-7c Commercial Diving Rule Vessel Annual Internal Audit Costs

Wage Rate (Median Experienced Diver)	\$22.54
Hourly Loaded Rate	\$33.13
Auditor Rate	\$41.42
Total Company Labor Rate for Audit	\$51.77
Annual Data Storage	\$25.00
Hours (Days) to Complete Audit	8 (1)
Per Firm Audit Cost	\$439
Industry Cost (12 non-ADCI firms)	\$5,270

Source: USCG Calculations

Total Company Labor Cost (\$51.77)*Hours to Complete (8) + Data Storage Cost (\$25)
= \$439 per Firm

3/ Typical audit should take just one day.

Table 3-7d Commercial Diving Rule Vessel Annual External Audit Costs*

Wage Rate (Median Experienced Diver)	\$22.54
Hourly Loaded Rate	\$33.13
Loaded Rate * Loaded Auditor	\$41.42
Total Company Labor Rate for Audit	\$51.77
Annual Data Storage	\$25.00
Hours (Days) to Complete Audit	8 (1)
Per Firm Audit Cost	\$176
Industry Cost (12 non-ADCI firms)	\$2,108

Source: USCG Calculations

Note: Two audits every five years, .4 of an audit annually (439 * .4 = \$176)

3.3.5 Drills Requirement §197.220

The proposed rule requires each commercial diving operation conduct diving drills on a monthly or quarterly basis. The types and frequencies of drills are described in Table 3-8.

Table 3-8 Section 197.220(d) – Drill requirements.

Requirement	Explanation
Ensure that each dive team member can perform his or her assigned dive team duties	Drill at least once every 30-calendar days, before initiating a commercial diving operation at a new dive location, when adding a new member to the dive team, or whenever you change an emergency drill procedure described in the operations manual.
Diver recovery	At least once every 90 days, drill on: (1) deployment of standby divers; (2) recovery of a diver from depth to a decompression chamber and first aid station; and (3) for dive systems utilizing hyperbaric rescue chambers or hyperbaric rescue craft, a full launch and recovery drill.
Dive modes	For each dive mode you use, drill using the unique equipment, personnel, and operational procedures required by that mode. Note that this requirement just means that the three types of drills are for each specific dive mode used by the commercial dive operator on a specific job.
Emergency rescue	Drill at least once every 30 calendar days. Ensure that personnel can successfully deploy the equipment and perform the procedures described in the operations manual for emergency rescue (but you do not have to deploy the emergency aviation resources or vessels you would need required to transport divers to offsite medical facilities).

We allocate costs to the 10 non-ADCI companies since we do not have evidence that this segment of the population is currently conducting drills that would meet the requirements of the proposed rule. As previously stated, we expect that ADCI firms are doing drills now. We expect the non-ADCI firms to be small and are likely to be using the simplest of non-SCUBA diving modes SSA (no decompression), given market forces for more complex diving (i.e., mixed-gas diving operations), with contracts requiring ADCI as discussed previously. Consequently, we assess drill costs only to non-ADCI firms and only for select SSA (no decompression) modes. The cost of the Standard Operations Review drill is developed based upon an estimate of 30 minutes per drill, once a month and for labor costs only. The labor category used is the median experienced diver loaded wage (\$33.13). The Diver Recovery and Emergency Rescue drills are estimated to last one hour. We present costs for an average of ten Surface-Supplied Air diving operations. Since the Diver Recovery drill is conducted once every 90 days, the monthly cost is one third that of the Emergency Rescue drill. The total annual cost of drills is estimated at \$43,729. See Tables 3-9a through 3-9d for further details.

**Table 3-9a Commercial Diving Proposed Drill Costs
(Standard Operations Review)**

Diving Type	Loaded Wage/hr	Crew	Time/Month (hours)	Monthly Cost	Annual Cost	Non-ADCI Firm No.	Total Annual Cost
Surface Supplied Air No Decomp	\$33.13	5	0.5	\$82.83	\$994	5	\$4,970
Surface Supplied Air Other	\$33.13	5	0.5	\$82.83	\$994	7	\$6,958
Total							\$11,928

Source: USCG Calculations

**Table 3-9b Commercial Diving Proposed Drill Costs
(Diver recovery)**

Diving Type	Loaded Wage/hr	Crew	Time/Month (hours)*	Monthly Cost	Annual Cost	Non-ADCI Firm No.	Total Annual Cost
Surface Supplied Air No Decomp	\$33.13	5	0.333	\$55.17	\$662	5	\$3,310
Surface Supplied Air Other	\$33.13	5	0.333	\$55.17	\$662	7	\$4,634
Total							\$7,944

Source: USCG Calculations

*Drill every 3 months, so monthly cost is .333 of that amount.

**Table 3-9c Commercial Diving Proposed Drill Costs
(Emergency Rescue)**

Diving Type	Loaded Wage/hr	Crew	Time/Month (hours)	Monthly Cost	Annual Cost	Non-ADCI Firm No.	Total Annual Cost
Surface Supplied Air No Decomp	\$33.13	5	1	\$165.67	\$1,988.03	5	\$9,940
Surface Supplied Air Other	\$33.13	5	1	\$165.67	\$1,988.03	7	\$13,916
Total							\$23,856

Source: USCG
Calculations

Table 3-9d Commercial Diving Total Proposed Drill Costs

Diving Type	Standard Operations Review (Table 3-9a)	Diver Recovery (Table 3-9b)	Emergency Rescue (Table 3-9c)	Total Annual Cost
Surface Supplied Air No Decomp	\$4,970	\$3,310	\$9,940	\$18,220
Surface Supplied Air Other	\$6,958	\$4,634	\$13,916	\$25,508
Total	\$11,928	\$7,944	\$23,856	\$43,729

Source: USCG
Totals may not sum due to rounding.

3.3.6 Reporting and Recordkeeping Costs

The proposed rule requires each commercial diving operation to perform documentation preparation and maintenance tasks that fall under the category of reporting and recordkeeping. This documentation provides a historical record of when a piece of equipment was inspected or serviced and by whom. The process will also include the documentation of new equipment as often as new equipment is added to a firm's asset base. In addition, the documentation also takes into account logbook entries of diving activities as well as maintenance of logbooks, audit reporting, and updates to operations manuals. We expect these costs to be incurred by the entire population of commercial diving operations since these record requirements exceed ADCI requirements.

In Table 3-10, we provide the costs of reporting and recordkeeping per requirement. The total annual cost is \$205 thousand.

Table 3-10 Private Sector Records and Documentation Costs

Description of Reporting and Recordkeeping Requirement	Number per Year (A)	Burden Hours per Action (B)	Burden Hours C= (B*D)	Reponses D= (A*F)	Unit Cost (E)	Entities (F)	Annual Cost (C*E)
Pre-audit notification: CDO 1/	0.4 (Twice every 5 years)	0.2	6.96	34.8	\$33.13	87	\$231
Pre-audit notification: Vessels/Facilities 2/	0.4 (Twice every 5 years)	0.2	6.96	34.8	\$33.13	87	\$231
Written Designation of Employee's Individual Roles	10 (estimated dives per year)	1	870	870	\$33.13	87	\$28,823
Operational Drill Documentation	12	0.5	522	1044	\$33.13	87	\$17,294
Diver Recovery Drill Documentation	4	0.5	174	348	\$3.13	87	\$5,765
Emergency Rescue Drill Documentation	12	0.25	261	1044	\$33.13	87	\$8,647
Document Compliance with Subpart and Maintain Record 3/	<u>2 (once every 5 years)</u>	0.1	1.74	17.4	\$33.13	87	\$58
Officer in Charge, Marine Inspection Dive Notice	10 (estimated dives per year)	1	870	870	\$33.13	87	\$28,823
Dive supervisor provides the PIC with a report on planned operation	10 (estimated dives per year)	1	870	870	\$33.13	87	\$28,823

Description of Reporting and Recordkeeping Requirement	Number per Year (A)	Burden Hours per Action (B)	Burden Hours C= (B*D)	Reponses D= (A*F)	Unit Cost (E)	Entities (F)	Annual Cost (C*E)
Detailed plans of the area and subject of the work to be performed	10 (estimated dives per year)	1	870	870	\$33.13	87	\$28,823
Logbook Maintenance	10 (estimated dives per year)	0.5	435	870	\$ 33.13	87	\$14,412
Logbook Updates per Operation	10 (estimated dives per year)	0.2	174	870	\$33.13	87	\$5,765
Modify Operations Manual	10 (estimated dives per year)	1	870	870	\$33.13	87	\$28,823
Retention of Casualty Reports	as needed (estimate 1 year)	0.5	43.5	87	\$33.13	87	\$1,441
Commercial Diving Operator: Maintain Equipment Logbook	as needed (estimate 1 year)	1	87	87	\$33.13	87	\$2,882
PIC Equipment: Maintain Equipment Logbook	as needed (estimate 1 year)	0.5	43.5	87	\$3.13	87	\$1,441
Dive Supervisor: Maintain Equipment Logbook	as needed (estimate 1 year)	0.25	21.75	87	\$33.13	87	\$721

Description of Reporting and Recordkeeping Requirement	Number per Year (A)	Burden Hours per Action (B)	Burden Hours C= (B*D)	Reponses D= (A*F)	Unit Cost (E)	Entities (F)	Annual Cost (C*E)
Diver: Maintain Equipment Logbook	as needed (estimate 1 year)	0.25	21.75	87	\$33.13	87	\$721
SSA Helmets: Maintain Compliance Log	as needed (estimate 1 year)	0.25	11	44	\$33.13	44	\$364
Maintain Equipment Service Information	as needed (estimate 1 year)	0.25	21.75	87	\$33.13	87	\$721
Sign for Equipment use with oxygen mixture: "FOR OXYGEN ONLY"	as needed (estimate 1 year)	0.1	8.7	87	\$33.13	87	\$288
TOTAL			6191				\$205,095

1) This event occurs twice in a 5-year period. Therefore, total cost is multiplied by 0.4 in order to distribute cost and burden over 5 years.

2) This event occurs twice in a 5-year period. Therefore, total cost is multiplied by 0.4 in order to distribute cost and burden over 5 years.

3) This event occurs once in a 5-year period. Therefore, total cost is multiplied by 0.2 in order to distribute cost and burden over 5 years.

In addition to the reporting and recordkeeping costs, the Coast Guard expects the 12 Non-ADCI members will need to purchase Version 6 of the ADCI standards, which is codified in this proposed rule. The cost of the ADCI 6th edition is \$275, for a total cost of \$2,750, which we add to the first-year costs of the rule.

3.3.7 Government Cost

We estimate the annual government cost of the proposed rule will be \$29,000 per year. Government costs consist of records maintenance and documentation by an auditor on behalf of the government as well as a review of audit reports and a review of compliance documentation by the Coast Guard. We assume an auditor assistant will need perform the records maintenance and will need to have knowledge of the industry beyond the apprentice level. Therefore, we estimate the unit cost of an auditor assistant will be equivalent to the median loaded wage of a commercial diver (\$33.13). A GS-13 equivalent will review

the audit reports and compliance documentation for the Coast Guard (\$79/hour)²³. See Table 3-11 below for further details on the cost calculation.

Table 3-11 Government Records and Documentation Costs

Regulation	Burden per Action (hrs.) A	Responses B	Burden Hours C= (A*B)	Unit Cost (\$/hr.) D	Annual Cost E=(C*D)
Auditors: Records Maintenance 1/	0.2	87	17.4	\$33.13	\$115
Auditors: Audit Documentation 2/	0.8	87	69.6	\$33.13	\$922
Auditor: Review Audit Results	2	87	174	\$ 79.00	\$13,746
CG: Review Documentation of Commercial Diving Compliance	2	87	174	\$79.00	\$13,746
Total		348	435		\$28,530

1)This event occurs once in a 5-year period. Therefore, total cost is multiplied by 0.2 in order to distribute cost and burden over 5 years.

2)This event occurs twice in a 5-year period. Therefore, total cost is multiplied by 0.4 in order to distribute cost and burden over 5 years.

3.3.8 Third Party Organizations

In addition to modernizing CG rulemaking regarding commercial diving, an ancillary purpose of the NPRM is to facilitate the use of Third party Organizations (TPOs) to ensure regulatory compliance. The TPO usage has a long and useful history in Coast Guard to conduct a variety of tasks such as various inspections. By allowing industry into this activity, Coast Guard believes that it is saving budget money and resources better spent elsewhere. In Coast Guard's view, there is essentially no cost differential between TPO and USCG resources, so the money saved is based upon resources that could be used elsewhere and not a differential between civilian and USCG.

The proposal will result in certain costs to the TPO for being involved in this activity. The rule expects certain requirements to be fulfilled as part of the TPO responsibilities. These include the following items:

3.3.8.1 §197.209(d) Obtaining Initial Approval as a Third-Party Auditor

The proposed rule would require that an organization wishing to be approved as a third party submit an application to the Coast Guard. Given that auditors are already servicing the ADCI membership just two new auditors will likely be required. We estimate 16 hours of labor at the wage rate for a senior diver for each application, (according to the BLS and loaded of \$66.07 per hour) to prepare an application. This would bring the undiscounted cost to \$2,124 in the first year with no other approvals expected in the ten year planning horizon.

²³ Commandant Instruction 7310.1N , In-Govt. Hourly Rates. Memorandum of the USCG Commandant entitled "Coast Guard Reimbursable Standard Rates" dated February 28, 2011 and numbered COMDTINST 7310.1N, Enclosure 2 as found on www.uscg.mil/directives/ci/7000-7999/CI_7310_1M.pdf.

3.3.8.2 §197.209 (e): Notifying Coast Guard of Changes in Auditor

The proposed rule would require that, to add an auditor, the organization must submit the experience, background and qualifications to the Coast Guard for approval. In addition, the Coast Guard would need to be notified when an auditor is removed from employment. We estimate that 1 potential third-party auditor, based on information from ADCI, would need to notify Coast Guard of changes in personnel each year. The implementation of this requirement would begin in Year 2 and continue annually hereafter. We estimate 15 minutes of labor at the wage rate of a senior diver (based upon the BLS loaded rate of \$66.37 per hour). This would bring the undiscounted annual cost to \$16.59 per year beginning in Year 2 with one projected change per year times 12 auditor as a maximum activity (however unlikely) over the planning period. Total cost for this element will be \$1,792.

3.3.8.3 §197.213: Audit Reporting

The proposed rule would require that a third-party auditor retain the results of each audit conducted under its approval, including information pertaining to:

- (a) The names of the auditors;
- (b) The results of each audit conducted; and
- (c) Records of the continuing actions relative to an audit, such as resolution of deficiencies and non-conformities.

We estimate that the current 10 third-party auditors and two potential new ones, based on information from the ADCI, would need to retain documentation for five years as required by rule. The implementation of this requirement would begin in Year 1 and continue annually thereafter. We estimate 1 hour of labor at the wage rate for a senior diver, according to the BLS, of \$66.37, loaded, per hour and a cost of \$25 for electronic storage. The undiscounted annual cost would be \$474 beginning in Year 1 plus \$25 in the first year for electronic storage

3.3.8.4 Total Third Party Auditor Costs

Total annual costs for TPO activities required by the rule should be no more than \$1,296 per year except for the first year when the new auditors have to be approved. There is no change in current auditors for the first year and everything else is the same. That first year will cost will be an extra \$3,220 but with no change in auditor cost.

Table 3-12 Total Third Party Auditor Costs (\$)

Year	TPO Auditor Approval /1	Notifying Change /2	Auditor Reporting Cost	CD	Total
1	2,124		796	300	3,220
2		199	796	300	1,296
3		199	796	300	1,296
4		199	796	300	1,296
5		199	796	300	1,296
6		199	796	300	1,296
7		199	796	300	1,296
8		199	796	300	1,296
9		199	796	300	1,296
10		199	796	300	1,296
Total	2,124	1,792	7,964	3,000	14,880

Source: USCG Calculations

1/ 2 Auditors * Loaded BLS Senior Diver wage

2/ 1 Auditor Change Notice Costs* 12

3/ Auditor Report @ 1 hr * Loaded BLS Senior Diver wage

3.3.9 Summary of Cost Impact on a Per Firm Basis

This proposed rule calls for CDOs and commercial divers to comply with a new regulatory baseline that is based on the industry-developed consensus standards of ADCI plus certain CG additions (in manning and medical area). We believe the majority (75 out of 87 identified commercial diving firms) of the affected population is in compliance with the proposed baseline. We know that the 75 ADCI firms are in general (except for manning and medical upgrades from CG) in compliance or else they would not qualify for ADCI membership. Members of ADCI must meet the Association's standard or face a suspension of their membership and potential loss of contracts. For example, ADCI members who fail an ADCI audit inspired by a complaint or a random audit exercise, are given time to correct the deficiency. If the deficiency is not corrected in a reasonable time, ADCI will (and has in the past) disenroll the offending member. Members generally know this is a dangerous route to take as the re-enrollment process is very expensive, requiring complete audits of every facet of their operation. In general, not having the ADCI certification will likely result in fewer work opportunities particularly with the oil and natural gas industries.²⁴

We have no gauge of any compliance for the inferred non-ADCI firms. However, we anticipate that some CDOs and divers will need to take steps to ensure compliance with the proposed audit system, drills and exercises, medical examination requirements, personal operational requirements, and reporting/recordkeeping requirements. We assessed the costs for these CDOs and divers not already in compliance with ADCI (based upon the twelve Non-ADCI firms), as well as for all CDOs and divers to meet the other requirements added by the Coast Guard.

The costs impacting this rule are from changes in requirements in Dive manning, Drills, Audits, Med Issues, Records and Documentation as well as Third Party Activity. Total dive manning industry

²⁴ Conclusions based upon various USCG conversations with industry participants.

requirements are based upon 28 (23 ADCI and 5 non-ADCI) incremental divers in that SSA mode. Audits are required both internally and by external means (TPO) and range from \$176-\$2,096 depending on the cycle or vessel/firm. Drills can cost from \$3,300-\$14,000 per drill/firm depending on type (Standard Operations Review, Diver Recovery, or Emergency Rescue) for an annual total cost of \$18,000-26,000. Medical costs comprise two items: The first item is an annual medical exam for the 55 non-ADCI divers while the second is a biennial training session on cardiopulmonary resuscitation (CPR) and first aid for Saturation Technicians that were not ADCI required (an oversight expected to be corrected in the near future) training. The costs of the first medical item are the 55 non-ADCI divers times the annual medical examination costs plus the records storage costs for a total \$23,375 or (\$1948 per firm). The second cost is the \$60 cost of the training every other year times the Saturation Technicians (96) for a total of \$5,760.

Costs for CDOs are shown in Table 3-13.

Table 3-13 Average Cost per Firm: Commercial Diving NPRM

Rule Requirements	Cost per CDO (2012 \$)
Dive Manning	52,163
Drills	18,220 - ,25,508
Audits	3,549
Recordkeeping & Documentation	2,331
Medical I: Exams	1,948
Medical II: Training	240
Total	78,211 - 85,499

Source: USCG Calculations

3.3.10 Total Cost

We estimate the total private sector cost of this rulemaking over a 10-year period of analysis as \$17.8 million. We discounted the annual costs at 7 percent and also annualized the total costs at the same rate. The annualized cost of this proposed rule at a 7-percent discount rate is \$1.78 million. Due to the differences in expected current compliance in segments of the industry (discussed above), we provide various costs broken down by ADCI and non-ADCI portions of the industry, as well as total costs shown in Table 3-13a to 3-13c. Total costs of the proposed rule including \$28,530 in annual government costs are \$18.1 million over a 10-year period and \$1.81 million annualized at a seven and three percent discount rates.

Table 3-14a Total Cost (\$) of Commercial Diving Rule (ADCI Commercial Divers)

Year	Drills	Dive Manning/1	Audits	Recordkeeping & Documentation/2	Medical Issues	Third Party	Total	Disc @ 7%	Disc @ 3%
1		1,199,741		176,806	5,760	914	1,383,221	1,292,730	1,342,933
2		1,199,741		176,806		1,080	1,377,627	1,203,272	1,298,545
3		1,199,741		176,806	5,760	1,080	1,383,387	1,129,256	1,265,995
4		1,199,741		176,806		1,080	1,377,627	1,050,985	1,224,003
5		1,199,741		176,806	5,760	1,080	1,383,387	986,336	1,193,321
6		1,199,741		176,806		1,080	1,377,627	917,971	1,153,741
7		1,199,741		176,806	5,760	1,080	1,383,387	861,504	1,124,820
8		1,199,741		176,806		1,080	1,377,627	801,791	1,087,511
9		1,199,741		176,806	5,760	1,080	1,383,387	752,471	1,060,251
10		1,199,741		176,806		1,080	1,377,627	700,316	1,025,084
Total		11,997,411		1,768,060	28,800	10,630	13,804,901	9,696,630	11,776,204
Annualized								1,380,582	1,380,530
Source: USCG Calculations									
1)From Table 3-4a									

Table 3-14b Total Cost (\$) of Commercial Diving Rule (Non-ADCI Commercial Divers)

Year	Drills /1	Dive Manning /2	Audits /3	Recordkeeping & Documentation/4	Medical Issues	Third Party	Total /6	Disc @ 7%	Disc @ 3%
1	43,729	260,813	42,589	28,288.95	25,500	2,307	406,526	379,931	394,685
2	43,729	260,813	42,589	28,288.95	25,500	216	401,135	350,367	378,109
3	43,729	260,813	42,589	28,288.95	25,500	216	401,135	327,446	367,096
4	43,729	260,813	42,589	28,288.95	25,500	216	401,135	306,024	356,404
5	43,729	260,813	42,589	28,288.95	25,500	216	401,135	286,004	346,023
6	43,729	260,813	42,589	28,288.95	25,500	216	401,135	267,294	335,945
7	43,729	260,813	42,589	28,288.95	25,500	216	401,135	249,807	326,160
8	43,729	260,813	42,589	28,288.95	25,500	216	401,135	233,465	316,660
9	43,729	260,813	42,589	28,288.95	25,500	216	401,135	218,191	307,437
10	43,729	260,813	42,589	28,288.95	25,500	216	401,135	203,917	298,482
Total	437,287	2,608,133	425,886	282,889.53	255,000	4,251	4,009,195	2,822,446	3,427,001
Annualized								401,853	401,749

Source: USCG Calculations

1) From Table 3-8d

2) From Table 3-4b

3) Total drawn from Tables 3-6a through 3-6d

4) 14% (12 firms out of 87) of total cost from Table 3-9

5) From Table 3-5

6) Includes 6th ed. ADCI Standards for \$3,300 in Year 1

Table 3-14c Total Cost (\$) of Commercial Diving Rule

Year	Drills	Dive Manning	Audits	Recordkeeping & Documentation/1	Medical Issues	Third Party	Total /2	Disc @ 7%	Disc @ 3%
1	43,729	1,460,554	42,589	205,095	31,260	3,220	1,789,747	1,672,660	1,737,618
2	43,729	1,460,554	42,589	205,095	25,500	1,296	1,778,762	1,553,640	1,676,654
3	43,729	1,460,554	42,589	205,095	31,260	1,296	1,784,522	1,456,702	1,633,091
4	43,729	1,460,554	42,589	205,095	25,500	1,296	1,778,762	1,357,009	1,580,407
5	43,729	1,460,554	42,589	205,095	31,260	1,296	1,784,522	1,272,340	1,539,344
6	43,729	1,460,554	42,589	205,095	25,500	1,296	1,778,762	1,185,264	1,489,685
7	43,729	1,460,554	42,589	205,095	31,260	1,296	1,784,522	1,111,311	1,450,980
8	43,729	1,460,554	42,589	205,095	25,500	1,296	1,778,762	1,035,256	1,404,171
9	43,729	1,460,554	42,589	205,095	31,260	1,296	1,784,522	970,662	1,367,688
10	43,729	1,460,554	42,589	205,095	25,500	1,296	1,778,762	904,232	1,323,566
Total	437,287	14,605,544	425,886	2,050,949	283,800	14,881	17,821,646	12,519,076	15,203,204
Annualized								1,782,435	1,782,279

Source: USCG Calculations

1) Does not include \$28,530 in annual reporting and record keeping costs to USCG

2) Includes \$3,300 cost to purchase ADCI 6th ed. Standards in year 1

4.0 Benefits

This chapter presents the benefits from the proposed Commercial Diving regulations.

4.1 Background

The primary benefits are based on the reduction in risk of injuries and fatalities related to commercial diving incidents. The rule is expected to reduce impacts in the event that an incident occurs, including a reduction in the number of fatalities or injuries associated with commercial diving accidents. The Coast Guard estimates that there are 811 divers and 85 marine firms in the scope of this proposed rule. We are proposing new requirements because of various fatal and non-fatal accidents over the last 15 years and to update Coast Guard regulations to match current industry practice.

The commercial diving industry operating under Coast Guard jurisdiction includes the segment operating outside the 3-mile limit, as well as the segment operating off of Coast Guard-certificated vessels anywhere, including inland waters. The majority of the former segment consists of heavy construction work for the oil and gas industry. The latter portion is focused on ship husbandry such as hull inspection, cleaning, and painting, propeller inspection and repair.

4.1.1 Description of Activities

Diving risk varies with the dive cycle and with the dive mode. In this analysis we consider three types of commercial diving modes that are most frequently used: saturation diving, surface-supplied air diving, and mixed-gas diving (SCUBA is not addressed as it is not recommended for the heavy construction work addressed here and we have no casualties involving SCUBA operations).

Saturation diving is an operational diving mode that reduces the risk of decompression sickness (“the bends”) for divers working at great depth for long periods of time. Decompression sickness occurs when inert gas dissolves in the body tissues while breathing at depth. Bubbles of inert gas result which may block blood vessels or physically damage surrounding cells. “Saturation” refers to the fact that the diver’s tissues have absorbed the maximum amount of inert gas possible at a specific depth due to the diver being exposed to breathing gas at that partial pressure for prolonged periods. This is significant because once the tissues become saturated, the time to ascend from depth to decompress safely will not increase with further exposure.

In saturation diving, the divers live in a pressurized environment, which can be a saturation system or “saturation spread,” a hyperbaric environment on the surface, or an ambient pressure underwater habitat. This may be maintained for up to several weeks, and they are decompressed to surface pressure only once, at the end of their tour of duty. By limiting the number of decompressions in this way, the risk of decompression sickness is significantly reduced.

Typically, a saturation diving engagement will last for 14-28 days. The divers will live in a habitat (hyperbaric chamber), either under water or on a diving vessel, or on an oil rig configured for this requirement. Divers will work anywhere between four- and eight-hour shifts and then return to habitat for a specified rest period. They must have at least 12 hours of rest in a 24-hour period per ADCI rules. Aside from the dangers of working at depth, there is also the risk of coming to the surface at an uncontrolled or unmeasured rate. There is also always risk when decompressing. According to the U.S. Navy diving tables, decompression lasts for as long as the diver was in saturation mode and typically at a rate of 1 day per 100 fsw (feet seawater). So if a diver was in saturation mode for a depth of 300 feet, he or she would need 3 days to decompress. There is a risk on every saturation dive. Improving the

operation and response activities through increased drills as well as increasing the manning levels can reduce the risk of decompression.

Surface-supplied air (SSA) is an operational diving mode where the diver's air supply at surface pressure is connected to a pump on the surface. Depending on the depth and time of submergence, the diver has to be cognizant of nitrogen narcosis issues. Extended time at depth will require decompression in the water or on the surface in a hyperbaric chamber. Time at depth could be as little as 30 minutes or several hours. Risks are the work at depth and the ascent plus decompression requirements if necessary. Working at depth has risks of equipment failure, either of diver life support or the mechanical equipment (e.g. saw, hammer, etc.) he or she is working with. In addition, unknown issues (matter spun up from a tool toward the diver or the diver encountering a volatile bubble) may happen as detailed in two of the incidents reported in the MISLE series. Ascent that is not controlled risks nitrogen narcosis ("bends").

Mixed-Gas Diving, similar to SSA, uses supplied air with an inert gas added to the mixture. In this diving mode, the diver's mixed-gas air supply, at surface pressure, is connected to a pump on the surface. Depending on the depth and time of submergence, the diver has to be cognizant of nitrogen narcosis issues. Extended time at depth will require decompression in the water or on the surface in a hyperbaric chamber. Time at depth could be as little as 30 minutes or several hours. Risks are the work at depth and the ascent plus decompression requirements if necessary. Working at depth has risks of equipment failure, either of diver life support or the mechanical equipment (e.g. saw, hammer, etc.) he is working with. Furthermore, unknown issues (matter spun up from a tool toward the diver or the diver encountering a volatile bubble) may happen as detailed in two of the incidents reported in the MISLE series. Ascent that is not controlled risks of nitrogen narcosis ("bends").

4.1.2 Risks Faced During Commercial Diving

Commercial Diving is a very hazardous activity, no matter whether it is very shallow water diving (100 feet or less) or deep water saturation diving, which generally occurs from 300 to 1000 feet. As the riskiness of this occupation shows and the accidents over the last 10 years have demonstrated, incidents can occur from equipment failures (breathing apparatus, tools being used, etc.), unforeseen dangers at depth (undetected natural gas bubble or items flung up from tool activity), to poor planning, to medical situations abuse (including legal and illegal drugs), etc. A small segment of the population is at risk (10 firms) to incidents described above and some risk remains to the ADCI firms (due to inadequate manning) without the proposed regulations. Although it is impossible to eliminate all risk, codification of ADCI standards will improve the safety conditions on all commercial diving operations (ADCI and non-ADCI) and will ensure that the entire industry is meeting the same safety standard.

4.2 Baseline

The provisions of this rule are expected to reduce the risk of deaths and injuries associated with commercial diving incidents for all 85 commercial marine diving firms and their estimated 811 divers. We do not have information on commercial diving casualties for non-ADCI firms per se. We present a baseline of damages and risk using the incidents that have occurred in the USCG regulated portion of the commercial diving industry from 2002-2011.²⁵ These incidents represent the types of casualties that could occur in the non-ADCI segment of the marine-oriented commercial diving sector and thus represent the potential benefits in terms of avoided or mitigated deaths and injuries. For these incidents, we will describe how the rule will mitigate the impacts.

4.2.1 Baseline Risk

²⁵ See Appendix C for a description of pertinent casualties.

MISLE reports from 2002-2011 contained incident reports of 20 casualties involving commercial diving operations (Tables 4-1a and 4-1b). We examined the incident reports for each case, including a review of the *Finding of Facts* as well as the *Causal Analysis* and recommendations provided by the Coast Guard investigating officer, as available. Furthermore, we reviewed the evidence records, including witness statements and final reports from investigating officers. Based on this review, 12 fatalities and 8 injuries (See Tables 4-1a and 4-1b) or a rate of 1.2 fatalities per year and 0.8 injuries per year were used to establish the baseline risk to the industry.

Table 4-1a All MISLE Fatality Incidents: Baseline

Date	Activity ID	Vessel or Facility Name	Location	Cause
3/7/2002	1483715	M/V King of the Red	Mile 228 on the Red River.	Equipment Failure; Planning Issues defects
7/6/2002	1645241	M/V Mr. Fred	Eugene Island Block 273, at Lat. N28-25.5, Lon. W91-36.8.	Equipment Failure; Planning Issues defects
7/5/2003	1867086	Witch Queen	Ewing Banks (block 827) Gulf of Mexico	Equipment Failure; Planning Issues defects
12/28/2003	1970383	Platform Edith	9 miles off the Port of LA-LB, CA.	Medical issues defect
1/6/2005	2270536	Derrick Barge Long Beach	Santa Barbara Channel Access	Operations Manual; Audit defects
7/30/2005	2457122	Allied Elevator No. 2	Main Pass Block 35, Gulf of Mexico	Operations Manual; Audits defects
8/2/2006	2734747	M/V Midnight Star	Gulf of Mexico Vermillion Block 250	Operations Manual; Audits defects
8/29/2006	2765094	Rowan Halifax/Global Explorer	Lat 028° 04" 4' N, Lon 092° 42" 0' W Gulf of Mexico	Manning; Operations Manual; Audit: Drills defects
2/3/2007	2866598	M/V Superior Endeavor	West Cameron Block 590 Gulf of Mexico	Manning; Operations Manual; Audit defects
11/17/2007	3100303	Miss Polly	West Cameron Block 168, Gulf of Mexico	Operations Manual; Medical defects
7/27/2008	3281272	M/V Lonestar	Atlantic Deepwater Spine (off of New England SE Coast)	Operations Manual; Medical defects
01/08/2011	3929340	King Arthur	15 NM SE Galveston Texas Galveston Bay	Manning, Operations Manual

Source: USCG MISLE data

Table 4-1b All MISLE Injury Incidents: Baseline

Date	Activity ID	Vessel Name	Location	Cause
2/14/2002	1600506	Superior Conqueror	South Timbalier Block 63	Equipment; Operations Manual defects
2/23/2002	1713105	BB 45	Gulf of Mexico Vermillion Bay Block 93	Operations Manual Defect
6/19/2003	1822244	OB 111	Romere Pass	Operations Manual defects but need additional information
5/22/2005	2396013	Cpl. Louis J. Haug, Jr.	APRA Harbor Guam	Operations Manual defects but need additional information
8/3/2006	2762375	Big Chief	Gulf of Mexico	Manning; Operations Manual; Audits Defects
8/29/2006	2765094	Rowan Halifax/ Global Explorer	Lat 028° 04" 4' N, Lon 092° 42" 0' W Gulf of Mexico	Manning; Operations Manual; Audit: Drills defects
8/29/2006	2765094	Rowan Halifax/ Global Explorer	Lat 028° 04" 4' N, Lon 092° 42" 0' W Gulf of Mexico	Manning; Operations Manual; Audit; Drills defects
2/8/2008	3147443	Jaya Installer 5	Grand Isle Block 47c, Gulf Deep Water Spur	Operations Manual defects

Source: USCG MISLE data

In Table 4-2, we present a timeline of the commercial diving accidents for both fatalities and injuries over the period 2002 to 2011. As Table 4-2 demonstrates, most of the accidents occurred from 2002-2008 with an average number of fatalities at more than 1.5 per year and just under one injury per year. ADCI introduced its fifth edition of its best diving practices in 2004.²⁶ Based on the incident data, it can be inferred that, 2 to 3 years after its publication, the industry began showing signs of improved safety. Despite the standards set by the industry, risk still remains, as a fatality occurred in 2011.

The industry recognizes that risk remains with commercial diving activities. In May of 2011, the ADCI sixth edition of best diving practices was ratified with the intent to further improve the safety conditions on diving operations. Though ADCI has more extensive standards in the sixth edition and is generally followed by its member firms, the Coast Guard feels the proposed rule will complement ADCI with enforcement power and ensure that the standards are implemented over the entire commercial marine diving industry. Similar to the previous edition of ADCI standards, we expect to see further safety improvements in the 2 to 3 years following its ratification.

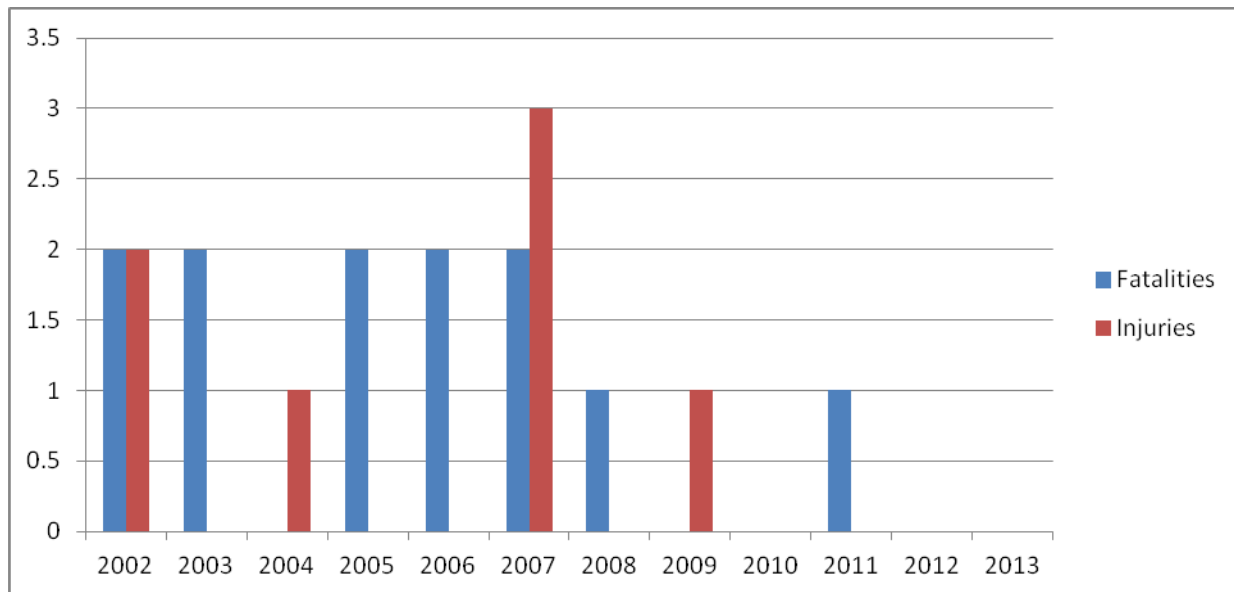
²⁶ Consensus Standards for Commercial; Diving and Underwater Operations, ADCI, 2004

Table 4-2: Commercial Diving Incidents by Year

	Fatalities	Injuries
2002	2	2
2003	2	1
2004	0	0
2005	2	1
2006	2	3
2007	2	0
2008	1	1
2009	0	0
2010	0	0
2011	1	0
Total	12	8

Exhibit 4-1 provides a trend analysis of the ten year period.

Exhibit 4-1 Trends in USCG Regulated Commercial Diving Fatalities and Injuries



4.2.2 Baseline Damages

In this section, we use available incident information to estimate a monetary value for commercial diving incidents since 2002. The typical approach is to apply the value of statistical life (VSL) to each fatality and add that value to a monetized estimate of injuries and damages. We apply an Abbreviated Injury Scale (AIS) to monetized commercial diving injuries. Further details on this approach along with a total monetized value of baseline damages are presented below.

4.2.2.1 Value of Statistical Life and Monetization of Fatalities

Research has developed a way to evaluate the impact of a life lost or saved. The generally accepted means is called the value of a statistical life, for which the current valuation is \$9.1 million per life.²⁷ For example, a \$9.1 million VSL means the public is willing to pay \$9.10 to reduce the risk of a fatality by one in a million. This figure should not be interpreted to be an estimate of the value of human life. Rather, VSL provides a tool for the valuation of the amount society would be willing to pay to reduce the probability of fatality.

We apply the VSL to the twelve lives lost from 2002-2011 to generate a monetized value of lives lost during commercial diving accidents to \$109.2 million over a 10-year period. This value averages to \$10.92 million per year and represents the baseline value of fatalities from commercial diving accidents.

4.2.2.2 Monetization of Injuries

The AIS is an anatomical scoring system first introduced in 1969. Since its introduction, the scale has been revised and updated and is generally accepted as a means of ranking the severity of injuries.²⁸ Injuries are ranked on a scale of 1 to 6, with 1 being minor (and sometimes not reported in MISLE), 5 being critical, and 6 being an injury that is not survivable.²⁹

Table 4-3: Abbreviated Injury Scale (AIS)³⁰

AIS Score	Injury
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Not Survivable

Based on a review of casualty reports, Table 4-4 presents the Coast Guard evaluation of injury severity of the commercial diving accidents from 2006 through 2011. This list excludes fatalities and injuries prior to 2006, as those incidents predate the listing of injury severity in MISLE.

Table 4-4: Commercial Diving Accident Injuries and AIS Scores

Activity ID	Year	AIS Score
2762375	2006	2
2765094	2006	3
2765094	2006	3
3147443	2008	3

²⁷ Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses, available at: <http://www.dot.gov/sites/dot.dev/files/docs/VSL%20Guidance%202013.pdf>

²⁸ The AIS is monitored by a scaling committee of the Association for the Advancement of Automotive Medicine. The AIS is not an injury scale, in that the difference between the first and second categories is not the same as that between fourth and fifth categories. The AIS scale has similarities to the Organ Injury Scales of the American Association for the Surgery of Trauma. (<http://www.trauma.org/archive/scores/ois.html>)

²⁹ The consensus treatment of "unsurvivable injury" is that it is considered 'threat to life' associated with an injury and is not meant to represent a comprehensive measure of severity.

³⁰ Copes, WS, Sacco WJ, Champion HR, Bain LW, "Progress in Characterizing Anatomic Injury", In *Proceedings of the 33rd Annual Meeting of the Association for the Advancement of Automotive Medicine, Baltimore, MA, USA* 205-218.

We used the AIS level of injuries to perform further analysis on the valuation of the injuries. A common method used is the willingness to pay (WTP) approach developed by Miller, et al³¹ as updated for use in regulatory analysis in Department of Transportation guidance.³² This estimates the AIS levels as percentages with respect to willingness to pay for saving a life, similar to the VSL. The Coast Guard generated a monetized value of injuries using the same VSL used in the monetization of fatalities. Specifically, for each AIS level, the Coast Guard multiplied the AIS percentage by \$9.1 million to obtain a dollar value for each of the AIS levels. In the following table, we present AIS categories, percentages, and their associated WTP values.

Table 4-5: AIS and Percent of Willingness to Pay (WTP)

AIS Level	Description	Percent of VSL³³	WTP Per Injury
1	Minor	0.003	\$27,300
2	Moderate	0.047	\$427,700
3	Serious	0.105	\$955,500
4	Severe	0.266	\$2,420,600
5	Critical	0.593	\$5,396,300

We multiplied the WTP value per injury times the number of injuries for each AIS level to obtain a weighted average cost per injury of \$823,946. We then multiply this by the total number of injuries over the 10-year period of analysis (8) for a total cost of \$6,591,568. The average cost of injuries per year during that time period is \$659,157. This value represents the baseline value of injuries from commercial diving accidents.

Table 4-6: Total Cost per Injury from Accidents

AIS Level	Severity	Count	Fraction of VSL	VSL	Cost of Injuries
AIS 1	Minor	0	0.003	\$27,300	\$82
AIS 2	Moderate	1	0.047	\$427,700	\$427,700
AIS 3	Serious	3	0.105	\$955,500	\$2,866,500
AIS 4	Severe	0	0.266	\$2,420,600	\$0
AIS 5	Critical	0	0.593	\$5,396,300	\$0
Total		4			\$3,294,200
Weighted Avg. Cost Per Injury					\$823,550
Estimated Number of Injuries Over 1—year Period					8
Total Cost of Injuries Over 10-year Period					\$6,588,400
Annual Cost of Injuries per Year					\$658,840

³¹ Miller, Ted R., C. Philip Brinkman, and Stephen Luchter; Crash Costs and Safety Investment; Proceedings of the 32nd Annual Conference, Association for the Advancement of Automotive Medicine, Des Plaines, IL, 1988.

³² http://www.dot.gov/sites/dot.dev/files/docs/VSL%20Guidance_2013.pdf

³³ Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses, available at: <http://www.dot.gov/sites/dot.dev/files/docs/VSL%20Guidance%202013.pdf>

4.2.3 Total Damages

Total damages include 12 fatalities. The fatalities are valued at \$9.1 million each for a total of \$109.2 million over the 10-year period of analysis. The eight injuries would be evaluated at an average cost per injury of \$823,550 each for a total of \$6,588,400 over the 10 years. On an annual basis, the baseline damage for commercial diving fatalities is estimated at \$10.92 million for fatalities and \$0.66 million for injuries, totaling \$11.58 million.

4.3 Beneficial Impacts of Proposed Rule

In order to demonstrate the potential benefits from the proposed rule, we have developed a crosswalk table that compares significant notions from the two precipitating reports outlining the roots of this proposed rule (see Chapter One), and matches them with key components of the proposed rule. This crosswalk table is presented in Tables 4-7a and 4-7b, to guide this regulatory analysis in developing benefits. Thus, we will be able to compare the new key elements in the Coast Guard's proposed rule with the guidance from the earlier reports. The crosswalk tables, one each for the respective events that help precipitate this rulemaking, track the proposed rule's key sections.

For example, the RIG 12 report proposes to require a standby diver dressed out and with separate air supply, ready to quickly deploy for all commercial diving operations regardless of depths. The proposed rule allows for that in §197.241 and 290. We expect this rule element will add a major direct safety benefit. Other major elements can also be seen in the proposed rule that evolved out of this report.

For the NOSAC report, we made similar tracings. The NOSAC report suggests an audit process be installed. The proposed rule allows for that in §197.209, 210, 211, 212, and 213. We expect this rule element will add to management control of the commercial diving activity as well as incur safety benefits. Other major elements can also be seen in the proposed rule that evolved out of this report.

Table 7a RIG 12 Report Crosswalk with NPRM Regulatory Text

Implemented Major RIG12 Recommendation	Proposed NPRM Rule Element
3. Commandant should require a standby diver dressed out and with a separate air supply, ready to quickly deploy for all commercial diving operations regardless of depth.	§197.240, 241
5. Commandant should require the Diving Supervisor and the Master or Person-in- Charge to develop a site specific rescue plan designating the equipment and personnel that will be used for a rescue or removal of an injured diver from the water for all commercial diving operations.	§197.220, 221,224
6. Commandant should require that, prior to any commercial diving operation, the Diving Supervisor describes the rescue plan to all members of the diving team.	§197.220
7. Commandant should require the Diving Supervisor to complete a Job Hazard Analysis before every commercial diving operation.	§197.222, 251
8. Commandant should require Diving Supervisors to complete a pre-dive safety checklist suitable to the type of diving equipment and procedures to be used, prior to all commercial dive operations.	§197.220, 251
9. Commandant should consider changing Coast Guard regulations to ensure accountability of commercial diving contractors for maintaining records and logs for their diving equipment. Commandant should also make minor changes to Coast Guard regulations in addition to those described above to ensure Offshore Installation Managers play a more active role in pre-dive safety preparations. Present Coast Guard diving regulations place record keeping responsibilities on diving supervisors. Diving supervisors are appointed on a job to job basis and their designation ends when the diving job they supervise ends. Many of the record keeping responsibilities, however, are continuous and must be completed between diving jobs, away from the dive site. The following	§197.271, 272, 273, 274, 281, 286

recommended regulation changes illustrate how the commercial diving contractor and Offshore Installation Manager could be given a more responsible role in the record keeping and pre-dive safety processes.

- | | |
|--|---------------|
| d. Commandant should change 46 CFR 197.210
[Designation of diving supervisor] as follows:
"The Commercial Diving Contractor shall designate in writing a Diving Supervisor for each commercial diving operation. The Diving Supervisor shall present the written designation to the Master or Person-in Charge." | §220 |
| e. Commandant should change 46 CFR 197.402 (2) (i)
[Responsibilities of the person-in-charge] as follows: "Prior to permitting any commercial diving operation to commence, the Master or Person-in-Charge shall examine the Diving Supervisor's written designation to ensure it is complete as require197.210." | §197220, 251 |
| f. Commandant should cross-reference 46 CFR 109.109
[Responsibilities of master or person in charge] with 46 CFR 197.402
[Responsibilities of person-in- charge]. | §197.220, 251 |
| g. Commandant should change 46 CFR 197.480 (c)
[Logbooks] as follows:
(c) The Diving Contractor and the Diving Supervisor conducting commercial diving operations from a vessel or facility subject to this subpart shall maintain a logbook for making the entries required by this subpart. | §197.220 |
| (d) The logbook required to be maintained by this subpart shall be taken to the jobsite for every commercial diving operation and shall be available for inspection by the Master or Person-in-charge, the United States Coast Guard, or any other cognizant agency. | §197.223 |
| (e) The Diving Contractor shall retain the logbook required to be maintained by this subpart for a period of not less than 3 years. | §197.223 |
| h. Commandant should change 46 CFR 197.482(d) | §197.223 |

[Logbook entries] as follows:

(d) The Diving Contractor and the Diving Supervisor shall insure that a record of the following is maintained: . . .

(e) The Diving Contractor and the Diving Supervisor shall insure that copies of each of the records required under paragraph (d) are included in the operations manual required by 46 CFR 197.420. The records required under paragraph (d) must be maintained by the Diving Contractor for a period of not less than 3 years. §197.223

i. At 46 CFR 197.420 [Operations manual], Commandant should add the following:

(e) The operations manual must contain copies of the records required to be maintained by 46 CFR 197.482 (d) and (e). §197.223

j. At 46 CFR 197.450 [Breathing gas tests], Commandant should change the words "The diving supervisor shall ensure that" - to The Diving Contractor shall ensure that -

k. At 46 CFR 197.450 [Breathing gas tests], Commandant should add the following:

(d) The Diving Contractor shall maintain the above stated test records for a period of not less than 3 years. §197.286

10. Commandant should require the Dive Supervisor and Master or Person-in-Charge to execute a Declaration of Inspection verifying their respective duties have been completed before any commercial dive operation begins. See 46 CFR 35.35-30 for an example of the concept as it is applied to oil transfers. §197.220

11. At 46 CFR 197.204 [Definitions], Commandant should include a definition of "Diving Tender". Commandant should consider adopting the description of Diver Tender set out in the Navy Dive Manual. §197.201, 241

12. At 46 CFR 197.204 [Definitions], Commandant should include a definition of "Dive Tending" or "Tending." §197.201, 241

13. Commandant should consider limiting the duties of a dive tender to only tending the dive umbilical during a commercial diving operation, as §197.241

illustrated by the following wording.

At 46 CFR 197.432 (c)[Surface-supplied air diving],
Commandant should add the words:
the person tending the diver shall have no other
duties while the diver is under water;

- | | |
|--|-------------------|
| 15. Commandant should establish minimum manning standards for all diving operations. Commandant should consider adopting the standards set out in the ADC Consensus Standards | §197.240-246, 290 |
| 16. Commandant should establish commercial diving qualification standards for Commercial Divers, Commercial Diving Tenders, and Commercial Diving Supervisors. Commandant should consider adopting the standards set out in the ADC Consensus Standards. | §197.240-246 |

TABLE 7b NOSAC Recommendation Crosswalk with NPRM Regulatory Text

Implemented Major NOSAC Recommendation	Proposed NPRM Rule Element
AUDITS/THIRD PARTIES: It is recognized that auditing of Diving Contractor compliance should be a requirement addressed in the new standards, however it is the consensus of the NOSAC diving committee that auditing of Diving Contractor's to ensure they are in compliance with the new USCG regulations should be left to qualified auditors that are already doing compliance auditing on a worldwide basis and that there isn't a need to create a verification industry as one already exists. Other than stating, what are the minimum qualifications for various levels of auditing, as in 192.210, the format as set out in technical trade organizations as Recommended Practices can provide the basic structure for defining a person qualified to audit compliance with the USCG Standards. It should also be noted that any effort to include auditing in this standard should be a part of an Appendix and not part of the standard itself.	§1, §8, §197.210,211,212,213
AUDITS/SMS: Other elements of auditing should be covered in a requirement	§8, §197.210, 211,212, 213,§

for all Contractor's to have a Safety Management System (SMS) in place which outlines all the required audits and describes how the Contractor will address all safety requirements for diving safely and all auditing requirements could be the introductory chapter of their Diving Safety Manual.	§197.225
MEDICAL EXAMINATIONS: Modify Periodic Medical Examinations	§197.250
DIVING SUPERVISOR: In (b), replace "...utilize Operation Risk Management (ORM) incorporating hazard identification, hazard assessment, making of risk decisions, control implementation and supervision" with "...insure that a SMS is in place, reviewed, and being implemented with respect to the proposed operation."	§197.222, 250
OPERATIONS MANUAL:/STAFFING: Add to 420(a) "Manning levels and working hours for all diving projects should be based on a review of each project by Contractor and Client and be consistent with existing labor law standards." 420(e) should be revised to include consideration of a depth limit and the task specifics if the dive team only has 3 members. 104 (f) should be modified from "130" FSW to "100" FSW. This topic should be addressed in the Contractor's Diving (Safety) Manual.	§197.223, 0
DRILLS: Add "(a) Contractor shall develop emergency procedures specific for each type of diving done by the company." Renumber section. Additional emphasis should be made for periodic drills to include the recovery of an injured or unconscious diver and deployment of the HRC for companies engaged in saturation diving operations. This topic should be addressed in the Contractor's Diving (Safety) Manual	§197.220

4.4 Potential Impacts of Rule on Risk of Casualties

While the table above demonstrates the connection between the key components of the proposed rule and the recommendations made in the RIG 12 casualty investigation and NOSAC report, the Coast Guard also evaluated the potential impact of the proposed rule on the risk of the commercial diving casualties that resulted in a fatality or an injury. We evaluated the potential for the rule to reduce the risk of commercial diving fatalities or injuries on a case-by-case basis for historical casualties from 2002-2011. During that time, 20 casualties took place that resulted in 12 fatalities and 8 injuries. We conducted a detailed review of the incident report and the full set of supporting documents for each event available in Coast Guard's MISLE database.

We reviewed each casualty to assess if the specific proposed rule requirement might reduce the risk of the event taking place or mitigate the impacts of the event. The rule requirements evaluated for risk reduction potential include the following:

- Personnel/operational requirements (particularly standby diver availability and readiness)
- Drills
- Audits
- Records and documentation related to equipment inspection
- Medical exams

If specific findings of cause are stated in the casualty report, we rely heavily on these conclusions made by the field staff and investigation team to evaluate the contributory factors. We supplement the findings with the judgment of the reviewers (e.g., Coast Guard staff with expertise in marine safety and risk analysis) based on information presented in the case files.

Table 4-8 links the specific incidents of the baseline with provisions of the proposed rule. The reader can examine details of each incident (Appendix D.) when reviewing the incident links and justification.

Table 4-8. Incident Links to the Proposed Rule

Activity ID	Related Provision	Justification
<u>Fatalities</u>		
1483715	Personnel Operational Requirements	Report indicated a standby diver was not properly suited up and ready to deploy as required by proposed rule. Investigative officer as well as fellow divers (during interviews) identified this as a potential cause.
	Drills	Additional drills could have exposed diver to a hot suit, reminded to follow procedures when in trouble, and provided practice on removing equipment.
	Audits	Regular audit procedures would likely have uncovered issues with equipment maintenance as well as operational procedures and readiness.

Activity ID	Related Provision	Justification
1645241	Records & Documentation Related to Equipment Inspection	Problems were discovered with the helmet. However, diver-owned/-maintained helmet lacked a comprehensive record of repairs and maintenance. No records available to indicate when breathing hoses used by diver were last pressure tested or hydrostatic tested. Proposed regulation requires that log books be updated to track equipment tests. This could have ensured equipment was inspected periodically or a pre-dive inspection of equipment was conducted.
	Audits	Auditing requirement may have identified the marginal state of maintenance of the diver's helmet. Furthermore, audit would have likely discovered that the vessel did not have a supply of medical-use oxygen on board.
	Personnel Operational Requirements	Standby diver was not outfitted with any rescue related equipment to address the situation as required by proposed rule
	Drills	Drills required by proposed rule would help ensure diver follows procedure in an emergency. Diver did not slide the pneumofathometer underneath his neoprene neck dam and into his helmet. This would have taken him several seconds to do, but it could have provided him with an alternate source of breathing air.
2270536	Personnel Operational Requirements	Report indicated that company personnel displayed fatigue due to lack of sleep. Proposed rule would include 12 hour work hour limits in 24 hour period.
	Drills	Drills would have improved the probability divers followed written and established safety procedure. As indicated in interviews, "there was no safety meeting for the dive crew prior to incident. Divers were unaware of any safety procedure or plan to follow in case an emergency to retrieve an injured diver out of the water." As stated under the observations by the inspecting officer, "Training for dive team personnel seemed to be lacking."
	Records and Documentation Related to Equipment Inspection	Interviews indicated that the diver's umbilical may have been fouled. Documentation of maintenance and inspection of equipment is required under the proposed regulation. This could have helped ensure equipment was periodically inspected.
2734747	Medical Exams	Proper medical examination may have revealed tears or irregularities in the diver's lungs and kept him from diving.
	Audits	Audits would ensure compliance with the medical fitness requirement for divers.
	Records and Documentation Related to Medical Records	Documentation of medical examination is required by the proposed rule and maintains a history of medical conditions that could be used to avoid putting a diver in danger.
2765094	Personnel Operational Requirements	Standby diver was not ready to enter water as required by rule.

Activity ID	Related Provision	Justification
	Audits	Regular Audits may identify failures of sufficient manning/certification levels of the dive team.
	Drills	Rescue diver had trouble donning gear when preparing to enter water. Investigating officer recommendation is for monthly emergency rescue and recovery diving training for all commercial diving vessels. In addition to a fatality, multiple injuries resulted from incident.
3281272	Personnel Operational Requirements	One of the supervisors was also the standby diver. Proposed rules would not allow multiple responsibilities.
	Audits	Regular Audits may identify failures of sufficient manning/certification levels of the dive team.
	Medical Exam	Diver had previously unknown cardiac condition. A medical exam focused on hyperbaric exposure would have led to a cardiac exam which could have identified the cardiac condition and not permitted the dive.
3100303	Records and Documentation Related to Medical Records	Documentation of diver's medical fitness may identify the diver's condition and medication risk.
2866598	Drills	Delays were experience in recovering troubled diver. Drills would have identified the difficulty of one tender/diver conducting diver retrieval.
	Personnel Operational Requirements	Superintendent also was serving as dive supervisor. The proposed rules would not allow multiple responsibilities.
	Audits	Audits would ensure compliance with the medical fitness requirement for divers.
	Records and Documentation	Documentation serving as a guide and checklist during the JHA may have prevented the diver's entanglement and the uncontrolled ascent of the lift bags.
1970383	Medical Exams	Lab test results indicated diver had hypertensive heart disease and drowned. Potential causal factor for this fatality was a pre-existing medical condition apparently aggravated by the individual performing strenuous activity while diving. Medical exams may have identified this precondition and prevented fatality.
<u>Injuries</u>		
2762375	Personnel Operation Requirements	The need for a diver to work for such extended periods indicates a lack of sufficient manning as required by rule.
	Audits	Regular audits would identify substandard practices and excessive work hours resulting in fatigue.

Activity ID	Related Provision	Justification
1600506	Personnel Operational requirements	Dive supervisor was acting as the diving tender. The Diving Supervisor could not oversee the safety of the operation if he was performing dive tender duties. The proposed rules would not allow multiple responsibilities.
2765094	(See Details Above)	(See Details Above)

For many of the provisions, it is difficult to attribute risk reduction to a specific incident as the baseline of standard operating practices has changed over the period of analysis. ADCI introduced its fifth edition of its best diving practices in 2004, with most of the industry adopting these practices over the next several years, resulting in an overall increase in safety. Based on the incident data, 2 to 3 years after publication of best diving practices, the industry began showing signs of improved safety. Based on this changing baseline, we opt to not quantify or monetize benefits for those regulatory provisions that are adopting ADCI best practices.

The exception is the personnel operational requirements that require additional staffing for SSA dive teams. This requirement goes beyond ADCI best practices and applies to both current ADCI and non-ADCI firms. The following describes the process for quantifying and monetizing the benefits that result from the proposal's manning requirements.

4.5 Quantified Incremental Benefits

Regulatory decision makers and regulated entities in reviewing proposed changes often find it useful to review incremental benefits. Such a review offers a presentation of the estimated benefits of a regulatory action in which the estimated benefits are separated out by the regulatory part. In doing so, one may see the contribution of each regulatory part to the benefits model. This section presents the incremental benefits of the rule by monetizing the benefits associated with the provision that impacts all entities (manning) and providing a break even analysis for the remaining requirements of the proposed rule.

Since the driver of the cost of this rule is the requirement for one more diver in the SSA dive team, no matter whether it is an ADCI or non-ADCI firm, it is appropriate that we focus on SSA casualties related to manning issues. The following narrative explains CG's identification of appropriate casualties from a recent period, the analysis of those casualties, how we identified the effectiveness of the rule in preventing or mitigating the likelihood of a similar fatality in the future and the monetary quantification that resulted.

4.5.1 Identifying SSA Fatal Casualties

As discussed earlier, there were twelve fatalities in the period 2002-2012 (and none since then). Of those twelve, nine were using the SSA diving mode. Of those nine, four stand out, as shown in Table 4-9 as having manning issues that this rule might mitigate or reduce the likelihood of another similar fatality. Each incident is briefly described below.

Table 4-9a: - Surface Supplied Air Fatalities Baseline with Manning Issues as Potential Causal Factor

Incident	Description	Conclusion
2457122	Fatality resulted from accidental engagement of vessels engines while diver's umbilical cord was wrapped around propeller. From the report, "diver was subsequently dragged into propeller and crushed. Dive supervisor enters water to assist diver..." A supervisor diving in the water instead of a backup diver or dive tender indicates a manning deficiency was associated with this incident.	The dive team was likely undermanned, a concept addressed in the proposed NPRM rule.
2765094	Fatality at least partially resulted from inadequate supervision according to the report's conclusions. From the facts of the report, the standby diver was not ready to splash at a moment's notice and subsequently had equipment issues. This delay contributed to valuable time in getting the troubled diver out of the water. Also, the vessel paramedic was not trained in hyperbaric ailments.	The supervisor did not have a standby diver ready on a moment's notice to splash and assist another diver in the water. The proposed NPRM rules provide for a very strict regime for the supervisor to follow. From Section 290 (a), (b) and (c) clearly require the supervisor to make sure "...that minimum dive team requirements are met..." and "ensure that the necessary levels of personnel and equipment are available for all commercial diving operations.." Further, Section 197.222 of the NPRM requires "Each supervisor...must...: (a) Comply with this subpart and the applicable requirements for dive supervisors and diving modes outlined in sections 3.0 and 4.0 of the ADCI Standards (incorporated by reference...)..." ³⁴
3281272	Fatality resulted initially from diver's heart attack. If a fully staffed dive team was available, the deceased might have been pulled from the water quicker and received CPR earlier, a different result may have happened. Dive tender	A second person would have enabled one person to maintain focus on safety, allowing earlier detection of the diver distress and more rapid and effective response

³⁴ Specifically, that incorporation by reference is the following Section 3.7.1 of the ADCI 6th ed. International Consensus Standards, supervisor's responsibilities as follows: *Be fully cognizant of all relevant governmental regulatory agency regulations that apply to the diving operation and the diving mode employed, and the employer's basic safe practices/operations manual. See that all rules and regulations are followed....*

While actually on duty, be in immediate control and available to implement emergency procedures. The diving supervisor is not permitted to dive unless another qualified diver is present who has also been appointed and designated to assume responsibility...

Personally inquire if all personnel on the dive team are qualified and physically able to perform tasks assigned. Make an assessment of the physical condition of the divers prior to each dive to determine if any physical impairment is present that would be detrimental to the diver's health and safety in the water or under hyperbaric conditions.

Incident	Description	Conclusion
	and supervisor was the same person. However from the facts of the incident in the report, the dive team was composed of four persons (dive supervisor, diver, backup diver and tender...all interacting in various roles as appropriate). With the proposed rules, this arrangement would be prohibited. Members of dive teams all have specific responsibilities and do not take on other roles as well.	
3929340	Fatality resulted from cascading issues starting with a regulator problem, no dive tender was present, nor was a secondary diver ready to assist immediately From the conclusions of the report," the dive supervisor failed to ensure the diver was continuously tended while in the water. Furthermore, two helmets that were inspected by the dive supervisor failed the day of the incident and he allowed the dive support team to sleep in the shack while a diver was in the water."	Additional personnel might have increased the likelihood of detecting issues encountered and stopping unsafe practices.

Source: USCG MISLE data set

4.5.1.1 Fatality Casualty Analysis for Effectiveness Regarding NPRM Rule

The benefits calculation process is a step by step analysis as follows. The casualty baseline is first identified. Then, the proposed rule's provisions are examined based upon their ability to mitigate or reduce the risk of each casualty. This process provides Coast Guard with an effectiveness measure of the proposed rule. The Coast Guard used Subject Matter Experts (SME) to assess the effectiveness of the proposed rule's provisions at mitigating or correcting the deficient issue in each incident analyzed. We employed the following effectiveness factors: (0.2, 0.5, and 0.8). Each effectiveness factor reflects the mitigation potential of the NPRM element discussed. For example, an EF of 0.8 would have a high likelihood of mitigation of an accident. An EF of 0.2 would have some positive effect but not nearly as pronounced as that of a 0.8 EF factor

In other words, before we can monetize the baseline and determine incremental benefits from this rule, we must analyze each of the four cases to determine the applicability of the rules components and how they might mitigate the casualty examined. In essence, what level of success might we expect from instituting this rule? How effective might this rule be in preventing or mitigating future fatalities?

Table 4-9b: - Effectiveness Factors for Surface Supplied Air Fatalities Baseline with Manning Issues as Potential Causal Factor

Incident	Effectiveness Factor	Explanation
2457122	0.5	The SME chose this EF since there were complications in the accident such as the diver being pulled into the propeller. The fact that there were not enough members of the correct dive team available, meant that there were not enough "eyes" to watch out for unusual situations or "negative" activities. With the extra "eyes" from another diver, fatality might have been prevented if the proposed rule was in place.
2765094	0.8	The SME chose this EF since the supervisor failed to live up his responsibilities, especially with regard to having the standby diver ready on a moment's notice to splash and assist another diver in the water. The proposed NPRM rules provide for a very strict regime for the supervisor to follow. While this is not necessarily a manning issue as the other three incidents clearly are, the fact that the backup diver was not ready immediately to splash created a short term manning issue that may have contributed to the fatality. If the backup diver was immediately ready to splash, under the supervisor's oversight, as required under the proposed rule, the fatality might have been prevented.
3281272	0.5	The SME chose this EF since the dive tender and the supervisor was the same person. This would be prohibited and might have mitigated the death if the proposed NPRM rules were in place.
3929340	0.8	The SME chose this EF since a key decision of the supervisor was not to have a dive tender present, let alone a secondary diver ready to splash while a diver was in the water. This would be prohibited and would have provided a higher chance of mitigating this incident's fatality if the proposed NPRM rules were in effect.

4.5.1.2 Case Study Examples of Incident Benefit Analysis

For example, the summaries of the following two case studies illustrate how complex and difficult it is to estimate benefits for this rule let alone quantify them.⁶

Case Review Example 1

Incident Report 2765094

Vessel: Rowan Halifax/Global Explorer

Date:8/29/06

Damages:0

Deaths:1

Injuries:2

Commercial divers using surface-supplied air were working on the rigging of the legs of a sunken MODU. A diver was attempting to attach a 2 and 3/4 inch chain to a shackle for pre-rigging the MODU. Shortly after diver 1 entered the water, there was a loss of communication with him, although a gurgling sound inside helmet was heard. The standby diver was ordered to splash. Diver 1 visibly panics and begins ascent towards diving bell. Diver 2 dons gear, but has trouble with airflow to helmet. Problem fixed and he enters the water. Somehow Diver 1's helmet lands in worksite. Diver 2 descends, switching to 14% O₂. He pulled his way to Diver 1 via latter's hose. He notices Diver 1's helmet from 20 feet away. Diver 2 arrives at Diver 1, shakes him with no response. Diver 2 notifies topside to pull up slack. Divers arrive at bell and with standby diver, attempt to pull Diver 1 into bell. Diver 1 is finally pulled up topside. Diver 2 becomes fouled on the bell, then unfouls himself. He begins his ascent but switches to air "on the fly". Vessel paramedic performs lifesaving procedures. Since the paramedic is not hyperbaric qualified, backup is ordered into hyperbaric chamber to continue lifesaving procedures. Shore side physician finally orders halt to lifesaving procedures. Shortly afterwards, Diver 2 shows signs of the bends, while backup, still "dirty", from an earlier dive that day, experiences decompression sickness. Investigation concluded that there was inadequate supervision and a good rule was misused.

Reviewer Notes:

Supervisor did not have a standby diver ready on a moment's notice to splash and assist another diver in the water. The proposed NPRM rules provide for a very strict regime for the supervisor to follow. From Section 290 (a), (b) and (c) clearly require the supervisor to make sure "...that minimum dive team requirements are met..." and "ensure that the necessary levels of personnel and equipment are available for all commercial diving operations.." Further, Section 197.222 of the NPRM requires "Each supervisor...must...: (a) Comply with this subpart and The applicable requirements for dive supervisors and diving modes outlined in sections 3.0 and 4.0 of the ADCI Standards (incorporated by reference...)..."

Fatality at least partially resulted from inadequate supervision according to the report's conclusions. From the facts of the report, the standby diver was not ready to splash at a moment's notice and subsequently had equipment issues. This delay contributed to valuable time in getting the troubled diver out of the water. Also, the vessel paramedic was not trained in hyperbaric ailments.

Regular Audits may identify failures of sufficient manning/certification levels of the dive team.

Regular drills may have mitigated this incident. The rescue diver had trouble donning gear when preparing to enter water. Investigating officer recommendation is for monthly emergency rescue and recovery diving training for all commercial diving vessels. In addition to a fatality, multiple injuries resulted from incident.

Case Review Example 2

Incident Report 3929340

Vessel: NS Power

Date: 1/26/2011

Damages: 0

Deaths: 1

Injuries: 0

On January 8, 2011, a series of divers were engaged in bottom cleaning, through solo dives, on the NS Power from a series of other vessels including the King Arthur. Four divers used in sequence to perform bottom cleaning work on the NS Power. During the course of the work evolution, a diver's helmet neck seal failed flooding the helmet. While the diver was able to leave the water, delay caused time constraints on the activity.. Then another diver reported regulator problems in his dive. Attempts to retrieve him are less than by the book and result in his drowning. Some 13 hours after the beginning of the dive evolution, Galveston receives word of an unresponsive diver on the King Arthur.

Reviewer Notes:

From the MISLE report: dive support team members were negligent in their duties while a diver was in the water resulting in the loss of life .Investigation concluded that there was inadequate supervision and a good rule was misused as well as active failures of equipment. Supervisor did not have a standby diver ready on a moment's notice to splash and assist another diver in the water. The proposed NPRM rules provide for a very strict regime for the supervisor to follow. From Section 290 (a), (b) and (c) clearly require the supervisor to make sure "...that minimum dive team requirements are met..." and "ensure that the necessary levels of personnel and equipment are available for all commercial diving operations.." Further, Section 197.222 of the NPRM requires "Each supervisor...must...: (a) Comply with this subpart and The applicable requirements for dive supervisors and diving modes outlined in sections 3.0 and 4.0 of the ADCI Standards (incorporated by reference...)..."

Regular Audits may identify failures of sufficient manning/certification levels of the dive team.

Regular drills may have mitigated this incident. The rescue diver had trouble donning gear when preparing to enter water.

In both cases, the addition of one more dive team member so that responsibilities were adequately spread around might have made all the difference in the world to the victims. In addition, other requirements of the NPRM rule could have mitigated the incidents.

The rule's other benefits besides proper manning and manning procedures, while very visible, are more difficult to quantify. They are drills, audits ,records and documentation, as well as medical requirements.

As seen in the first example case, regular drills likely would have mitigated one of the problems in that incident. Drills provide regular practice for situations that require immediate instinctive response and not follow the instructions to complete response

Regular audits would have provided a paper trail to maintenance needs and if recommendations were followed through on. Audit procedures likely would have mitigated issues ion both incidents. Records and documentation are parallel with audits in providing a trail of responsibility for maintaining equipment in proper working order.

4.5.1.3 Monetization of Foregone Fatality Casualties or Benefits

As table 4-10 demonstrates, annual benefits are estimated at \$2.4 million dollars. This was developed by applying the effectiveness factor to the \$9.1 million dollar estimate of a VSL and summing over the relevant time period, in this case 2002-2011. That sum of \$23,660,000 is then divided by ten to estimate the average annual avoided fatality cost or that same period or \$2,366,000.

Table 4-10 Benefit Calculations for Fatality Mitigation

Date	Incident	Effectiveness	Valuation
07/30/2005	2457122	0.5	\$4,550,000
08/29/2006	2765094	0.8	\$7,280,000
07/27/2008	3281272	0.5	\$4,550,000
01/08/2011	3929340	0.8	\$7,280,000
	Total		\$23,660,000
	Average Annual		\$2,366,000

Source: USCG Calculations

4.5.2 Identifying SSA Injury Casualties

As discussed earlier, there are eight injuries in the period 2002-2011. Of those eight, six were using the SSA diving mode. Of those six, two incidents resulting in a total of three injuries standout, as shown in Table 4-11, as having manning issues that this rule might mitigate or reduce the likelihood of another similar injury. Each incident is briefly described below.

Table 4-11 - Surface Supplied Air Injuries Baseline with Manning Issues as Potential Causal Factor

Incident	Description	Conclusion
2762375	From the facts of the report, the solo diver was working at 62 feet when his foot got tangled in the lift bag and was pulled to the surface rapidly. The transit resulted in a fractured ankle and head injuries about the eye. Diver was on duty for 20 straight hours before the accident.	The supervisor did not live up to his responsibilities in using a diver who was on watch for 20 straight hours before the accident.
2765094	From the facts of the report, standby diver was not ready to splash at a moment's notice and subsequently had equipment issues. This delay contributed to valuable time in getting the troubled diver out of the water. Two divers reported bends symptoms. Also, the vessel paramedic was not trained in hyperbaric ailments.	The supervisor failed to live up his responsibilities, especially with regard to having the standby diver ready on a moment's notice to splash and assist another diver in the water. ADCI supervisor requirements, which the proposed NPRM references, are very strict in terms of supervisors responsibilities as explained in the fatalities section above regarding the same incident.

4.5.2.1 Injury Casualty Analysis for Effectiveness Regarding Rule

As with fatalities, before we can monetize the baseline and determine incremental benefits from this rule, we must analyze each of the three injury cases (note: that one case had two injuries; both of them being symptoms of the bends, while the third injury was the broken bone and eye /head injury) to determine the applicability of the rules components and how they might mitigate the casualty examined. In other words, what level of success might we expect from instituting this rule? How effective might this rule be in preventing or mitigating future fatalities?

Again, CG used an SME to assess the effectiveness of the rule element mitigating or correcting the deficient issue in each incident analyzed. This effectiveness rating is based upon the SME's expert opinion on the effectiveness of the rule in the case reviewed.

Table 4-12 - Effectiveness Factors for Surface Supplied Air Injuries Baseline with Manning Issues as Potential Causal Factor

Incident	Effectiveness Factor	Explanation
2762375	0.5	The SME chose this EF since there were multiple causes of this, incident. High on the list were the apparent absence of manning standards that resulted in a much longer work day than current ADCI protocols (and the NPRM) proposes.
2765094	0.5	The SME chose this EF since there were multiple causes of this incident in which two injuries were reported (both injuries symptoms of the bends). Both injuries at least partially resulted from inadequate supervision according to the report's conclusions. Further, the supervisor did not have a standby diver ready to splash in order to render immediate assistance to divers in distress.

4.5.2.2 Monetization of Foregone Injury Casualties or Benefits

As table 4-12 demonstrates, the average annual benefits are estimated at \$117 thousand dollars. Using the VSL injury analysis developed above calculations were developed by applying the EF to the product of an AIS of a VSL for a specific type of injury (moderate and serious) and summing over the relevant time period, in this case 2002-2011. That sum of \$1,169,350 is then divided by ten to estimate the average avoided injury for that same period or \$116,935.

Table 4-13 Benefit Calculations from Injury Mitigation

Date	Incident	Effectiveness	% of VSL	Valuation
07/30/2005	2762375	0.5	0.047	\$213,850
08/29/2006	2765094	0.5	0.105	\$477,750
08/29/2006	2765094	0.5	0.105	\$477,750
	Total			\$1,169,350
	Average Annual			\$116,935

Source: USCG Calculations

4.5.4 Total Benefits

The total benefit is the sum of fatality and injury benefits or \$2.5 million. As Table 4-14 demonstrates, the incremental net benefits for fatality mitigation are at least \$0.94 million dollars for the key cost driver (manning) of this NPRM and \$0.65 million dollars overall. For the remainder of the provisions, given the uncertainty in quantifying risk to assess benefits, one approach to analyzing benefits is to determine the breakeven point, where the costs of the proposed rule are equal to the expected reduction in losses due to fatalities and/or injuries. Breakeven analysis is useful when it is not possible to quantify the benefits of a regulatory action. OMB Circular A-4 recommends a threshold or breakeven analysis when non-quantified benefits are important to evaluating the benefits of a regulation. In this case, we attempt to quantify risk reduction. Threshold or breakeven analysis answers the question, “How small could the value of the non-quantified benefits be (or how large would the value of the costs need to be) before the rule would yield zero net benefits?” Below, we describe a breakeven analysis for the documentation and recordkeeping, drills, audits, medical exams and medical training requirements.

We used annualized costs at a 7-percent discount rate over a 10-year period for each requirement: drills (annual cost of \$43,700), audits (annual cost of \$42,600), medical examinations (annual cost of \$23,400), medical training (annual cost of \$3,000), plus records and documentation (annual cost of \$205,100). We then take the VSL, \$9.1 million³⁵ as the benefit that could be derived from the rulemaking if one fatality per year is prevented, and compare it to the annualized cost that would be incurred for each regulatory requirement. We divide the VSL by the annualized costs to obtain the required frequency of a fatality prevented for the benefits of the requirement to break even with the costs. For example, at a 7-percent discount rate, the proposed rule’s breakeven point for drills is 208 years (\$9,100,000/\$43,729) (i.e., the requirement for drills would need to prevent one fatality every 208 years for the benefits to break even with the costs). See Table 4-14 below for a complete listing of the breakeven years.

Table 4-14 – Incremental Breakeven Analysis of Proposed Rule

Proposed Rule Increment	Benefits		Cost* Annualized (7%, millions)	Net Benefits (7%, \$ millions)	Fatalities Reduced to Breakeven
	Description	Average Annual			
Manning	Increase 1 crewman /team for SSA for both ADCI and non-ADCI firms	2.4	1.46	0.94	N/A
Documentation & Recordkeeping	Assists CG with enforcement	Not Quantifiable	0.205	N/A	1 every 44 years
Drills	Non-ADCI Firm Drills provides regular training	Not Quantifiable	0.0437	N/A	1 every 208 years
Audits	Non-ADCI Firm Audits assists CG with enforcement	Not Quantifiable	.0426	N/A	1 every 214 years
Medical Exams	Medical Exams for Non-ADCI Firms provides safety measure	Not Quantifiable	0.0238	N/A	1 every 389 years
Medical Training	Support Saturation Diver Crewmen receive First Aid and CPR Training	Not Quantifiable	0.003	N/A	1 every 3,056 years
TOTAL		≥ 2.4	1.755	≥0.645	

Source: USCG Calculations

* Total may not sum due to rounding.

5.0 Initial Regulatory Flexibility Analysis

5.1 Summary of Findings

The U.S. Coast Guard (USCG) has performed this analysis of the impacts on small businesses from the proposed rule. USCG performed this assessment using the cost information discussed in cost chapter of this RA.

Whenever an agency is required by section 553 of the Regulatory Flexibility Act of 1980³⁶ (RFA) or any other law, to publish general notice of proposed rulemaking for any proposed rule, or publishes a notice of proposed rulemaking for an interpretative rule involving the internal revenue laws of the United States, the Regulatory Flexibility Act requires that the agency prepare and make available for public comment an initial regulatory flexibility analysis. The RFA requires that such analysis describe the impact of the proposed rule on small entities and that the initial regulatory flexibility analysis or a summary be published in the Federal Register at the time of the publication of general notice of proposed rulemaking for the rule.

In addition, the RFA requires that the agency transmit a copy of an initial regulatory flexibility analysis to the Chief Counsel for Advocacy of the Small Business Administration. In the case of an interpretative rule involving the internal revenue laws of the United States, The RFA's requirements apply to interpretative rules published in the Federal Register for codification in the Code of Federal Regulations, but only to the extent that such interpretative rules impose on small entities a collection of information requirement.

Under the Regulatory Flexibility Act³⁷ the Coast Guard must consider whether the rule would have a significant economic impact on a substantial number of small entities. Small entities³⁸ include small businesses,³⁹ small not-for-profit organizations that are independently owned and operated and are not dominant in their fields,⁴⁰ and small governmental jurisdictions with populations of less than 50,000.⁴¹

Based on the information from this analysis, we found that:

³⁶ Public Law 96-354 (5 U.S.C. 601-612)

³⁷ <http://www.sba.gov/advo/laws/regflex.html>

³⁸ The RFA considers "small entity" as having the same meaning as the terms "small business," "small organization" and "small governmental jurisdiction."

³⁹ The RFA defines "small business" has the same meaning as the term "small business concern" under section 3 of the Small Business Act, unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.

⁴⁰ The RFA defines the term "small organization" means any not-for-profit enterprise which is independently owned and operated and is not dominant in its field, unless an agency establishes, after opportunity for public comment, one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register;

⁴¹ The RFA defines small governmental jurisdiction" means governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand, unless an agency establishes, after opportunity for public comment, one or more definitions of such term which are appropriate to the activities of the agency and which are based on such factors as location in rural or sparsely populated areas or limited revenues due to the population of such jurisdiction, and publishes such definition(s) in the Federal Register."

- There are no governments or not-for-profit organizations which are anticipated to be affected by the proposed rule.
- There are 85 U.S. entities (all private firms) that would potentially be impacted by the proposed rule. Of the 85, 75 are ADCI-registered firms of which we have some information on, and 10 are non-ADCI firms of which we have no information on but are assumed to be small. Furthermore, of the 75 firms we can identify, we found ownership and revenue data for only 45 firms. Of these 45 firms, 37 were determined to be small entities based on available data.
- We assume firms without available ownership or revenue data are small. Therefore, of the 85 firms considered only 8 can be considered non-small given the evidence available for this analysis.
- Initial and annual recurring costs of the proposed rule would result in less than 1 percent impact on revenue for 32 percent of the small entities with available data;
- 68 percent of small entities with available data will incur costs greater than 1 percent of revenue.

This chapter provides an Initial Regulatory Flexibility Analysis for commercial diving operations.

5.1.1 Preliminary Initial Regulatory Flexibility Analysis

The Regulatory Flexibility Act of 1980 (Public Law 96-354) establishes “as a principle of regulatory issuance that agencies shall endeavor, consistent with the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration.”

Under the RFA, we are required to consider if this rule will have a significant economic impact on a substantial number of small entities. Agencies must perform a review to determine whether a rule will have such an impact. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA. Under Section 603(b) of the RFA, the Initial Regulatory Flexibility Analysis (IRFA) must provide and address:

- A description of the reasons why action by the agency is being considered;
- A succinct statement of the objectives of, and legal basis for, the proposed rule;
- A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply;
- A description of the projected reporting, recordkeeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;
- An identification, to the extent practicable, of all relevant Federal rules which may duplicate, overlap or conflict with the proposed rule;
- A description of any significant alternatives to the proposed rule which accomplish the stated objectives of the applicable statutes and which minimize any significant economic impact of the proposed rule on small entities.

The term “small entities” comprises small businesses, not-for-profit organizations that are independently owned and operated and are not dominant in their fields, and governmental jurisdictions with populations of less than 50,000. The rule affects only small private entities. The following describes the Initial Regulatory Flexibility Act (IRFA) process for this rule.

We determined that the rule affects a variety of small private entities and therefore, based on the requirements mentioned above, we have prepared the following IRFA assessing the impact on small entities for this proposed rule. The analysis presented below addresses the issues specific to small entities that we have not addressed elsewhere in this RA

5.2 IRFA Requirements

5.2.1 Descriptions of reasons why action of by the agency is being considered

Agencies take regulatory action for various reasons, one being the failure of the market to reach the socially optimal outcome. This can occur when there are economic incentives lacking for industry to pursue that outcome and such market failures are the impetus for this proposed rule. A negative externality is the byproduct of a transaction between two parties that is not accounted for in the transaction. Vessels and commercial diving operations that operate with lower safety standards may cause harm or increased risk of harm without accounting for the consequences to third parties, who do not directly participate in the business transactions of the affected entities. These costs are not borne by the responsible entities and are therefore external to the business decisions of the responsible entity. Section 4.2 describes the externality addressed by this rule.

5.2.2 Objectives of, and Legal Basis for , the Proposed Rule

The purpose of this rulemaking is to clarify and update our existing commercial diving regulations to reflect current industry best practices and to facilitate the use of approved third-party organizations (TPOs) in ensuring regulatory compliance. There has been no update since the 1978 original diving rules.

In addition, a series of reports on commercial diving safety demonstrated a need for updating USCG commercial diving regulations. These reports were developed in response to a series of commercial diving accidents that gained major public attention starting with one in 1996. The report titled “Investigation into the Circumstances Surrounding the Commercial Diving Accident Onboard the Mobile Offshore Diving Unit Cliff’s Drilling Rig No. 12 on March 4, 1996 with the Loss of Life” influenced the Coast Guard to improve its regulations for commercial diving. That report, released in March, 2001, and also known as the RIG 12 Report, started a process that has slowly gained momentum these past few years. The most recent findings, the 2008 National Offshore Safety Advisory Committee (NOSAC) report, provided Coast Guard with additional appropriate information regarding the industry and its safety efforts. The objective of the proposed rule is to establish safety regulations governing the inspection, standards, and operation of commercial diving operations. The proposed rule would promote safer work practices and reduce casualties in commercial diving operations by ensuring that those operations adhere to recommended safety standards and operational protocols.

The statutory bases for the Coast Guard’s rulemaking are located in: 33 U.S.C. 1509(b), which requires safety regulations for deepwater ports; 43 U.S.C. 1333(d)(1), which permits safety regulations for Outer Continental Shelf (OCS) facilities and their equipment; 46 U.S.C. 3306, which requires regulations to implement subtitle II of Title 46 of the U.S. Code with respect to inspected vessels, including offshore supply vessels (OSVs) and their equipment; 46 U.S.C. 3703, which requires safety and environmental protection regulations for liquid bulk dangerous cargo carriers and their equipment, to be issued after consultation with Federal, State, and local governments and with private sector entities; and 46 U.S.C. 6101, which requires regulations for reporting and investigating marine casualties. These statutes confer regulatory authority on the Secretary of Homeland Security, who has delegated this authority to the Coast Guard; DHS Delegation No. 0170.1(75), (90), and (92). In addition, we are conducting this rulemaking in accordance with a December 19, 1979, Memorandum of Understanding between the Coast Guard and

the Occupational Safety and Health Administration (OSHA), which regulates commercial diving operations conducted near shore or in U.S. internal waters.

5.2.3 Description and Estimate of the Number of Small Entities to Which the Proposed Rule Will Apply

5.2.3.1 Data Development

We used MISLE owner and operator name and address information as well as ADCI member information to research public databases (MANTA) for entity type (subsidiary or parent company), primary line of business, employee size, revenue, and other information.⁴² We matched this information to the Small Business Administration's "Table of Small Business Size Standards" to determine if an entity is small in its primary line of business as classified in the North American Industry Classification System (NAICS).⁴³

ADCI member data and Coast Guard data shows that there are 85 entities engaging in marine oriented commercial diving in the 2009-2011 timeframe. We acknowledge that only 75 diving firms belong to the ADCI.⁴⁴ USCG estimates that number of non-ADCI firms to be 10 based on our total population estimate (see affected population section for details). We found revenue and employment data for 45 firms that were ADCI in origin. Of the 45 firms, 37 were determined to be small businesses according to Small Business Administration standards. We assume that entities without small business data are small. In Table 5-1, we provide a summary of the small business data. As a result of our analysis, we concluded that small entities make up approximately 79 percent of the total affected marine population ((37 known small firms+ 10 estimated and likely small firms + 30 firms with no revenue data)/85 total marine firms).

Table 5-1 Firm Data Development

Firm Type	Number of Firms
Marine Commercial Marine Diving Firms in ADCI	75
Revenue and Employment Info	45
Number of Small Business Firms Based on Available Data	37

Source: USCG Calculations

Table 5-2 provides small entity information, in the detail of the NAICS Code industries affected by this rule.

⁴² We used information and data from Manta (<http://Manta.com>)

⁴³ The SBA lists small business size standards for industries described in the North American Industry Classification System (NAICS). See <http://www.smallbusinessnotes.com/fedgovernment/sba/13cfr121/201-4849.html> (as of April 7, 2008).

⁴⁴ See commercial dive firm population calculation in Appendix B.

Table 5-2 Small Entities by NAICS Codes with SBA Size Standards

NAICS Codes	Description	SBA Size Standards (≤ \$M)	Number of Small Entities*	Percent of Small Entities
236220	Commercial & Inst. Building Construction	33.5	1	4.2
237990	Other Heavy and Civil Engineering Cons.	33.5	3	12.5
238910	Site Preparation Contractors	14	5	20.8
541330	Marine Engineering and Naval Architecture	18.5	1	4.2
541990	All Other Prof., Scientific & Tech. Services	7	11	45.8
561499	All Other business Support Services	7	1	4.2
561990	All Other Support Services	18.5	2	8.3
Total		-	24	100

Source: USCG Calculations

*ADCI Firms identified with revenue data

5.2.3.2 Industries Affected by the Proposed Rule

A brief description of the industries⁴⁵ most affected by this proposed rule is presented as follows:

236220 Commercial and Institutional Building Construction -- This industry comprises establishments primarily responsible for the construction (including new work, additions, alterations, maintenance, and repairs) of commercial and institutional buildings and related structures, such as stadiums, grain elevators, and indoor swimming facilities. This industry includes establishments responsible for the on-site assembly of modular or prefabricated commercial and institutional buildings. Included in this industry are commercial and institutional building general contractors, commercial and institutional building for-sale builders, commercial and institutional building design-build firms, and commercial and institutional building project construction management firms.

237990 Other Heavy and Civil Engineering Construction -- This industry comprises establishments primarily engaged in heavy and engineering construction projects (excluding highway, street, bridge, and distribution line construction). The work performed may include new work, reconstruction, rehabilitation, and repairs. Specialty trade contractors are included in this group if they are engaged in activities primarily related to engineering construction projects (excluding highway, street, bridge, distribution line, oil and gas structure, and utilities building and structure construction). Construction projects involving water resources (e.g., dredging and land drainage), development of marine facilities, and projects involving open space improvement (e.g., parks and trails) are included in this industry.

238910 Site Preparation Contractors -- This industry comprises establishments primarily engaged in site

⁴⁵ These descriptions were excerpted from the U.S. Census Bureau. (<http://www.census.gov/cgi-bin/sssd/naics/naicsrch>).

preparation activities, such as excavating and grading, demolition of buildings and other structures, and septic system installation. Earth moving and land clearing for all types of sites (e.g., building, non-building, mining) are included in this industry. Establishments primarily engaged in construction equipment rental with operator (except cranes) are also included.

541330 Engineering Services -- This industry comprises establishments primarily engaged in applying physical laws and principles of engineering in the design, development, and utilization of machines, materials, instruments, structures, processes, and systems. The assignments undertaken by these establishments may involve any of the following activities: provision of advice, preparation of feasibility studies, preparation of preliminary and final plans and designs, provision of technical services during the construction or installation phase, inspection and evaluation of engineering projects, and related services.

541990 All Other Professional, Scientific, and Technical Services -- This industry comprises establishments primarily engaged in the provision of professional, scientific, or technical services (except legal services; accounting, tax preparation, bookkeeping, and related services; architectural, engineering, and related services; specialized design services; computer systems design and related services; management, scientific, and technical consulting services; scientific research and development services; advertising, public relations and related services; market research and public opinion polling; photographic services; translation and interpretation services; and veterinary services).

561499 All Other Business Support Services -- This U.S. industry comprises establishments primarily engaged in providing business support services (except secretarial and other document preparation services; telephone answering and telemarketing services; private mail services or document copying services conducted as separate activities or in conjunction with other office support services; monetary debt collection services; credit reporting services; repossession services; and court reporting and stenotype recording services).

561990 All Other Support Services -- This industry comprises establishments primarily engaged in providing day-to-day business and other organizational support services (except office administrative services, facilities support services, employment services, business support services, travel arrangement and reservation services, security and investigation services, services to buildings and other structures, packaging and labeling services, and convention and trade show organizing services).

5.2.3.3 Census Data by NAICS

Table 5-3 presents census data for selected industries in Table 5-2. The Small Business Administration uses industry NAICS to determine if an entity is small based on their revenue data. The table below provides a distribution of the number of entities per industry by revenue.

Table 5-3 Distribution of Firms by Revenue

NAICS Code	Industry Title	Number of Entities by Revenue						
		\$0-\$99k	\$100k-\$500k	\$500k-\$1M	\$1M-\$5M	\$5M - \$10M	\$10M +	Grand Total
236220	Commercial and Inst. Building Construction	2,373	9,805	5,695	11,601	3,319	4,415	37,208
237990	Other Heavy and Civil Engineering Construction	1,463	4,504	1,770	2,083	339	343	10,502
238910	Site Preparation Contractors	3,968	14,725	5,091	5,217	887	608	30,496

Source: US Census Bureau 2002. (<http://www.census.gov/econ/census02/guide/INDRPT23.HTM>)

5.2.3.4 Revenue Impact on Small Entities

The regulatory costs in this rule (including Manning, Drills, Audits, Records & Documentation and Medical Examinations) are evaluated in total in the following conventional IRFA analysis. To estimate the revenue impact on the identified small businesses, we followed guidance from the U.S. Small Business Administration's Office of Advocacy's "A Guide for Government Agencies: How to Comply with the Regulatory Flexibility Act." We compared the total cost per business to the revenue data collected to assess the impact of the rule to those businesses. Using this information we were able to estimate the impact as a percentage of revenue for the affected firms.

As a result of our analysis, we concluded that small entities with a significant impact likely comprise 68 percent of the small entity population evaluated. Of the 37 small entities with available business data, we determined that 32 percent of small entities would have an annual cost-to-revenue impact of less than 1 percent. Further, we estimated that 41 percent of the small entities would have a cost-to-revenue impact between 1 and 3 percent and 27 percent would have an impact equal to or greater than 3 percent. These results are summarized in Table 5-4. We estimate 68 percent of small entities would have an impact greater than 1 percent from a cost to revenue ratio perspective.

Table 5-4 Revenue Impacts On Small Entities

Impact	Sample	Percentage
$0\% \leq \text{Impact} \leq 1\%$	12	32%
$1\% > \text{Impact} < 3\%$	15	41%
$\geq 3\% \text{ Impact}$	10	27%
Total	37	100%

Source: USCG Calculations in Appendix B

5.2.4 Description of the Projected Reporting, Recordkeeping, and Other Compliance Requirements of Small Entities

The Coast Guard expects new reporting or record keeping requirements resulting from this rule. The proposed rule impacts commercial marine diving operations under Coast Guard jurisdiction and requires each operation perform documentation preparation and maintenance tasks that fall under the category of reporting and recordkeeping. This documentation provides a historical record of when a piece of equipment was inspected or serviced and by whom. The process will also include the documentation of new equipment as often as new equipment is added to a firm's asset base. In addition, the documentation also takes into account logbook entries of diving activities as well as maintenance of logbooks, audit reporting, and operations manuals.

5.2.5 Duplication with Other Federal Rules

There are no relevant Federal rules that may duplicate, overlap, or conflict with the proposed rule. OSHA has commercial diving responsibility to the 3-mile limit, and Coast Guard has responsibility beyond the 3-mile limit, and also for any activity off of a Coast Guard inspected vessel within the 3-mile limit. The latter is composed of most of the non-Gulf of Mexico commercial divers discussed earlier.

5.2.6 Description of any Significant Alternatives to the Proposed Rule

The Coast Guard considered four alternatives to the NPRM alternative. A description of these alternatives is presented in Chapter 1. In general, safety rules do not lend themselves to alternatives favoring smaller entities. Being a small entity does not change necessarily the safety requirement.

Three alternatives involved a different regulatory approach from a status quo and ranged from involving the IMO in a global rulemaking to a consolidation of OSHA and US Coast Guard rules. All were rejected for reasons presented in Chapter 1.

6.0 Collection of Information

USCG reviewed this proposed rulemaking for any collection of information burden as defined by the Paperwork Reduction Act (PRA).⁴⁶ Collection of information requirements include reporting, recordkeeping, notification, and other ancillary requirements. As defined in 5 CFR 1320.3(c), "collection of information" comprises reporting, recordkeeping, monitoring, posting, labeling, and other similar actions. To prepare this analysis, USCG carefully considered the existing regulations' requirements, the proposed requirements and PRA guidance. With consideration to and evaluation of the existing standard, the agency has prepared this estimate of burden.

6.1 Background

The Paperwork Reduction Act defines the term "burden" to mean time, effort, or financial resources expended by persons to generate, maintain, or provide information to or for a Federal agency, including the resources expended for (A) reviewing instructions; (B) acquiring, installing, and utilizing technology and systems; (C) adjusting the existing ways to comply with any previously applicable instructions and requirements; (D) searching data sources; (E) completing and reviewing the collection of information; and (F) transmitting or otherwise disclosing the information.

The PRA defines the term "collection of information" as the obtaining, causing to be obtained, soliciting, or requiring the disclosure to third parties or the public, of facts or opinions by or for an agency, regardless of form or format, calling for either-- (i) answers to identical questions posed to, or identical reporting or recordkeeping requirements imposed on, ten or more persons, other than agencies, instrumentalities, or employees of the United States; or (ii) answers to questions posed to agencies, instrumentalities, or employees of the United States which are to be used for general statistical purposes.

The PRA defines the term "recordkeeping requirement" as a requirement imposed by or for an agency on persons to maintain specified records, including a requirement to-- (A) retain such records; (B) notify third parties, the Federal Government, or the public of the existence of such records; (C) disclose such records to third parties, the Federal Government, or the public; or (D) report to third parties, the Federal Government, or the public regarding such records.

The Act defines the term "burden" to mean time, effort, or financial resources expended by persons to generate, maintain, or provide information to or for a Federal agency, including the resources expended for (A) reviewing instructions; (B) acquiring, installing, and utilizing technology and systems; (C) adjusting the existing ways to comply with any previously applicable instructions and requirements; (D) searching data sources; (E) completing and reviewing the collection of information; and (F) transmitting or otherwise disclosing the information.

This proposed rule would call for a new collection of information under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501-3520). As defined in 5 CFR 1320.3(c), "collection of information" comprises reporting, recordkeeping, monitoring, posting, labeling, and other similar actions. The title and description of the new information collection, a description of those who must collect the information, and an estimate of the total annual burden follow. The estimate covers the time for reviewing instructions, searching existing sources of data, gathering and maintaining the data needed, and completing and reviewing the collection.

⁴⁶ 44 U.S.C.3501-3520

This proposed rule would add reporting and recordkeeping requirements of owners and operators of commercial diving operations.

6.2 Collection of Information Requirements – Private Industry

This section details the USCG’s estimate of collection of information burden of the proposed rulemaking on the private industry. Several provisions of the proposed rulemaking would require maintaining and periodically updating a log book, reporting and storing examination scores and certifications, and maintaining records of equipment inspections. Table 6-1 presents the burden associated with these requirements.

Table 6-1 Private Sector Records and Documentation Costs

Description of Reporting and Recordkeeping Requirement	Number per Year (A)	Burden Hours per Action (B)	Burden Hours C= (B*D)	Reponses D= (A*F)	Unit Cost (E)	Entities (F)	Annual Cost (C*E)
Pre-audit notification: CDO 1/	0.4 (Twice every 5 years)	0.2	6.96	34.8	\$33.13	87	\$231
Pre-audit notification: Vessels/Facilities 2/	0.4 (Twice every 5 years)	0.2	6.96	34.8	\$33.13	87	\$231
Written Designation of Employee’s Individual Roles	10 (estimated dives per year)	1	870	870	\$33.13	87	\$28,823
Operational Drill Documentation	12	0.5	522	1044	\$33.13	87	\$17,294
Diver Recovery Drill Documentation	4	0.5	174	348	\$33.13	87	\$5,765
Emergency Rescue Drill Documentation	12	0.25	261	1044	\$33.13	87	\$8,647
Document Compliance with Subpart and Maintain Record 3/	<u>2 (once every 5 years)</u>	0.1	1.74	17.4	\$33.13	87	\$58

Description of Reporting and Recordkeeping Requirement	Number per Year (A)	Burden Hours per Action (B)	Burden Hours C= (B*D)	Reponses D= (A*F)	Unit Cost (E)	Entities (F)	Annual Cost (C*E)
Officer in Charge, Marine Inspection Dive Notice	10 (estimated dives per year)	1	870	870	\$33.13	87	\$28,823
Dive supervisor provides the PIC with a report on planned operation	10 (estimated dives per year)	1	870	870	\$33.13	87	\$28,823
Detailed plans of the area and subject of the work to be performed	10 (estimated dives per year)	1	870	870	\$33.13	87	\$28,823
Logbook Maintenance	10 (estimated dives per year)	0.5	435	870	\$33.13	87	\$14,412
Logbook Updates per Operation	10 (estimated dives per year)	0.2	174	870	\$33.13	87	\$5,765
Modify Operations Manual	10 (estimated dives per year)	1	870	870	\$33.13	87	\$28,823
Retention of Casualty Reports	as needed (estimate 1 year)	0.5	43.5	87	\$33.13	87	\$1,441
Commercial Diving Operator: Maintain Equipment Logbook	as needed (estimate 1 year)	1	87	87	\$33.13	87	\$2,882

Description of Reporting and Recordkeeping Requirement	Number per Year (A)	Burden Hours per Action (B)	Burden Hours C= (B*D)	Reponses D= (A*F)	Unit Cost (E)	Entities (F)	Annual Cost (C*E)
PIC Equipment: Maintain Equipment Logbook	as needed (estimate I year)	0.5	43.5	87	\$33.13	87	\$1,441
Dive Supervisor: Maintain Equipment Logbook	as needed (estimate I year)	0.25	21.75	87	\$33.13	87	\$721
Diver: Maintain Equipment Logbook	as needed (estimate I year)	0.25	21.75	87	\$33.13	87	\$721
SSA Helmets: Maintain Compliance Log	as needed (estimate I year)	0.25	11	44	\$33.13	44	\$364
Maintain Equipment Service Information	as needed (estimate I year)	0.25	21.75	87	\$33.13	87	\$721
Sign for Equipment use with oxygen mixture: "FOR OXYGEN ONLY"	as needed (estimate I year)	0.1	8.7	87	\$33.13	87	\$288
TOTAL			6,191				\$205,095

1)This event occurs twice in a 5-year period. Therefore, total cost is multiplied by 0.4 in order to distribute cost and burden over 5 years.

2)This event occurs twice in a 5-year period. Therefore, total cost is multiplied by 0.4 in order to distribute cost and burden over 5 years.

3)This event occurs once in a 5-year period. Therefore, total cost is multiplied by 0.2 in order to distribute cost and burden over 5 years.

The Coast Guard asks for public comments on the proposed collection of information to assist in the determination of (1) how useful the information is, (2) whether the information collection can help the agency perform its functions better; (3) whether the information is readily available elsewhere; (4) how

accurate the Coast Guard's estimate of the burden of collection is; (5) how valid the agency's methods for determining burden are; (6) how Coast Guard can improve the quality, usefulness and clarity of the information; and (7) how USCG can minimize the burden of collection.

6.3 Compliance Burdens – Government

The proposal would impose a collection of information burden on the Government. This section presents the analysis of the additional burden imposed on the Government. Government burden consist of records maintenance and documentation review by auditors on behalf of the government as well as a review of audit reports and a review of compliance documentation by the Coast Guard. See Table 6-2 for details.

Table 6-2 Government Records and Documentation Costs

Regulation	Burden per Action (hrs.)	Responses	Burden Hours	Unit Cost (\$/hr.)	Annual Cost
	A	B	C=(A*B)	D	(C*D)
Auditors: Records Maintenance ¹	0.2	87	17.4	\$33.13	\$115
Auditors: Audit Documentation ²	0.8	87	69.6	\$33.13	\$922
Auditor: Review Audit Results	2	87	174	\$79.00	\$13,746
CG: Review Documentation of Commercial Diving Compliance	2	87	174	\$79.00	\$13,746
Total		348	435		\$28,530

1)This event occurs once in a 5-year period. Therefore, total cost is multiplied by 0.2 in order to distribute cost and burden over 5 years.

2)This event occurs twice in a 5-year period. Therefore, total cost is multiplied by 0.4 in order to distribute cost and burden over 5 years.

I. TITLE: Marine Occupational Health and Safety Standards for Commercial Diving Operations -
- 46 CFR 197 Subpart B

OMB Control Number: 1625-NEW

Section 46 CFR part 197, subpart B covers commercial diving operations. We propose a revision to these regulations by modifying or clarifying some general provisions without significantly affecting their substance. As well, we would replace most of the regulations that impose specific operational, personnel, or equipment requirements. For those topics, we propose new regulations that adopt the latest standards provided by leading industry groups such as ADCI. Each of these groups has developed a set of standards that reflect best industry practices. The proposed rule would improve the safety of commercial diving operations by reducing the risk of injuries and fatalities related to diving incidents.

Under the proposed rule, commercial diving operations would: 1) periodically update a log book of diving activities; 2) ensure all personnel have taken the required qualification examinations and report them to the US Coast Guard and 3) conduct and maintain a record of equipment inspections before and after diving operations.

SUMMARY OF THE COLLECTION OF INFORMATION: The existing collection of information entails reporting and recordkeeping requirements. The proposed rule would include requirements ranging from maintaining and periodically updating a log book, reporting and storing examination scores and certifications, and maintaining records of equipment inspections. The collection of information would aid the regulated public in assuring safe practices associated with commercial diving operations.

NEED FOR INFORMATION: The Coast Guard needs this information to determine whether an entity meets the regulatory requirements.

PROPOSED USE OF INFORMATION: The Coast Guard would use this information to determine compliance of the regulatory requirements.

DESCRIPTION OF THE RESPONDENTS: The respondents are owners and operators of U.S marine commercial diving operations.

NUMBER OF RESPONDENTS: The burden of this proposed rule for this collection of information includes certifications, preparation of records, and records of inspections. This collection of information applies to owners/operators of commercial diving operations. We estimate the maximum number of respondents per year is 87.

FREQUENCY OF RESPONSES: This proposed rule will vary the number of responses each year by requirement. Details are shown in the preliminary Regulatory Analysis.

BURDEN OF RESPONSE: The burden of response for each regulatory requirement varies. Details are shown in the preliminary Regulatory Analysis.

ESTIMATE OF TOTAL ANNUAL BURDEN: We estimate an annual burden of 6,191 hours for the industry.

Appendix A - Population Calculations: In-Scope Commercial Diver and Diving Firms Population

Number of ADCI Diving Firms:

We estimate the relative number of commercial diving firms engaged in various modes of diving using ADCI data. First, we establish the marine firms under USCG jurisdiction (Table A-1). Per the 2012 ADCI listing of member firms, we can identify the marine oriented firms (USCG jurisdiction) and confirming that by surveying their websites. The identification process was mainly focused on reviewing a firm's website to identify what business interests the firm advertised. This information on the number of firms engaged in Marine activities is subsequently used to identify the total number of commercial divers under USCG jurisdiction.

Table A-1

Table A-1. Results of ADCI Firm Analyses	Number
Listed USA Commercial Diving firms registered with ADCI	175
Adjusted ADCI firms (accounting for mergers and non-diving companies such as manufacturing, research, etc.)	171
Marine firms Under USCG Jurisdiction	75
Marine firms under USCG Jurisdiction as a Proportion of Total ADCI firms (75/171)	.4386

Number of Affected Commercial Divers:

We estimate the number of affected commercial divers and commercial dive operations by reviewing BLS Commercial Diving population numbers. Those numbers account for all commercial diving in the U.S., including not only USCG regulated activity, but also OSHA regulated activity. After reviewing the latest 2 years of information, we used the 2009 population as it provided more information on three segments of the total population that were representative of the USCG responsibility. The key sub segments are presented in Table A-2.

Table A-2 Total Commercial Divers in U.S. from BLS

	2009	2010
Other Support Services	900	N.A.
Support Activities for Mining	610	570
Other Heavy and Civil Construction	340	550
Total	1850	1120

We estimate the total number of USCG jurisdictional divers by multiplying the proportion of ADCI firms engaged in work under USCG jurisdiction (43.86 percent) times the number of commercial divers in the affected sub segments ($1850 * .4386 = 811$ commercial marine divers). Therefore, we estimate there are an estimated 811 in-scope commercial divers involved in commercial diving activities regulated by the U.S. Coast Guard. U.S. Coast Guard jurisdiction includes all diving beyond the three mile limit and on the Outer Continental Shelf as well as diving that is done off of inspected vessels inside the three mile limit and other waterways within the U.S. (meaning all rivers and the Great Lakes).

Commercial Divers by Type:

ADCI also provides an estimate of the number of divers, which suggests a much bigger industry than the BLS data. However, the ADCI data set has two characteristics that suggest an industry closer to the BLS level. In discussing the data set characteristics with the ADCI staff, it became obvious that a.) the total number of divers represents not fully employed divers but just personnel who are qualified to be a commercial diver, and b.) the divers listed are likely listed multiple times depending on how many qualifications they have (e.g. saturation diver, mixed-gas diver, surface-supplied air diver, etc.).

Table A-3 ADCI Diver Population

	Total Population	USCG Jurisdiction*
Saturation Divers	859	859
Mixed-Gas Divers (MGD)	1,455	638
Surface Supplied Air (SSA) Divers	5,124	2247
SCUBA	65	40
Total	7503	3784

*USCG jurisdiction is all marine divers as developed below

Based on discussions with ADCI, in the Coast Guard's view, the BLS data set represents a more accurate accounting of the number of divers, while the ADCI data set is more useful for estimating the relative mix of surface-supplied air divers and mixed-gas divers.

The following assumptions, based upon our research, were used in the continuing analyses of the diving modes we expect to encounter:

- We estimate Saturation Diving involved 12 vessel/firms with 2 teams of 14 divers each. This conclusion as based upon an internet survey of known Saturation Diving firms with U.S. flag vessels, augmented by a discussion with participant firms at the 2012 Underwater Intervention Conference (ADCI sponsored commercial diving conference), and ADCI manning practices; This equates to 336 Saturation Divers.
- SCUBA is estimated to represent only 3 percent of the total commercial divers engaged in USCG jurisdictional activity. This equates to 24 divers at 4 men/team;
- Surface Supplied Air (SSA) diving populations were developed based upon the table using the ADCI divers qualification data
 - $SSA/No\ Decompression = (Total\ Marine\ Divers - Sat\ divers - SCUBA) * SSA\%^{47}$
 - $SSA/Other = (Total\ Marine\ Divers - Sat\ divers - SCUBA) * SSA\%$

⁴⁷ From Table A-3, SSA Divers under USCG Jurisdiction divided by Total Divers under USCG Jurisdiction

- Mixed-Gas (MG) diving populations were developed based upon the table using the ADCI diver's qualification data.
 - Mixed-Gas divers = (Total Marine Divers – Sat divers-SCUBA) * MGD%⁴⁸

Table A-4 Distribution of Mixed-Gas and Surface-Supplied Air Divers

	Divers	Percent of Total
SSA Divers	2247	78
SSA 100fsw ⁴⁹ /No Decompression		26
SSA 100fsw/Decompression		26
SSA 101-190 fsw		26
MG Divers	638	22
Total	2886	100

Source: ADCI

Commercial Diving Operations by Type:

Although we know the number of ADCI dive firms subject to USCG jurisdiction, we assess that there are some unaffiliated dive firms as well. Using the number of firms in each diving mode as an initial guide, and the initial distribution of divers per dive mode, we can estimate the number of firms assuming one dive team per firm as follows.

Using the total number of divers and subtracting out what the Coast Guard knows about Saturated Diving and SCUBA diving numbers. For example, we subtract the 336 Saturation divers as well as the 24 SCUBA divers from the total population of commercial marine divers (811). This gives us 451 divers that are not involved in saturation or SCUBA diving activities. We then multiply the 435 remaining divers by the ratio of mixed-gas divers presented above (.22) and estimate 96 divers involved in mixed-gas diving. Based on current Federal regulations and current industry protocols, we determine that each mixed-gas team contains five members. This brings the number of commercial mixed-gas diving teams to 19. We follow this same procedure to calculate the number of surface-supplied air divers and operations. See Table A-5 for results.

Table A-5 Estimated Commercial Dive Teams and Firms

	Divers	Dive Team Size	Dive Teams*
Total Marine Commercial Divers	811		
Saturation	336	14	24
SCUBA	40	4	10
Mixed-Gas Diving and SSA	435		
Surface Supplied Air (No Decompression)	113	4	28
Surface Supplied Air (Other)	226	5	45

⁴⁸ From Table A-3, Mixed-Gas Divers under USCG Jurisdiction divided by Total Divers under USCG Jurisdiction

⁴⁹ feet seawater

Mixed-Gas Diving	96	5	19
Total			127

*Total may not add due to rounding.

Based on the information in Table A-5, we estimated that 127 dive teams are under Coast Guard jurisdiction. If we assume that each ADCI firm has only 1 dive team each, we are left with 52 dive teams that are not accounted for (i.e., not ADCI members or are in fact part of a n ADCI multiple dive team firm).

Commercial Diving Operations, ADCI and Non-ADCI:

In order to allocate dive teams into ADCI and non-ADCI firms, we reviewed revenue and employment information for ADCI firms to determine the number of dive teams that could fit into a firm's revenue stream, knowing also (without detail) that the revenue stream would also account for equipment rental (vessels and sundry equipment).. The annual revenue that could be generated by 1 dive team will vary from about \$350,000 (SSA 5 man team) to \$1.3 million for a saturation dive team (14 man team). Obviously the firms revenue stream will also include equipment rental, with higher fees accruing to more complex diving equipment (SSA being the simplest to the extremely complex saturation diving mode). Of the 75 ADCI firms, 41 have revenues that support 1 dive team each or do not have publicly available revenue estimates (these latter we assume to be small and to have just 1 dive team). Of the remaining firms, 19 have revenue that would need 2 dive teams to support their revenue stream.. The remaining 15 firms have revenues that would support multiple dive teams and large equipment rentals (especially large saturation diving vessels).. Coast Guard estimates that 36 dive teams would be supported by these firms. Thus, we estimate that the ADCI firms account for 115 dive teams, with the remaining 12 teams distributed to non-ADCI firms. As the non-ADCI firms are expected to be smaller and involved in less complex diving operations, we assume that non-ADCI firms have one team per firm, resulting in an estimate of 12 non-ADCI firms (127-115). Therefore, we estimate there are 87 total commercial diving firms that would be impacted by the proposed rule (75 ADCI and 12 non-ADCI).

Table A-6 Estimated ADCI and Non-ADCI Commercial Dive Teams and Firms

Revenues	Dive Teams per Firm	Number of Diving Firms	Total Dive Teams
ADCI			
<=\$2.0 million or no data	1	69	41
> \$2 million to \$5 million	2	3	38
> \$5 million	Misc.	3	36
Total ADCI		75	115
Total Non-ADCI		10	12
TOTAL		85	127

Realizing there are many firms with multiple dive teams, we then estimate the ADCI firms using a numerical analysis that scales the non-sat, non-SCUBA, and non-MG firms appropriately. We are using the mix of commercial diving operations to distribute the population into the 75 ADCI firms.

Table A-7 Development of ADCI and Non-ADCI Firms and Divers*

Item Description	SAT	SCUBA	SSA	SSA	MG	Total
------------------	-----	-------	-----	-----	----	-------

ADCI Firms		12	10	13	21	19	75
ADCI SSA firm ratios				0.382	0.618	0	1
				13/34	21/34		
Distribution of “excess” teams		127-75-12		15	25		40
		Tot-ADCI-non-ADCI		0.382*40	0.618*40		
Add “excess” dive teams to single							
ADCI team firm estimate yields							
Total ADCI firms dive teams w/o SA and SCUBA				23	38	19	80
				(15+8))	(24+14)		
Non-ADCI Firm Distribution same as ADCI Distribution:							
SSA Dive firms assume one team /firm				5	7		12
Incremental Divers				5	0	0	5
Distribution of Current							
non-ADCI divers				20	35		55
Distribution of NPRM							
Non-ADCI divers				5	0		5
ADCI Divers				23	0	96	23
NPRM Divers				28			28

Source: USCG Calculations

* Calculations may not sum due to rounding

Vessel Population

Knowledge of the commercial diving vessel population is necessary since we need to estimate the cost of the vessel audits. Since we are working with non-ADCI firms which we assume are small by definition, we assume they have one dive vessel per firm. That yields 12 firms to audit.

Appendix B - IRFA Calculations

Table B-1 Marine Commercial Diving Firms from ADCI 2012 Directory USA

Name	NAICS Code	Upper Limit	Annual Revenue \$	Cost/Annual Revenue	≤1	>1≤3	>3
Firm 1	541990	14,000,000	1,000,000	0.051			1
Firm 2	238910	14,000,000	2,500,000	0.020		1	
Firm 3	561499	14,000,000	51,000	0.992			1
Firm 4	561990	10,000,000	1,500,000	0.034			1
Firm 5	541990	14,000,000	2,500,000	0.020		1	
Firm 6	561990	14,000,000	2,500,000	0.020		1	
Firm 7	237990	33,500,000	28,500,000	0.002	1		
Firm 8	541990	14,000,000	2,500,000	0.020		1	
Firm 9	541330	18,500,000	2,500,000	0.020		1	
Firm 10	236220	33,500,000	400,000	0.127			1
Firm 11	541990	14,000,000	5,000,000	0.010	1		
Firm 12	238910	14,000,000	2,500,000	0.020		1	
Firm 13	541990	14,000,000	1,000,000	0.051			1
Firm 14	237990	33,500,000	12,500,000	0.004	1		
Firm 15	238910	14,000,000	2,500,000	0.020		1	
Firm 16	541990	14,000,000	5,000,000	0.010	1		
Firm 17	541990	14,000,000	10,000,000	0.005	1		
Firm 18	541990	14,000,000	2,500,000	0.020		1	
Firm 19	238910	14,000,000	10,000,000	0.005	1		
Firm 20	561990	14,000,000	2,000,000	0.025		1	
Firm 21	541990	14,000,000	2,500,000	0.020		1	
Firm 22	541990	14,000,000	10,000,000	0.005	1		
Firm 23	541990	14,000,000	2,500,000	0.020		1	
Firm 24	488330	35,500,000	1,000,000	0.051			1
Firm 25	541990	14,000,000	1,000,000	0.051			1
Firm 26	541990	14,000,000	1,000,000	0.051			1
Firm 27	541990	14,000,000	2,500,000	0.020		1	
Firm 28	541990	14,000,000	500,000	0.101			1
Firm 29	238910	14,000,000	2,500,000	0.020		1	
Firm 30	541990	14,000,000	1,000,000	0.051			1
Firm 31	541990	14,000,000	5,000,000	0.010	1		
Firm 32	238910	14,000,000	5,000,000	0.010	1		
Firm 33	238910	14,000,000	2,500,000	0.020		1	
Firm 34	541990	14,000,000	5,000,000	0.010	1		
Firm 35	541990	14,000,000	2,500,000	0.020		1	
Firm 36	488330	35,500,000	10,000,000	0.005	1		
Firm 37	237990	33,500,000	20,000,000	0.003	1		
		Rule cost/firm	50,615		12	15	10

Appendix C - Benefits: Casualty Data and Breakeven Calculation

This Appendix contains all of the MISLE case information pertaining to the casualty cases we used to assess the benefits as well as the actual breakeven calculations.

C-1 Commercial Diving Casualty Cases

Note that detail in each case depends on the extent of content of the MISLE file. For the most part these are not oil and gas servicing related incidents, since we expect that portion of the industry to be using the best practices of the ADCI rules currently. There are some oil and gas servicing incidents included, but it was CG judgment that the nature of the incident was so generic, that it could have happened anywhere.

Fatalities

Item F-I Incident Report: 1483715

Date: 3/7/2002

Vessel Name: M/V King of the Red

Service: Vessel

Summary

On 07MAR02 a diver employed by DivCon and contracted to complete surface-supplied-air diving operations beneath the loading barge for the M/V KING OF THE RED, drowned as a result of a diving accident. SNM was engaged in mud and sediment removal operations beneath the loading barge when the casualty occurred. The apparent cause of this casualty is asphyxiation caused by the intake of water into his lungs. A post casualty inspection of the personal diving gear conducted at the U. S. Navy's Experimental Diving Unit in Panama City, FL found that a foreign object had lodged inside of the regulator in such a fashion as to prevent the flow of air to the diver (*see proposed regulation on Equipment and Operations Manual*). This effectively disabled both the surface-supplied air and the emergency air supply that the diver carried with him. The inspection of the personal dive gear and interviews with crewmembers showed that there were other problems with his gear that likely contributed to the casualty. (*see proposed regulations on Equipment and Operations Manual*). The dive-support equipment owned by Cal Dive/Aquatic aboard the MR. FRED was inspected and tested as a part of this investigation. It was found to be operating properly and in accordance with the regulations.

The investigation also identified some procedural deficiencies aboard the vessel. A standby diver was not ready to deploy with the appropriated suit. (*see proposed regulations on Operations*). There was no dive plan meeting held. The diver did not follow procedure and remain in one place when in trouble (*see proposed regulations on Drills*). Had proper procedures been in place they may have helped identify some of the problems with the gear prior to the dive (*see proposed regulations on Operations and Audits*). Furthermore, the diver was unable to or forgot to use the quick disconnect on his hot water suit during his attempted bail out (*see proposed regulations on Drills*). The report also states that this is the first time the diver had worn or was exposed to a hot water suit (*see proposed regulations on Operations*).

Location mile 228 on the Red River.

Causal Factors:

Based on MISLE Causal Analysis Report, several factors were identified as a potential cause.

- Workplace Factors:
 - Operations not in accordance with rules and regulations.
- Defense Factors:
 - Defense that could reasonably have been expected but never put in place
 - Absence of Briefings
- Precondition Factors:
 - Mismatches between the person and equipment
 - Improper Conditioning (wear) of equipment

Judgment of Need (Recommendations):

Accident Report:

The accident report provided a list of contributing factors.

- No Dive Plan: As stated in the accident report, the team was not using a written dive plan nor were they conducting proper safety meetings each morning prior to diving operations. According to the report, one employee had safety concerns regarding the dive but never voiced them to the dive supervisor.
- No Standby Diver: The standby diver was not suited up and in the water point of entry as required when diving in a physically confining space. Additionally, the standby diver was not suited up with the same setup as the primary diver (a hot water suit). As stated in the accident report “no suited stand-by diver was available on-scene when Diver 1 began experiencing problems. Had there been a stand-by diver, Diver 1 may still be alive today.
- Diver: The diver did not follow procedures requiring him to stay in one place when in trouble. Instead, he attempted to bail out of his gear and swim out. Unfortunately, he was unable to disconnect the “quick disconnect” on the hot water suit or he had forgotten to do so. This was the first time the diver had worn and been exposed to a hot water suit.

Investigating Officer Recommendations (Directly from IO report):

- Recommend that 46 CFR 197.204 (Coast Guard diving regulations definitions) and 29 CFR 1910.402 (OSHA diving regulations definitions) be amended to define what constitutes a physically confining space.

In incident investigation activity 1483715, a commercial diver drowned while conducting a surface-supplied air diving operation beneath a permanently moored uninspected deck barge. The diver was conducting mud and sediment removal operations underneath the barge when the casualty occurred. During the course of the investigation, it became apparent that Diver 1 had been diving within an excavated hole in the mud underneath the barge without a second diver tending his lines at the point of entry. The excavated hole was approximately 4' wide by 4' high by 10' long in size. When asked why there had not been a second diver in the water at the point of entry leading beneath the barge, there was some confusion by the dive supervisor and the dive team as to what constituted a "physically confining space." The dive team believed the situation did not constitute diving within a physically confining space because they were diving in 10 feet of water and were close to the bank.

There were many factors that led to this casualty occurring; however, had a second diver been in the water at the point of entry, the Investigating Officer believes Diver 1's chances of being successfully rescued would have been greatly increased. The phrase "physically confining space" is listed three times under 46 CFR 197.432 and 29 CFR 1910.425, however, no definition of this phrase can be found within either of these regulations. Had this definition existed within these regulations it may have brought some clarification to the dive team as to when a diving operation constitutes diving within a physically confining space. With this clarification, a stand-by diver may have been posted at the entrance to the hole leading underneath the barge and Diver 1 may

have been rescued prior to his demise. Also, had the definition existed and still been ignored by the dive team, appropriate measures could have been taken by the appropriate agency to hold the dive supervisor and DivCon, LLC accountable.

Recommend the phrase "physically confining space" be defined within 46 CFR 197.204 and 29 CFR 1910.402.

- Recommend 46 CFR 197 (Coast Guard commercial diving regulations) be amended to include a part listing required qualifications of a dive team similar to those stated in 29 CFR 1910.410 (OSHA commercial diving regulations).

In incident investigation activity 1483715, a commercial diver drowned while conducting a surface-supplied air diving operation beneath an uninspected deck barge. During the course of the investigation into this casualty, several questions arose regarding the qualifications of the divers and the dive supervisor which made up the dive team. As the dive operation was being conducted in accordance with the OSHA diving regulations in 29 CFR 1910.400, the Investigating Officer (IO) was able to determine the required qualifications as they are stated under 29 CFR 1910.410. However, he was unable to find any such part within 46 CFR 197. Had this diving operation been conducted under the jurisdiction of 46 CFR 197, the IO would have been unable to determine what qualifications the divers were required to have. In accordance with 46 CFR 197, any individual can walk off the street and be a diver as long as the dive supervisor ensures he is meeting the regulations stated. If the regulations stated in 29 CFR 1910.410 were incorporated into 46 CFR 197, specific requirements would exist regarding the qualifications of the dive team and would ensure accountability of the dive supervisor to use only qualified divers.

Recommend 29 CFR 1910.410 be incorporated into 46 CFR 197 to ensure only qualified divers are used to conduct diving operations conducted under the jurisdiction of 46 CFR 197.

Proposed Rules Assessment:

- **Manning, Proposed section on operations:** Report indicated a standby diver was not properly suited up and ready to deploy. Investigative officer as well as fellow divers (during interviews) identified this as a potential cause.
- **Drills, Proposed section on operations:** Additional drills could have exposed diver to a hot suit, reminded to follow procedures when in trouble, and provided practice on removing equipment.
- **Operations Manual, Proposed section on operations:** Has procedures requiring better maintenance and standards for inspection to mitigate the "other problems" that contributed to the casualty.
- **Audits, proposed section on audits:** regular audit procedures would likely uncover issues with equipment maintenance and operational procedures and readiness.
- **Dive Plan, Proposed section on operations:** The proposed regulations, requires the team to develop a dive plan and conduct pre-dive meetings. Investigative officer identified this as a potential cause.
- **Equipment, Proposed section on equipment:** The proposed regulations require regular maintenance and checking of all dive equipment.

Item F-II Incident Report: 1645241

Date: 7/6/2002

Vessel Name: M/V Mr. Fred

Service: Vessel

M/V Mr. Fred was conducting a diving operation in the Gulf of Mexico. The MR. FRED is owned and operated by Cal Dive/Aquatica out of Lafayette, LA, and was under contract to British Petroleum. The diver was working at a depth of 103 feet and breathing surface-supplied air. He was using his personal Kirby Morgan Superlite 17B dive helmet in addition to other personal dive gear. He was also wearing a helmet-mounted video camera that recorded both visual images of the work he was performing and audio of his communications with the dive shack aboard the MR. FRED. His assignment was to make a smooth cut around the end of a 36-inch diameter pipe in preparation for the installation of a bell guide. The first portion of the dive went well with nothing unusual to note. Forty-six minutes into the dive he had a minor problem using his helmet mounted headset to communicate with the dive shack. The source of the problem was a loose fitting on his helmet (*see proposed regulations on Equipment*). He adjusted the fitting and was able to communicate with the vessel again. Four minutes and four seconds later, after a total of fifty minutes into his dive, the diver experienced a sudden and catastrophic loss of breathing air. His last words to the vessel's Rack Operator were, "My air." The vessel immediately put the Standby Diver into the water to assist. When the Standby Diver descended to the diver's location he found him unconscious and laying over a cross beam that was attached to the structure at a depth of 107 feet. His helmet was off of his head and his neck dam was missing. (*see proposed regulations on Operations Manual, Drills*). By the time the Standby Diver was able to bring the diver up to the surface he had been without air for seven minutes. The dive team aboard the MR. FRED immediately began performing CPR. They also administered oxygen and placed him in the onboard hyperbaric chamber in an attempt to revive him. They were unable to revive him.

A post casualty inspection of the personal diving gear conducted at the U. S. Navy's Experimental Diving Unit in Panama City, FL found that a foreign object had lodged inside of the regulator in such a fashion as to prevent the flow of air to the diver (*see proposed regulations on Equipment*). This effectively disabled both the surface-supplied air and the emergency air supply that the diver carried with him. The inspection of the personal dive gear and interviews with crewmembers showed that there were other problems with his gear that likely contributed to the casualty. Better maintenance and inspection of the helmet and flow valve was needed prior to the dive. Records were not available to indicate when breathing hoses were last tested. (*see proposed regulations on Equipment*). The dive-support equipment owned by Cal Dive/Aquatica aboard the MR. FRED was inspected and tested as a part of this investigation. It was found to be operating properly and in accordance with the regulations. The investigation identified some procedural deficiencies aboard the vessel. The dive team did not have immediate access to medical and rescue equipment (*see proposed regulations on Operations*). Had proper procedures been in place they may have helped identify some of the problems with the gear prior to the dive (*see proposed regulations on Operations and Equipment*).

Location Eugene Island Block 273, at Latitude N28-25.5, Longitude W91-36.8.

Causal Factors:

Investigative Officer did not complete a Causal Analysis

Judgment of Need (Recommendations):

Accident Report:

The accident report provided a list of contributing factors.

- The defogger/free flow valve was found to be badly worn and encrusted with fine mud.
- Various problems with SuperLite 17B helmet could have been rectified if preventive maintenance and inspection had been performed. Operations and Maintenance Manual recommends preventive maintenance.
- Diver did not follow procedure. Diver did not slide the pneumofathometer underneath his neoprene neck dam and into his helmet. This would have taken him several seconds to do, but it could have provided him with an alternate source of breathing air.
- Standby diver was not outfitted with any rescue related equipment to address the situation.

- No effective pre-dive inspection in place to ensure that problems with the diver's helmet were identified and reported. In addition, it would have been determined that the diver's bailout bottle was leaking and due for a hydrostatic test.
- No records available to indicate when breathing hoses used by diver were last pressure tested or hydrostatic tested.
- None of the emergency procedures in Cal Dive's Safety Manual or ADS's Consensus Standards address failure of a diver's equipment. They do not address emergencies that originate with the diver's equipment.
- Vessel did not have a supply of medical-use oxygen on board.

Investigating Officer Recommendations (Directly from OI Report):

- It is recommended that the U. S. Coast Guard amend 46 CFR Part 197 to require vessels engaged in commercial dive operations to carry medical rated oxygen for use during emergencies. In addition, personnel should also be trained and qualified to operate such equipment. This amendment should be included at 46 CFR 197.314(a)(1)(ii) as being an additional supply item required for treating minor trauma and illnesses resulting from hyperbaric exposure.
- It is recommended that the U. S. Coast Guard amends 46 CFR Part 197 to require vessels engaged in commercial dive operations to carry a portable Automatic External Defibrillator (AED) for use during medical emergencies.

Modern defibrillators are durable, portable, and require minimal maintenance and training to use.

According to the American Heart Association's Public Access Defibrillation program pamphlet they are highly reliable (see Encl 49, and

http://216.185.112.41/Cpr_aed/cpr_aed_menu.htm):

"If the operator has attached the AED to an adult victim who's not breathing and pulse less (in cardiac arrest), the AED will make the correct "shock" decision more than 90 times out of 100 and a correct "no shock indicated" decision more than 95 times out of 100. This level of accuracy is greater than the accuracy of emergency professionals who must read and interpret the rhythms."

If AED's can be used safely in a shipboard environment, they will be an invaluable aid in ensuring the survivability of diving accident victims. AEDs will also be helpful during a variety of other medical emergencies that involve cardiac arrest.

- It is recommended that the U. S. Coast Guard amend 46 CFR Part 197 to require a separate air supply for the Standby Diver. In this fatal dive case the cause of the accident was initially not known, yet the Standby Diver entered the water breathing from the same air supply. Had carbon monoxide poisoning, carbon dioxide poisoning, or some other contaminant in the air overcome the diver, the Standby Diver would have suffered the same fate. On p. 257 in the book "The Physiology and Medicine of Diving," Mr. Gorman states that the Standby Diver should have a separate source of gas for this very reason. Rescuing a diver can be compared to rescuing someone from inside of a confined space-if the rescuer is breathing the same contaminated air as the first victim, then the rescuer is liable to become the second victim. Requiring an independent air source for the Standby Diver is the only way to prevent multiple deaths or injuries involving Standby Divers during an emergency. This should also be incorporated into any regulations developed relating to manifold design discussed in "Safety Rec. for Coast Guard - 8 - (MISLE Safety Recommendation # 5501) to amend 46 CFR 197 to include specifications for the design and construction of diving manifolds."
- It is recommended that the U. S. Coast Guard amend 46 CFR Part 197 to require Periodic and Post Casualty maintenance of dive helmets-preferably by a third party. Had either type of maintenance been performed on Mr. Mouritsen's helmet it is likely that this

accident would not have been fatal. Post Casualty maintenance, had it been required, would have identified all of the helmet's problems after the June incident-including the foreign object and the mud encrustation problems. Periodic maintenance, even if conducted prior to the June 6, 2002, incident, would at least have found the worn defogger parts and the excessive looseness of the demand regulator's roller lever.

- It is recommended that the U. S. Coast Guard amend 46 CFR Part 197 to require periodic shipboard drills that address various diving emergencies-including the rescuing of divers. At present different Coast Guard regulations require drills for such things as fires and abandoning ship, but none is required for responding to diving emergencies. The required drills should focus on what the different dive team members aboard the vessel are required to do. Participants should include the Dive Supervisor, dive manifold operator ("Rack Operator"), Standby Diver, and Tenders. In the July 6, 2002 accident that is the subject of this investigation the vessel did not advise Mr. Mouritsen to use the pneumo. Although events unfolded so quickly that this did not impact the casualty, practicing these procedures and developing the correct habits may save lives in the future. This recommendation dovetails with "Safety Rec. for Coast Guard - 6 - (MISLE Safety Recommendation # 5499) to amend 46 CFR 197 to require employers to put divers through periodic training and drills."
- It is recommended that the U. S. Coast Guard amend 46 CFR Part 197 to require employers to put divers through periodic training and drills designed to refresh the divers' knowledge of proper procedures for responding to underwater emergencies while at depth. Divers are trained in emergency procedures while attending Dive School, but there are no requirements for refresher training to keep their knowledge and skills current. Mr. The Diver appears to have attempted to perform some of the procedures required for loss of air, but he did not insert the pneumofathometer into his helmet. Had he been required to practice loss of gas flow procedures periodically, he might have had a greater chance of surviving this casualty. Requiring companies to put commercial divers through periodic drills or refresher training will accomplish this. This recommendation dovetails with "Safety Rec. for Coast Guard - 5 - (MISLE Safety Recommendation # 5498) to amend 46 CFR 197 to require periodic shipboard drills that address various diving emergencies."
- It is recommended that the U. S. Coast Guard amend 46 CFR Part 197 to increase its casualty reporting requirements for diving incidents. Reporting should be required for operational failures of vessel diving system life support equipment and operational failures of diving helmets. It was clear from this investigation that no steps were taken after the June 6, 2002, incident to ensure that the helmet was still serviceable. While the June incident would only have fallen under Coast Guard jurisdiction per 46 CFR 197.202 if the dive had been conducted off of a vessel, the July incident was required to be reported by 46 CFR 197.486. The reason it was reportable, however, was because of the fatality involved and not because the helmet failed. Had the Diver not been injured, the incident would have gone unreported under current regulations. The Coast Guard has very few regulations on helmets at the present time, so the collection and evaluation of casualty data will help identify areas for future improvements. Requiring helmet and vessel life support system failures to be reported will also facilitate the development of preventative measures by commercial dive companies.
- It is recommended that the U. S. Coast Guard amend 46 CFR Part 197 to require commercial diving vessels to have Dive Medical Technicians (DMTs) aboard during diving operations. The DMTs should also be required to have training in the administration of oxygen as discussed in "Safety Rec. for Coast Guard - 1 - (MISLE

Safety Recommendation # 5494)," and in the use of AED's as discussed in "Safety Rec. for Coast Guard - 2 - (MISLE Safety Recommendation # 5495)."

- It is recommended that the U. S. Coast Guard amend 46 CFR Part 197.410(a)(3) to require the Dive Supervisor to instruct each diver to report problems with the diver's personal equipment prior to each dive. This reporting should include problems with the helmet and the emergency air supply system. Current regulations only require the diver to be instructed to report "...physical problems or physiological effects including aches, pains, current illnesses, or symptoms of decompression sickness prior to each dive."
- It is recommended that Kirby Morgan Dive Systems redesign the Regulator Body Breathing Tube in the Superlite 17B Dive Helmet to prevent foreign objects from entering it and passing into the regulator.
- It is recommended that Cal Dive/Aquatica provide its dive vessels with Automatic External Defibrillators (AED's) for use during emergencies.
- It is recommended that Cal Dive/Aquatica initiate a program to conduct shipboard emergency drills focused on diving incidents. The drills should practice what the different dive team members aboard the vessel are required to do during the various emergencies and rescue operations that might occur. Participants should include the Dive Supervisor, dive manifold operator ("Rack Operator"), Standby Diver, and Tenders.
- It is recommended that the U. S. Coast Guard amend 46 CFR Part 197.420 to require employers to update their Dive Operations Manuals with emergency procedures for responding to failures of a diver's personal gear.
- It is recommended that the U. S. Coast Guard amend 46 CFR Part 197 to include specifications for the design and construction of dive manifolds. At present the CFR does not specifically address dive manifolds, yet the manifold is the key point in the life support system where all gas inputs are controlled and distributed to divers. Failure or improper operation of the diving manifold could have serious consequences for a diver in the water. While the manifold was operated properly and performed as designed during this incident, several items were noted:

Valves, gauges, and gas input and output lines need standardized labeling. A brief look at pages six through nine of this report and the diagrams and photos thereon illustrate the complexity of the system. While companies can still be allowed to design manifolds that best suit their overall diving system, new regulations should at least ensure labeling is required and standardized so that all of the components can be clearly identified.

The gas flow control valves do not have any method of being secured in either the open or closed position, nor are they labeled or tagged to indicate the position they should be in during an operation. Divers interviewed during this investigation reported that at times in their careers they had either had their own air supply inadvertently cut off while diving aboard other vessels or they were aware that such incidents had happened to other divers. At a minimum, new regulations should simply state that dive manifolds shall be designed so that all valves can be secured in either the open or closed position so as to prevent them from being inadvertently opened or closed. This can be accomplished with a quick-release mechanism.

The training given to manifold operators ("Rack Operators") is on the job with no classroom time or formal qualification process included. While the Coast Guard does not license "Rack Operators," nor should the Coast Guard license them, it must be recognized that the individual that operates the manifold fills a critical role in the life support system for the diver. At a minimum, new regulations should require companies to establish a qualification process that involves formal training for manifold operators. The training should include operation of the manifold and instructions to the diver during emergencies. The regulations should also require that manifold operators be designated

in writing similar to the way the "Person in Charge" is designated in writing. This designation will focus attention on the advanced training of individuals filling this critical position.

- It is recommended that Cal Dive/Aquatica establish a pre-dive inspection program to insure that the diving gear used by Divers is properly inspected prior to each dive and that any deficiencies noted are reported to the Dive Supervisor for evaluation before the diver enters the water. The pre-dive inspection should include tests to verify the proper functioning of:
 - Purge Button on helmet,
 - Defogger/free flow valve on helmet,
 - Auxiliary Valve on helmet,
 - Communications system in helmet, and
 - Bailout system

Cal Dive/Aquatica should also verify that the equipment used by divers, such as bailout bottles, has been properly serviced in accordance with federal regulations and that the servicing is current.

- It is recommended that Kirby Morgan Dive Systems update the "Kirby Morgan Superlite-17A/B Diving Helmet Operations and Maintenance Manual." Section 4.0 on page 31 entitled, "Inspection Maintenance Timetable for Superlite 17," should include guidance on what the diver should do following any casualty and/or operational failure of the helmet's components. The guidance should require professional inspection and servicing of the helmet and include a warning statement that the helmet should not be used again until such servicing is performed.
- It is recommended that the Association of Diving Contractors develop consensus standards that require member companies to conduct shipboard drills focused on diving incidents. The drills should practice what the different dive team members aboard the vessel are required to do during the various emergencies and rescue operations that might occur. Participants should include the Dive Supervisor, dive manifold operator ("Rack Operator"), Standby Diver, and Tenders.
- It is recommended that the Association of Diving Contractors develop consensus standards that require member companies to put divers through periodic training and drills to practice emergency procedures. The goal of the training and drills is to enhance the divers' knowledge and abilities to properly respond to underwater emergencies when at depth.
- It is recommended that the Association of Diving Contractors develop consensus standards that require member companies to update their Diving Operations/Safety Manuals. Updates should include emergency procedures to be followed in the event that a diver is rendered unconscious and in the event that the life support equipment a diver is using fails—such as a helmet.
- It is recommended that Cal Dive/Aquatica initiate a program to require its divers to undergo periodic training and drills to practice emergency procedures. The goal of the training and drills is to enhance the divers' knowledge and abilities to respond properly to underwater emergencies when at depth.
- It is recommended that Cal Dive/Aquatica update its Diving Safety Manual to include emergency procedures to be followed in the event that a diver is rendered unconscious and in the event that the life support equipment a diver is using fails—such as a helmet.
- It is recommended that the Association of Diving Contractors develop consensus standards for dive manifolds. Standards should include labeling, methods for securing valves in place with quick releases, and the training of Rack Operators.

Proposed Rules Assessment:

- **Drills, Proposed section on operations:** Drills would assist divers and crew of the procedures to follow in case of emergency.
- **Operations Manual, Proposed section on operations:** Has procedures required better maintenance of equipment (helmet and flow valve) and standards for inspection the "other problems" that contributed to the casualty.
- **Medical and Rescue Equipment, Proposed section on operations:** The proposed regulations require the team to have access to medical and rescue equipment.
- **Reporting and Recordkeeping: section on equipment:** No records available to indicate when breathing hoses used by diver were last pressure tested or hydrostatic tested. Proposed regulation requires that log books be updated to track equipment tests.

Item F-III: Incident Report: 1970383

Date: 12/28/2003

Vessel Name: Platform Edith

Service: Facility

Causality Fatality

On December 28, 2003, Diver 1, as one of two divers, was performing underwater operations, under a contract to remove mussels growing on the underwater structural sections of platform Edith, located 9 miles off the Port of LA-LB, California. Two divers first went down to 25 ft for 235 minutes and then descended to 80 ft for 3 minutes. At that time the other diver noted slack in the line they had spanned out and were trying to attach (to keep kinks out of the suction hose used to collect the mussels) and saw Diver 1 with all of his face gear removed. Lab test results indicated Diver 1 had hypertensive heart disease and drowned. All dive equipment was brought ashore and inspected by Diver 1's dive associate and IO. All equipment was found to be in good working order.

Location 9 miles off the Port of LA-LB, CA.

Causal Factors:

MISLE file listed none.

Recommendation or Corrective Action:

CG has taken no action beyond documentation since all evidence shows that 1) the main causal factor for this fatality was a pre-existing medical condition apparently aggravated by the individual performing strenuous activity while diving, and 2) the actual dive was in accordance with 46 CFR 197 requirements.

Proposed Rules Assessment (Effectiveness in Mitigation)

Manning: 3 High. The requirement for annual medical exams and medical assessment for fitness for duty should have identified the medical affliction

Operations Manual: 3 High. High. The requirement for documentation of diver medical fitness should have prevented this event.

Audit: 3 High. Audits would ensure compliance with the medical fitness requirement for divers.

Drills: 0 No effect.

Records Documentation: High. Documentation of compliance with medical requirements should have prevented the diver from entering the water.

Item F-IV: Incident Report: 2270536

Date: 1/6/2005

Vessel Name: Derrick Barge Long Beach

Service: Vessel

Diver was conducting an initial salvage survey for the M/V NEW HORIZON when the incident occurred. The New Horizon was anchored floating stern up in approximately 70 feet of water on the starboard side of the derrick barge Long Beach. The diver appeared to have been caught between the hull of the barge and the M/V NEW HORIZON during this initial survey. The impact apparently caused the diver's air

supply hose and his emergency air line to be severed from his helmet. The communication line was also severed sometime shortly after the accident. The "Dive Supervisor" responded by deploying the stand-by diver and also used the tending skiff to assist in the rescue. Diver was brought on board the tending skiff where first aid resuscitation attempts were made by rescuing personnel.

An investigation of the incident determined that there was no safety meeting for the dive crew prior to the incident. (Divers were not aware of safety procedures to follow in case of an emergency.) In addition, some members of the dive crew showed signs of fatigue or lack of sleep. This may have impeded their response. The investigative officer also concluded that "Training for the dive team personnel seemed to be lacking." Finally, interviews with dive crew indicate that the diver's umbilical may have been fouled.

Location Santa Barbara Channel Access. Casualty yes, Fatality yes.

Causal Factors:

Based on MISLE Causal Analysis Report, several factors were identified as a potential cause.

- Organization Factors:
 - Improper and inadequate schedules
 - Deficient planning
 - Improper or inadequate risk management
- Workplace Factors:
 - Supervision
 - Inadequate guidance
 - Inadequate Training
 - Inadequate work/rest schedule
 - Corrective Actions deferred/ignored
- Precondition Factors:
 - People
 - Physical conditions
 - conditions
 - Mismatches between the person and another person
- Production Factors:
 - Inattention to errors
- Defense Factors:
 - Defenses that were in place but failed due to inadequacy
 - Inadequate Briefings
 - Inadequate Training
 - Defense that could reasonably have been expected but never put in place
 - Absence of Training

Judgment of Need (Recommendations):

Accident Report: Below is the direct language from CG correspondence related to the accident. These based on the Investigative Officer's interviews and investigations. The last four concerns along with the last 6 recommendations are addressed by the proposed rule.

The following are safety concerns and/or observations made by Coast Guard Investigators during the initial and subsequent investigation and should be addressed prior to continuing with this salvage operation:

- Vessel(s) location: The (2) vessels involved in the salvage operation - The D. B. LONG BEACH and the M/V NEW HORIZON appeared to be much too close to each other for conducting safe salvage operations. It was reported that the D. B. LONG BEACH has the ability to extend its crane more than a 100+ feet off either side of the vessel and initially should not have been so close to the NEW HORIZON.
- The use of the towing vessel to help maintain the position of the barge may have also been a contributing factor. The towing vessel was trying to maintain the barges position by controlling the slack in the towing chain while also trying to adjust for the occasional

swell rolling through. This occasional adjustment may have moved the barge in a slight starboard direction toward the vessel being salvaged. This would not have been an issue if greater distance was maintained between the barge and the NEW HORIZON.

- The dive company(s) also had the ability to extend the diver out to a distance that would have created a much safer working environment. The tether line connected to the diver which included his supply airline and communications cable was approximately 300 feet long, but only approx. 20'-25' were being used due to the close proximity of the two vessels conducting the salvage operations.
- Using (2) separate contracted dive companies created possible communication/responsibility gaps between personnel. The tender for the safety/stand-by diver stated he was asked to tend the main diver so the other tender could take care of something else (welding machine). This exchange in duties took place immediately prior to the incident. Also, having a dive supervisor from one company in charge of a salvage operation involving two companies may have caused some confusion.
- Training for dive team personnel seem to be lacking: A member of the dive team stated he had not received any formal training prior to assuming his role as a tender in the salvage operation.
- Fatigue: (2) members of the dive team received approximately 2 to 3 hours of sleep from the night before. A 12-hour job (which ended at approximately 2300 the night before) was completed in Long Beach prior to them making the drive up to Ventura. They left Long Beach around 2400 and drove the 2 hours to Ventura where they stayed in a local Hotel. The salvage job scheduled for them the following day required them to be up @ 0500.
- Established safety procedures appeared to be in place but in certain cases were not always applied.

Recommendations:

1. Amend salvage/dive plan to ensure all safety related concerns are addressed and what changes will to be made prior to continuing with this or this type of salvage operation. These changes should be submitted via letter to the Coast Guard prior to continuing with salvage operations on the M/V NEW HORIZON. Things to consider:

- Distance between vessels should be kept at a distance that will ensure a safe working environment.
- Allowing diver to enter water using support/rescue boat verses barge ensuring enough umbilical line is available for use.
- Limit amount of contracted companies used in a salvage operation or ensure each companies role in completed understood by all parties involved prior to commencing operations.
- Insuring qualifications for team members assigned; annual dive requirements for divers; training for supporting personnel; safety training, etc. are current and kept up-to-date.
- Ensure each member of the team understands their role within the dive/salvage evolution and also the responsibilities that go with that role.
- If possible, task/assign members to one job.
- Fatigue/workload - ensure adequate rest for company personnel.
- Empowering each member of the salvage/dive team to speak up when safety concerns are observed.
- Follow written and established safety procedures.

Proposed Rules Assessment:

- **Manning, Proposed section on operations:** Report indicated that company personnel displayed fatigue due to lack of sleep. As indicated in interviews, this could have cause in the disagreements and confrontations experienced on the NEW HORIZON while the diver was in the water.

- **Drills and Dive Plan, Proposed section on operations:** Drills and exercises could have improved the probability divers followed written and established safety procedure. As indicated in interviews, “there was no safety meeting for the dive crew prior to incident. Divers were unaware of any safety procedure or plan to follow in case an emergency to retrieve an injured diver out of the water.”
- **Training, Proposed section on personnel:** As stated under the observations by the inspecting officer, “Training for dive team personnel seemed to be lacking.”
- **Equipment, Proposed section on equipment:** Interviews indicated that the diver’s umbilical may have been fouled. Maintenance and inspection of equipment is required under the proposed regulation.

Item F-V Incident Report: 2457122

Date: 7/30/2005

Vessel Name: Allied Elevator No. 2

Service: Vessel

Casualty: Fatality

Summary

Captain repositioned vessel in ten feet of water and engaged spuds. Engine was engaged to facilitate use of crane for repair operations. Commercial diving was required to repair a damaged pipe. Allied No. 2's engines were accidentally engaged and diver’s umbilical cord was wrapped around the propeller. Diver subsequently was dragged into propeller and crushed. Since diver supervisor lost communications with diver Chapman, he entered the water and followed his umbilical cord to find him. Supervisor cut Chapman free of propeller and brought him to the surface, where he applied CPR to no avail.

Location Main Pass Block 35, Gulf of Mexico.

Causal Factors:

According to the MISLE file, the initiating action was a vessel material failure (port engine, upon testing, had no neutral position). There was no criticism of the diving activity.

Recommendation or Corrective Action:

MISLE provided no information. Agency action complete with case closed

Proposed Rules Assessment (Effectiveness in Mitigation)

Manning: 1 Low

Operations Manual: 3 High A properly composed Operations Manual would restrict placing a diver in this hazardous location.

Audit: 3 High. Audits would ensure compliance with proscribed safety protocols.

Drills: 0

Records Documentation: High. Records and documentation would provide templates for dive planning and also ensure communication between the dive site and the vessel navigation team.

Item F-VI Incident Report: 2734747

Date: 8/2/2006

Vessel Name: M/V Midnight Star

Service: Vessel

Summary

The M/V MIDNIGHT STAR was conducting commercial diving operations on 01AUG06 when one of their divers having come back to the surface and gone through the decompression chamber was displaying symptoms of decompression sickness. The subject diver was put back into the chamber for treatment but his symptoms got progressively worse. An EMT on the boat was put into the chamber with him while a doctor specializing in diver injuries was flown in from New Orleans. The subject diver's

symptoms continued to worsen despite the treatments given and he died in the decompression chamber on 02AUG06. The subject diver's symptoms continued to worsen despite the treatments given and he died in the decompression chamber on 02AUG06. The autopsy report concluded the cause of death was decompression sickness with an arterial gas embolism. All of the air supply diving equipment was in good working order and the divers using it before and after the subject diver had no problems, air quality was satisfactory. The subject diver's dive helmet was tested and found to be in good working condition. The actions conducted and procedures used to lower the subject diver to the bottom and raise him back to the surface were proper. The decompression chamber was in proper working condition and decompression procedures used were proper. The doctor that treated the subject diver believes that arterial gas embolism was caused by the diver probably having small tears in his lungs from a previously unreported and probably somewhat recent injury (diving or non-diving) which when coupled with the resistance met when exhaling while on the Bibs mask in the decompression chamber would cause air to shoot through those tears in his lungs and into the blood stream. Some of the crew who knew him onboard the ship mentioned that the subject diver alluded to having problems/decompression sickness symptoms from previous dives but which were never reported. Subj diver's personal dive log and medical records confirm that he hadn't reported problems in the past. The coroner who performed the autopsy wouldn't have been able to test for these small tears since rigor mortis had already set in when the body reached his office. The probable reason that the subject diver didn't report his post dive problems before was that he may have believed that getting medical treatment would expose his marijuana use and that he would have been fired because of it. Subject diver had an upcoming trial in Louisiana where he was charged with possession of marijuana with intent to distribute. Subj diver's personal possessions from his bunk/locker onboard included a commercial package of synthetic urine (commonly used to subvert drug tests) and a small plastic bottle with a temperature strip on the side filled with yellow liquid assumed to be the synthetic urine. The subject diver's toxicology results from his autopsy were positive for marijuana metabolites.

Location Gulf of Mexico Vermillion Block 250. Casualty yes, Fatality yes.

Causal Factors:

Based on MISLE Causal Analysis Report, several factors were identified as a potential cause.

Under Pre-Conditions, the limitations of the person: physical conditions were listed.

Under Production factors, planning errors violations willful violation was listed.

Under Defense Factors, inadequate/ incorrect information about hazards was listed.

Recommendation or Corrective Actions

MISLE provided no information. Agency action complete. Case Closed.

Proposed Rules Assessment (Effectiveness in Mitigation)

Manning: Medium;

Medical Exam: High Proper medical examination would have revealed an issue.

Operations Manual: High; A properly composed Operations Manual require medical conditions (including drugs taken) to be reported.

Audit: High; Audits would ensure compliance with the medical fitness requirement for divers.

Drills: Low; Meaningful drills would have identified the difficulty of one tender/diver conducting a diver retrieval.

Records Documentation: High; Documentation serving as a guide.

Item F-VII Incident Report: 2765094

Date: 8/29/2006

Vessel Name: Rowan Halifax/Global Explorer

Service: Vessel

Summary

Commercial divers using surface-supplied air were working on the rigging of the legs of a sunken MODU. A diver was attempting to attach a 2 and 3/4 inch chain to a shackle for pre-rigging the MODU.

Shortly after Diver 1 entered the water, there was a loss of communication with him, although a gurgling sound inside helmet was heard. The standby diver was ordered to splash. Diver 1 visibly panics and begins ascent towards diving bell (*see proposed regulations for Operations Manual and Drills*). Diver 2 dons gear, but has trouble with airflow to helmet (*see proposed regulations on Manning, Equipment and Operations*). Problem fixed and he enters the water. Somehow Diver 1's helmet lands in worksite. Diver 2 descends, switching to 14% O₂. He pulled his way to Diver 1 via latter's hose. He notices Diver 1's helmet from 20 feet away. Diver 2 arrives at Diver 1, shakes him with no response. Diver 2 notifies topside to pull up slack. Divers arrive at bell and with standby diver, attempt to pull Diver 1 into bell. Diver 1 is finally pulled up topside. Diver 2 becomes fouled on the bell, then unfouls himself (*see proposed regulations on Operations and Drills*). He begins his ascent but switches to air "on the fly" (*see proposed regulations on Operations*). Vessel paramedic performs lifesaving procedures. Since the paramedic is not hyperbaric qualified, another staff is ordered into hyperbaric chamber to continue lifesaving procedures (*see proposed regulations on Manning and Operations*). Shore side physician finally orders halt to lifesaving procedures. Shortly afterwards, Diver 2 shows signs of the bends, while the other staff, still "dirty", from an earlier dive that day, experiences decompression sickness. Investigation concluded that there was inadequate supervision and a good rule was misused (*see proposed regulations on Operations*).

Location Lat 028° 04' 4" N, Lon 092° 42' 0" W Gulf of Mexico.

Causal Analysis from CG Investigation

Based on MISLE Causal Analysis Report, several factors were identified as a potential cause.

Under Preconditions, the following were noted:

- Mismatches between person and equipment;
- Mismatches between person and the environment;
- Equipment was in improper condition.

Under Production Factors, there was:

- Active failure of equipment

Under Defense Factors, there were the following noted:

- Inadequate training;
- Use of a bad rule;
- Inadequate supervision;
- Misuse of a good rule.

Judgment of Need (Recommendations):

Case is still open.

Proposed Rules Assessment (Effectiveness in Mitigation)

Manning: Proposed section on operations: Report indicates a lack of properly trained and certified medical personnel and divers were available to execute an emergency response. Standby diver apparently had to get "dressed" before he was ready to go. Another standby diver was already dirty for earlier dives recently. There were no hyperbaric trained medics aboard.

Operations Manual: Proposed section on operations: A properly composed Operations Manual would have defined the level of personnel and the required training and certification to execute an emergency. The frequency of equipment failure, utilization of a "dirty" diver for standby duty, standby diver not dressed and ready to enter the water, difficulty in placing diver into the bell, no hyperbaric qualified medical personnel all suggest insufficient staff, resulting in poor safety practices, lack of drills and improper supervision. Audits would identify the failure points in proper planning, personnel and qualifications required.

Audit: Proposed section on audits: Regular Audits would identify failures of sufficient manning/certification levels of the dive team.

Drills: Proposed section on operations: Drill would identify the insufficiency of the dive team standards, availability and certification.

Records Documentation: Proposed section on audits and operations: Templates and checklists for review of procedures, manning and drills would guide the dive team and support the regular auditing processes. Drills would identify the failure points in proper planning and qualifications required.

Item F-VIII Incident Report: 3100303

Date: 11/17/2007

Activity ID: 3100303

Vessel Name: Miss Polly

Service: Vessel

Casualty: Fatality

Summary

Deceased was splashed in water in full gear. Was swimming towards WC 168 to effect repairs. Complained of discomfort, made attempt to return to vessel. Made two steps back up ladder, then fell. Stand by diver launched for recovery, CPR started immediately once subject was on the deck of the vessel. CPR conducted for 1 hour 40 minutes. CPR was stopped and the victim was transported to the Calcasieu Parish Coroner's office. Coroner's report states the cause of death was "undetermined." The toxicology report indicated that the victim had an elevated level of medication; Tramadol (Ultram, a potent pain medication) (*see proposed regulations on Operations*). It was possible the medication contributed to the decedent's death according to the coroner's report. SECTOR Houston Galveston notified MSU Port Arthur of a requested medivac in West Cameron Block 168 of a diver in distress. Diver died before medivac was started by CG. MSU Port Arthur investigators responded to incident. All diving gear cleared, although there was no information on procedures.

Location West Cameron Block 168, Gulf of Mexico.

Causal Factors:

Based on MISLE Causal Analysis Report, several factors were identified as a potential cause.

Under Preconditions, limitations of the person, physical condition was listed.

Under Production Factors, planning errors, mistakes, use of a bad rule was cited.

Under Defense Factors, planning errors, violations, willful violation was listed.

Recommendations or Corrective Action: Agency action complete.

MISLE file had no information. Case closed. Agency action complete.

Proposed Rules Assessment (Effectiveness in Mitigation)

Manning: Low; not likely to have a significant effect

Medical Exam/Certification: High; Proper medical examination procedures and certification would mitigated this fatality

Operations Manual: High; A properly composed Operations Manual would restrict placing a diver in this situation.

Audit: High; Regular Audits would identify failures of sufficient medical certification of the dive team.

Drills: Low; not likely to have a significant effect

Records Documentation: High; Documentation of diver's medical fitness would validate the diver's condition.

Item F-IX Incident Report: 3281272

Date: 7/27/2008

Vessel Name: M/V Lonestar

Service: Vessel

Casualty Fatality

Summary

Four person (dive supervisor, diver, backup diver and tender...all interacting in various roles as appropriate) BIDCO dive operations in 64 feet of water. Dive superintendent added half way through shift. Diver 2 departs surface for 6th dive of this 12 hours shift and encounters difficulty working and communicating. Primary Diver orders Spencer to surface. Primary Diver notices Diver 2 stopped ascending, goes to assist and orders backup diver into water (*see proposed regulations on Operations*). Within minutes, Diver 2 is lifted onto deck and then transported to hospital (all over 25 minutes by USCG 47259). Diver 2 pronounced dead at Gloucester hospital. Diver 2 likely had a previously undiagnosed cardiac condition.

The autopsy report concluded the cause of death was decompression sickness with an arterial gas embolism. All of the air supply diving equipment was in good working order and the divers using it before and after the subject diver had problems, air quality was satisfactory. The subject diver's dive helmet was tested and found to be in good working condition. The actions conducted and procedures used to lower the subject diver to the bottom and raise him back to the surface were proper. The decompression chamber was in proper working condition and decompression procedures used were proper.

Location Atlantic Deepwater Spine (off of New England SE Coast).

Causal Analysis from CG Investigation

Based on MISLE Causal Analysis Report, several factors were identified as a potential cause.

Physiological conditions

Other unspecified production and defensive factors

Multiple job responsibilities some each diving participants

CG Recommendations

Case is still open

Proposed Rules Assessment (Effectiveness in Mitigation)

Manning: High; One of the supervisors was also the standby diver. Proposed rules would not allow multiple responsibilities

Operations Manual: High; A properly composed Operations Manual would restrict placing a diver in this hazardous situation (multiple dives on one shift).

Audit: High; Regular Audits would identify failures of sufficient manning/certification levels of the dive team.

Records Documentation: High; Proper documentation and records maintenance would provide the divers and the supervisors with templates and procedures for consistency in the application of required reporting and also would facilitate auditing functions.

Medical Exam: If the condition was known, and annual medical exams should reveal that condition, the diver would not be permitted to dive. A medical; exam focused on hyperbaric exposure, would lead to a cardiac exam.

Injuries

Item I-I Incident Report: 1600506

Date: 2/14/2002

Activity ID: 1600506

Vessel Name: Superior Conqueror

Service: Vessel

Location: South Timbalier Block 63

Casualty: Injury

Surface supplied air diving operation to service a riser pipe. Diver was a standby diver waiting his turn to enter the dive stage which sits on deck. It is composed of a basket secured to handrails, a standard bowbit and a starboard crane which has a 10 foot cable sling and 20 foot strap. The dive supervisor was preparing the dive stage and had released the ropes and chains that secured the stage to the starboard bit and handrail. There was in slack in the cable sling and nylon strap when Diver tried to enter the diver stage. The stage tipped over due to the slack in the sling and the Diver fell overboard. The stage met the end of the slack and swung back toward the boat, whereupon Mr. Pegues met the stage in midflight and suffered injuries. The Diver was able to crawl back into the now lowered stage. Diver suffered a broken hip and patella from his fall. He was transferred to Hospital in Houma, LA.

Causal Factors:

MISLE file provided no information.

Recommendations or Corrective Action:

MISLE file provided no information.

Proposed Rules Assessment:

- **Manning:** 3 High. Dive supervisor was acting as the diving tender. The Diving Supervisor could not oversee the safety of the operation if he was performing dive tender duties
- **Operations Manual:** 3 A properly composed Operations Manual would prevent the Diving Supervisor from performing dive tender duties.
- **Audit:** 1 Low
- **Drills:** 1 Low
- **Records Documentation:** 1 Low

Injury Severity Calculation

Item I-II Incident Report: 1713105

Date: 2/23/2002

Activity ID: 1713105

Vessel Name: BB 45

Service: Vessel

Location: Gulf of Mexico Vermillion Bay

Casualty: Injury

Summary

Global diver contracted with Broussard Bros. to work on a Chevron pipeline. Diver, using surface-supplied air, was jetting a 3" pipeline. After making his initial pas, he was going around for a second time. He was using his left leg for support in place and his right leg straight. At that time, an unknown object (presumably metallic) punctured his thigh, through the wet suit. He was hospitalized for eight days. He was out of work from February 24, 2002 through June 28, 2002.

Causal Factors:

MISLE file Causal Analysis Report did not list any factors as a potential cause.

Recommendations or Corrective Action:

MISLE file empty.

Proposed Rules Assessment:

Manning: Low

Operations Manual: 2 Medium. There is no evidence that an errant piece of metal could be accounted for. However, perhaps a requirement for better protective shielding may have mitigated the risk.

Audit: Low

Drills: Low Hard to simulate an accident such as this one. However, drilling to recover an injured diver is possible and should be effected as part of normal drills.

Records Documentation: Low

Item I-III Incident Report: 2762375

Date: 8/3/2006
Activity ID: 2762375
Vessel Name: Big Chief
Service: Barge
Location: Gulf of Mexico
Casualty: Injury

Summary

Solo diver working on pipeline at depth of 62 feet. Diver's foot got tangled in lift bag and pulled to surface rapidly. In reviewing the 96 hour work/rest history prior to the accident, the diver apparently was on watch for 20 hours straight just before the accident. Diver suffered fracture ankle and head injuries about the eye. Injury was deemed to be of moderate severity.

Causal Factors:

MISLE file Causal Analysis Report did not list any factors as a potential cause.

Recommendations or Corrective Action:

MISLE file does not have this information.

Proposed Rules Assessment:

Manning: High; The need for a diver to work for such extended periods indicates a lack of sufficient manning standards.

Operations Manual: High; A properly composed Operations Manual would prevent work in excess of the restrictions in place. Also the issues of diver entanglement would have been addressed.

Audit: High; Regular audits would identify substandard practices an excessive work hours resulting in fatigue.

Drills: Low

Records Documentation: High; Templates and checklist to prevent excessive work and to ensure precautions are affected during lift bag operations may have prevented this event.

Item I-IV Incident Report: 3147443

Date: 2/8/2008
Vessel Name: Java Installer 5
Service: Barge
Location: Grand Isle Block 47c, Gulf Deep Water Spur
Casualty: Injury

Summary

Divers working among debris on sea floor at a depth of 90 feet. Diver was attempting to secure a 3,000 lb frame to sea floor with the assistance of a crane operator. Scuba diver was crushed between frame and a valve on a collection dome nearby. Diver fractured two ribs. Accident severity was serious.

Causal Factors:

According to the Causal and Human Error Analysis, the following issues were identified as contributing to this accident:

- 1.) There was a mismatch between the person and the environment;
- 2.) Inattention errors;
- 3.) Deregulation (removal of training, briefing, qualification and other requirements).

Recommendations or Corrective Action:

Corrective action was to change location of support frame, inspect rigging for items that could hang up, and limit crane movements to small increments.

Proposed Rules Assessment:

- **Manning: 1 Low**
- **Operations Manual: 3 High;** A properly composed Operations Manual would require a proper Pre-Dive planning meeting to include a job hazard analysis.

- **Audit: 3 High;** Regular audits of the diving operation would indicate the lack of job hazard analysis and evaluation.
- **Drills: 1 Low**
- **Records Documentation: 3;** Templates and checklist to guide the dive team during planning operations would have ensured the identification of hazards. Documentation would also facilitate a robust auditing process to identify deficiencies.

C-2 Benefit Calculations

For a breakeven analysis with regard to fatalities, we used annualized costs at a 7-percent discount rate over a 10-year period, and compared it to a construct called a statistical life (VSL).⁵⁰ We take the VSL, \$9.1 million,⁵¹ as the benefit that could be derived from the rulemaking if one fatality is prevented, divided by the annualized cost that would be incurred to determine the breakeven year. This breakeven is shown in the display below for each cost element not using the MISLE casualty data.. At a 7-percent discount rate, the proposed rule elements would need anywhere from 44 to 3,056 years to prevent one fatality in order to breakeven.

	Drills	Audits	Record Keeping	Med Exams	Med Training
Annualized Cost	\$43,729	\$ 42,589	\$ 205,095	\$23,375	\$2,977
Breakeven (yrs)	208.10	214	44	389	3,056

⁵⁰ See Chapter 4 discussion of benefits for detail on VSL.

⁵¹ Op. cit.

Appendix D - ADCI Audit Requirements

The following is the ADCI section that details their audit requirements that USCG expects to generally follow.

10.0 ADCI COMPLIANCE AUDIT PROCEDURES

10.1 INTRODUCTION AND PURPOSE OF AUDITS

The Association of Diving Contractors International (ADCI) offers three different types of audits for contractors and associate member schools that conduct diving operations. The first type of audit that the contractors and schools will become familiar with is the ADCI self-audit report. This report is conducted internally by company personnel and should be submitted with all other application information as part of the application process or as mandated by the association on a periodic basis. The purpose of this audit is to provide applying companies and schools with a clear idea of the necessary recommended and required items for compliance with the ADCI consensus standards. When required, the ADCI will direct existing members to submit a revised self-audit protocol so that updated information about the contractor or school will be available for review.

The second type of audit that the association offers is the ADCI diving contractor audit report. This protocol is to be completed by a third party designated by the ADCI executive director, in agreement with the submitting contractor. This audit is performed as the last step of the application process for contractor or associate member school applicants. This audit protocol can also be utilized as part of the membership review process for a contractor or associate member school. The purpose of this audit is to provide a degree of assurance to the ADCI board of directors that the company applying for admission or under review is capable of adherence to the ADCI consensus standards.

The third type of audit that the ADCI offers is the saturation diving inspection and checklist protocol. This protocol is utilized with contractors who are engaged in saturation diving operations. This protocol is to be completed by a third party, designated by the ADCI executive director, in agreement with the submitting contractor. The purpose of this audit is to provide a degree of assurance to the ADCI board of directors that the company engaging in saturation diving operations is capable of adherence to the ADCI consensus standards' recommended guidelines for saturation diving operations.

10.2 SELF-PERFORMED COMPLIANCE AUDIT (ADCI SELF-AUDIT REPORT)

Available on the following page.

10.3 THIRD-PARTY COMPLIANCE AUDIT

ADCI Diving Contractor Audit Report (on Page 184)

ADCI Saturation Diving Inspection and Checklist Protocol (on Page 207)

ADCI Pre-dive Safety Checklist (on Page 225)

SELF-PERFORMED COMPLIANCE AUDIT (ADCI Self-audit Report)

INFORMATION PROVIDED BY APPLICANTS WILL BE CONSIDERED CONFIDENTIAL

General Instructions for Completion

1. The following document includes references to the ADCI International Consensus Standards for Commercial Diving and Underwater Operations, with referenced sections noted in bold numeric typeface.

2. Companies completing this audit form should furnish brief statements where appropriate. Where entries are required (such as where multiple personnel or items of equipment are noted), this information can be provided on a separate attachment.

3. It is recognized that not all sections of this audit form may apply. For example, where a company does not have an ISO procedure in effect, that can be noted, or where a health certificate or diver insurance, etc., is not required, insertion note stating “not applicable” is satisfactory.

4. Companies performing self-audits may furnish attachments, as they consider necessary and appropriate. ADCI will make contact with the submitter for any additional information or clarification considered necessary. On-site audits can be conducted in a manner to permit the auditor to view documents retained in keeping with the company’s administrative procedures.

5. It is not acceptable to merely refer to the company’s safe practices/operations manual on the following audit form. Each question should be answered in a manner to assure the auditing evaluator that the submitting company is in compliance with the requirements.

ADCI SELF AUDIT REPORT
CONFIDENTIAL

Member Candidate or Member	
Company	
Company Representative	
ADCI or Company-designated Auditor or Self-audit	
Address	
Date	
Report Number	

This audit protocol sets out a list of questions, which the auditor will address with a view to determining compliance with the ADCI International Consensus Standards for Commercial Diving and Underwater Operations. These questions are structured to cover the following areas in a manner that is consistent with the information presented in the consensus standards.

The auditor may, if he or she feels it appropriate, amplify answers to questions in areas of concern identified during the application documentation review or during the course of the audit.

The applicant company shall be furnished an advance copy of these audit procedures for review and preliminary completion prior to arrival of the ADCI representative(s) on site. These audit procedures will be made available at www.adc-int.org.

1. General Information	
Company Name	
Address	
Telephone	
Facsimile	
Email	
Website	
Business Scope	
President,	
Managing Director	
Safety Manager	
QA/QC Manager	
Operations or	
Diving Manager	
2. Personnel Requirements	
2.1 Personnel Qualifications (must be on file at the company location for each diver). 2.2 Existing members are NOT required to submit complete information on these personnel but are required to have complete records on each diver employed or used during the conduct of commercial diving operations. Identify personnel by ADCI certification card number.	
Name of Diver	
Diver's Training Course(s) Section 3	
Other Training Course(s)	
Diver's Certification Section 3	
Diver's Log Book Section 5	
Diving Supervisor(s) Section 3 and Section 5	
Life-support Technician(s) Section 3	

2.3 Medical Requirements (Must be on-file at the company location for each diver). Note: It is not intended that disclosure of doctor-to-patient information is required but rather that a valid medical examination has been conducted and that examinee as been judged “fit to dive.”	
Medical Examination Section 2	
Examining Physician Organization Section 2	
Medical Records Section 2	Note: No confidential information is desired.
International Consensus Standards For Commercial Diving And Underwater Operations	
3. Operations Procedures	
3.1 General Operations Procedures	
Safe Practices/Operations Manual Section 5	
Does the safe practices/operations manual contain copies of recognized tables for decompression and treatment (including altitude corrections)?	YES _____ NO _____ What tables does your company use? _____
Emergency Aid Section 5	
First Aid Section 5	

Planning and Assessment Section 5	
Job Safety Analysis Procedure Section 5	
Dive Team Briefing Section 5	
Minimum Dive Team Numbers Section 4	
Inspection of Systems, Equipment and Tools Section 5 and Section 10	
Decompression Chamber Section 6	
Standby Diver Section 5	
Warning Display Section 5	
Reserve Breathing Supply Section 5	
Communications Section 5	
Company Record of Dives Section 5	
Personal Protective Equipment Section 5	
3.2 Assignments and Responsibilities (Are your procedures consistent with the requirements set forth in the consensus standards?)	

Diving Supervisor Section 3 and Section 5	
Diver Section 3	
Standby Diver Section 3	
Entry-level Tender/Diver Section 5	
Life-support (Saturation) Technician Section 3	
3.3 Safety Procedure Checklist – Section 5 and Section 10	
3.4 Equipment Procedure Checklist – Section 5 and Section 10	
3.5 Specific Operations Procedures (hand-held power tools; welding and burning equipment; explosives) – Section 5	
3.6 Emergency Procedures (fire; equipment failure; adverse environmental conditions; medical illness; treatment of injuries) – Section 7	

4. Equipment and Systems				
4.1 Does the company have established check-off lists for inspection of equipment and systems intended to be used for commercial diving and underwater operations to ensure functional and operational readiness and safety for intended use? _____ 4.2 Identify personnel who perform the initial and periodic examination, testing and certification of diving equipment and system: _____ _____				
4.3 Diver's Dress – Section 6				
Item	Description	Numbers	Last Inspection or Testing Date(s)	Comments
1	Dry Suits			
2	Hot Water Suits			
3	Harnesses			
4	Bailout Systems			
4.4 Helmets and Masks – Section 6				
Item	Description	Numbers	Last Inspection or Testing Date(s)	Comments
1	Heavyweight Helmet			
2	Lightweight Helmet			
3	Masks			
4.5 Hoses and Manifolds – Section 6				
Item	Description	Numbers	Last Inspection or Testing Date(s)	Comments
1	Umbilical & Breathing Hoses			Are these properly marked?
2	Oxygen Hoses			
3	Air-supply Manifold			
4	Mixed-gGas Manifold			
5	Other Manifolds (Breathing Gas Control Systems)			

4.6 Compressors – Section 6				
Item	Description	Numbers	Last Inspection or Testing Date(s)	Comments
1	Compressors a. Low Pressure b. High Pressure			
2	Volume Tanks			
3	Filters			
4	Air-purity Tests			
4.7 Diver Entry and Egress Systems – Section 6				
Item	Description	Numbers	Last Inspection or Testing Date(s)	Comments
1	Ladder and Stage			
2	Man-rated Lift s			
3	Open Bell (Class 1)			
4.8 Pressure Vessel for Human Occupancy – Section 6				
Item	Description	Numbers	Last Inspection or Testing Date(s)	Comments
1	DDC			
2	Systems			
3				
4				
4.9 Gauges – Section 6				
Item	Description	Numbers	Last Inspection or Testing Date(s)	Comments
1				
2				
3				

4.10 Relief Valves – Ss Appropriate to System Installed – Section 6				
Item	Description	Numbers	Last Inspection or Testing Date(s)	Comments
1				
4.11 Timekeeping Devices - Section 6				
Item	Description	Numbers	Last Inspection or Testing Date(s)	Comments
1				
2				
3				
5. Accident Reporting				
Article I. 5.1 What accident recording procedure (Section 7) does your company use?				
Article II. 5.2 Record the number of lost time incidents, fatalities, or near-miss reporting figures for past three years as recorded in company records/insurance information?				
6. Health, Safety and Environmental System Management (Company Process) – Section 10				
6.1 Is a health, safety and environmental management system in place, and how oft en is this communicated to employees?				

Article III. 6.2 What is your company's method for dealing with diving medical emergencies?	
6.3 Last emergency response drill conducted: 	
6.4 Last safety meeting conducted: 	
6.5 Last safety audit conducted: 	
7. QA / QC Management (Company Process) – Section 10	
Article IV.	
7.1 Does the company have an established QA/QC manual? 	
7.2 ISO registered certifications achieved (if applicable):	
7.3 Last QA/QC in-house audit date: 	
Diving Personnel Information Form	
This form should be used by new member applicants and may be used by existing members as an internal record to maintain pertinent information of employees or other personnel used in the conduct of commercial diving or other underwater operations. Existing members are NOT required to submit complete information on these personnel but are required to have complete records on each diver employed or used during the conduct of commercial diving operations. <u>Identify personnel by ADCI commercial diver certification card number.</u>	
Name of Diver	
Divers' Training Course(s)	
Other Training Course(s)	
Diver Certification #	
Is a commercial diver's log book properly maintained and periodically checked by the employer?	
Supervisor's Designation (if applicable)	
Medical Examination	
Examining Physician or Organization	
Examination Standard	

Medical Records (see Section 2) No confidential information is desired.	
--	--

Appendix E - Rig 12 Report Recommendations

RIG 12 Recommendations (from RIG12 accidentnarrative.doc)

Recommendations:

1. Commandant should require bailout bottles for all commercial diving operations, regardless of depth. The bailout bottles should have sufficient capacity to supply a diver with an appropriate volume of air at the deepest depth being worked. The facts of this case do not strongly support a recommendation for bailout bottles. Nevertheless, all diving experts consulted by the Investigating Officer agreed that bailout bottles come in so many sizes and configurations, and are so inexpensive that every dive should begin with the presumption that a bailout bottle will be used.

2. Commandant should require all unused auxiliary gas ports on diver worn life support equipment to be capped or blanked during all commercial diving operations. This will remove the possibility of water entering a diver's helmet if he inadvertently opens an emergency valve.

3. Commandant should require a standby diver dressed out and with a separate air supply, ready to quickly deploy for all commercial diving operations regardless of depth.

4. Commandant should require diving stages for all commercial diving operations regardless of depth, except where they would be impractical. This will speed entry to the water for divers and rescue divers and remove the need for rescue operations to work from personnel baskets. In this casualty, the rescue operation was itself so slow that using a crane operated Billy Pugh basket as a rescue platform did not significantly add to the delay. Nevertheless, there is no question that a diving stage at water level would have speeded up the rescue.

5. Commandant should require the Diving Supervisor and the Master or Person-in- Charge to develop a site specific rescue plan designating the equipment and personnel that will be used for a rescue or removal of an injured diver from the water for all commercial diving operations.

6. Commandant should require that, prior to any commercial diving operation, the Diving Supervisor describes the rescue plan to all members of the diving team.

7. Commandant should require the Diving Supervisor to complete a Job Hazard Analysis before every commercial diving operation. See IO Exhibit 57, ADC Consensus Standards, pg. 3-9 to 3-10b.

8. Commandant should require Diving Supervisors to complete a pre-dive safety checklist suitable to the type of diving equipment and procedures to be used, prior to all commercial dive operations. See IO Exhibit 53, Navy Dive Manual, pg. 4 -37 to 4-49.

9. Commandant should consider changing Coast Guard regulations to ensure accountability of commercial diving contractors for maintaining records and logs for their diving equipment. Commandant should also make minor changes to Coast Guard regulations in addition to those described above to ensure Offshore Installation Managers play a more active role in pre-dive safety preparations. Present Coast Guard diving regulations place record keeping responsibilities on diving supervisors. Diving supervisors are appointed on a job to job basis and their designation ends when the diving job they supervise ends. Many of the record keeping responsibilities, however, are continuous and must be completed between diving jobs, away from the dive site. The following recommended regulation changes

illustrate how the commercial diving contractor and Offshore Installation Manager could be given a more responsible role in the record keeping and pre-dive safety processes.

a. At 46 CFR 197.204 [Definitions], Commandant should add a definition "Commercial Diving Contractor" to describe the person or business that provides commercial diving services.

b. At 46 CFR 197.484(a) [Notice of casualty], after the words "person-in- charge", Commandant should include the words "Diving Supervisor or Commercial Diving Contractor."

c. At 46 CFR 197.486 [Written report of casualty], after the words "person-in-charge of a vessel or facility", Commandant should include the words "or Diving Supervisor or Commercial Diving Contractor."

d. Commandant should change 46 CFR 197.210 [Designation of diving supervisor] as follows: "The Commercial Diving Contractor shall designate in writing a Diving Supervisor for each commercial diving operation. The Diving Supervisor shall present the written designation to the Master or Person-in Charge."

e. Commandant should change 46 CFR 197.402 (2) (i) [Responsibilities of the person-in-charge] as follows: "Prior to permitting any commercial diving operation to commence, the Master or Person-in-Charge shall examine the Diving Supervisor's written designation to ensure it is complete as require197.210."

f. Commandant should cross-reference 46 CFR 109.109 [Responsibilities of master or person in charge] with 46 CFR 197.402 [Responsibilities of person-in- charge].

g. Commandant should change 46 CFR 197.480 (c) [Logbooks] as follows:

(c) The Diving Contractor and the Diving Supervisor conducting commercial diving operations from a vessel or facility subject to this subpart shall maintain a logbook for making the entries required by this subpart.

(d) The logbook required to be maintained by this subpart shall be taken to the jobsite for every commercial diving operation and shall be available for inspection by the Master or Person-in-charge, the United States Coast Guard, or any other cognizant agency.

(e) The Diving Contractor shall retain the logbook required to be maintained by this subpart for a period of not less than 3 years.

h. Commandant should change 46 CFR 197.482(d) [Logbook entries] as follows: (d) The Diving Contractor and the Diving Supervisor shall insure that a record of the following is maintained: . . .

(e) The Diving Contractor and the Diving Supervisor shall insure that copies of each of the records required under paragraph (d) are included in the operations manual required by 46 CFR 197.420. The records required under paragraph (d) must be maintained by the Diving Contractor for a period of not less than 3 years.

i. At 46 CFR 197.420 [Operations manual], Commandant should add the following:

(e) The operations manual must contain copies of the records required to be maintained by 46 CFR 197.482 (d) and (e).

j. At 46 CFR 197.450 [Breathing gas tests], Commandant should change the words "The diving supervisor shall ensure that" - to The Diving Contractor shall ensure that -

k. At 46 CFR 197.450 [Breathing gas tests], Commandant should add the following:

(d) The Diving Contractor shall maintain the above stated test records for a period of not less than 3 years.

10. Commandant should require the Dive Supervisor and Master or Person-in- Charge to execute a Declaration of Inspection verifying their respective duties have been completed before any commercial dive operation begins. See 46 CFR 35.35-30 for an example of the concept as it is applied to oil transfers.

11. At 46 CFR 197.204 [Definitions], Commandant should include a definition of "Diving Tender". Commandant should consider adopting the description of Diver Tender set out in the Navy Dive Manual. See IO Exhibit 53, Section 4-8.5.3.

12. At 46 CFR 197.204 [Definitions], Commandant should include a definition of "Dive Tending" or "Tending."

13. Commandant should consider limiting the duties of a dive tender to only tending the dive umbilical during a commercial diving operation, as illustrated by the following wording. At 46 CFR 197.432 (c)[Surface-supplied air diving], Commandant should add the words:

; the person tending the diver shall have no other duties while the diver is under water;

14. At 46 CFR 197.204 [Definitions], Commandant should consider consolidating the definitions "Commercial diver" and "Diver" into one inclusive definition.

15. Commandant should establish minimum manning standards for all diving operations. Commandant should consider adopting the standards set out in the ADC Consensus Standards. See IO Exhibit 57, pg. 3-24 to 3-29.

16. Commandant should establish commercial diving qualification standards for Commercial Divers, Commercial Diving Tenders, and Commercial Diving Supervisors. Commandant should consider adopting the standards set out in the ADC Consensus Standards. See IO Exhibit 57, pg. 2-3 to 2-8.

17. In the absence of a diver qualification program, Commandant should publish criteria for OCMI's to use when reviewing SEILOD applications to evaluate qualifications of divers to safely conduct diving operations.

18. Commandant should examine NVIC 12-69 and NVIC 1-89 to determine whether the older one should be cancelled and incorporated into the newer.

19. Commandant should require dive operation inspection training for all marine inspectors.

20. Commandant should remove the diving component from the MODU Inspector PQS workbook and establish a separate Performance Qualification Standards workbook for diving operations.

21. Commandant should evaluate the adequacy of the MODU/SEILOD job aid, CG- 840H-1 (9-92), to determine whether additional inspection items should be added to the diving checklist (pg. 20-22). See IO Exhibit 31.

22. Commandant should publish guidance emphasizing that Coast Guard marine inspectors should not attempt to delegate dive safety enforcement duties to any third party, including classification society surveyors.

23. Commandant should require dive casualty investigation training for all marine safety casualty investigators.

24. Commandant should consider tasking Coast Guard divers to assist in the investigation of diving casualties. In this case, the IO was assisted by a former Coast Guard diver and a U.S. Navy Master Diver, both with exceptional insight. However, previous investigators to this casualty did not have those valuable resources. The Marine Safety Manual recommends that an IO investigating diving casualties have diving experience, but there are few IO's available with that background.

25. Commandant should consider seeking an agreement with the Navy Experimental Diving Unit and the U.S. Navy Diving School to provide assistance in Coast Guard diving casualty investigations.

26. Commandant should establish a working group of industry experts to examine ways to improve safety practices in the commercial diving industry. The working group should consider whether the Coast Guard should adopt by reference the ADC Consensus Standards for commercial diving operations where they do not conflict with Coast Guard regulations. The group also should consider whether the Coast Guard should require oil-free compressors be used on commercial diving operations. During this investigation, industry experts made many excellent recommendations to improve safety in the industry, many of which could not be included in this report because they were beyond the scope of the investigation. If a group is convened, it should seek input from Marine Safety Office Houston-Galveston, which recently initiated a commercial diving safety awareness and compliance program.

27. Commandant should forward a copy of this investigation to OSHA for consideration.

28. Commandant should forward a copy of this investigation to the Association of Diving Contractors.

29. Commandant should forward copies of this investigation to all Eighth Coast Guard District Coastal OCMI's.

30. This casualty investigation should be closed.

Appendix F - NOSAC Report Recommendations

NOSAC Report key items are the following:

- a.) 46 CFR 197 Sub Part B should remain the USCG standard but with updated approved practices that reflect modern industry practice that has evolved since the first regulations developed in 1977;
- b.) Overly prescriptive regulatory standards will suppress innovation to the detriment of diving safety;
- c.) Drug usage, legal and illegal must be dealt with;
- d.) Diving operations have become more specialized today, so that mixed-gas and saturation diving have become specialized and receive appropriate regulatory attention , just as dynamic positioning versus moored /live boating vessels are different than earlier activities. Consequently

, each operation should be reviewed individually and not be considered as a different level of operation;

- e.) Training and its frequency should not be limited to just experience or classroom instruction, but a balanced combination of both as prescribed by industry recommended practices;
- f.) Industry audits would be invaluable, and;
- g.) Bell diving should be clarified to reflect “Wet Bell” Diving where referenced.

Appendix G - ADCI and IOGPA information

ADCI Description

The Association of Diving Contractors International (ADCI), founded in 1968, is a nonprofit organization that was formed to establish industry wide standards for commercial diving in the United States. Although ADCI has no regulatory jurisdiction, it has more than 500 member companies representing business, educational and medical communities from 41 nations around the world, and is considered the industry watchdog for safe commercial diving.

Among its various functions, the ADCI sets standards for various levels of commercial diver certification, as well as for ROV pilots and technicians. The basic ACD Commercial Diver certification is Entry Level Tender/Diver. To earn more advanced certifications, a diver must log experience in the field (called "field days") and underwater (referred to as "working dives"). Divers are required to receive on-the-job training to be eligible for more advanced commercial diver certification unless they received the required formal training through an accredited commercial diving school, military dive school, or the equivalent.

The Association of Commercial Diving Educators (ACDE) through an American National Standards Institute (ANSI) American national standard prescribes the educational content of commercial diver training programs. Referred to as ANSI-1988, the standard dictates the minimum training requirements and general curriculum that must be met for accreditation by the ACDE. The ACDE prescribes a broad curriculum for commercial diver certification, which exceeds the basic ADCI requirements for its Entry Level Tender/Diver, but includes the training requirements for the advanced commercial diver certifications such as Mixed-Gas Diving. The minimum requirements prescribed by ACDE/ANSI-1988 tally up to 625 hours of training. Students who complete an ACDE-accredited program are eligible for an ACDE/ANSI-1988 Commercial Diver Certification.

While ACDI and ACDE certifications are accepted by U.S. commercial diving companies, even those who work overseas, additional certification is generally required for those seeking foreign employment as a commercial diver. Commercial divers generally must be certified in the country where they are employed. For example, divers employed in Canada would require certification from the Diver Certification Board of Canada (DCBC); those employed in Australia would fall under the jurisdiction of the Australian Diver Accreditation Scheme (ADAS); and those in the UK require certification by the Health and Safety Executive (HSE). As Johnston says, the International Marine Contractor Association (IMCA) commercial diver certification is now recognized throughout most of the rest of the world.

IOGPA Description

What is OGP?

The International Association of Oil & Gas Producers encompasses the world's leading private and state-owned oil & gas companies, their national and regional associations, and major upstream contractors and suppliers.

Vision

To work on behalf of the world's oil and gas producing companies to • promote responsible and profitable operations

Mission

- To represent the interests of oil and gas producing companies to international regulators and legislative bodies
- To liaise with other industry associations globally and provide a forum for sharing experiences, debating emerging issues and establishing common ground to promote cooperation, consistency and effectiveness
- To facilitate continuous improvement in HSE, CSR, engineering and operations

Objectives

- To improve understanding of our industry by being visible, accessible and a reliable source of information
- To represent and advocate industry views by developing effective proposals
- To improve the collection, analysis and dissemination of data on HSE performance
- To develop and disseminate best practice in HSE, engineering and operations
- To promote CSR awareness and best practice