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GUIDANCE FOR DIVING IN CONTAMINATED WATERS

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Update procedures for diving in contaminated water.

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CERTIFICATION STATEMENT

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Safety Summary

STANDARD MILITARY SYNTAX

This manual uses standard military syntax as pertains to permissive, advisory, and mandatory language. Word usage and intended meaning in this manual is as follows:

a. *Shall* has been used only when application of a procedure is mandatory.

b. *Should* has been used only when application of a procedure is recommended.

c. *May* and *need not* have been used only when application of a procedure is discretionary.

d. *Will* has been used only to indicate futurity; never to indicate any degree of requirement for application of a procedure.

GENERAL SAFETY

This Safety Summary contains all specific WARNINGS and CAUTIONS appearing elsewhere in this manual and are referenced by page number. Should situations arise that are not covered by the general and specific safety precautions, the Commanding Officer or other authority will issue orders, as deemed necessary, to cover the situation.

SAFETY GUIDELINES

Extensive guidance for safety can be found in the OPNAV 5100.19 AFLOAT and 5100.23 ASHORE series instruction, U.S. Navy Safety Precautions.

SAFETY PRECAUTIONS

The WARNINGS, CAUTIONS, and NOTES contained in this manual are defined as follows:

WARNING **Identifies an operating or maintenance procedure, practice, condition, or statement, which, if not strictly observed, could result in injury to or death of personnel.**

CAUTION **Identifies an operating or maintenance procedure, practice, condition, or statement, which, if not strictly observed, could result in damage to or destruction of equipment or loss of mission effectiveness, or long-term health hazard to personnel.**

NOTE **An essential operating or maintenance procedure, condition, or statement, which must be highlighted.**

The following WARNINGS, CAUTIONS, and NOTES appear in the text of this manual and are repeated here for emphasis.

WARNING **During surface decompression operations, incomplete decontamination of divers may contaminate recompression chambers and present a fire hazard. (Page 4-2)**

WARNING The KM 37 (NS) and KM 97 helmets is not suitable for use in CAT 1 diving. Testing at NEDU confirms there is a risk of some water or vapor ingress into the KM 37 (NS) and KM 97 helmets (Page 4-3).

WARNING A high pressure rinse is not to be used during CAT 1 decontamination due to the increased risk of breaching the diver's personal protective equipment (Page 5-3).

WARNING Do not use in tandem, series or combine any bleach solution with any ammonia solution. This will result in the creation of chlorine gas, hydrochloric acid and liquid hydrazine. This is extremely hazardous and can cause injury or death (Page 5-3).

CAUTION Any breach of personal protective equipment used to conduct a dive in contaminated water should result in termination of the dive as soon as possible to limit exposure to the hazards. (Page 4-5)

NOTE Both Chemical and Biological Contaminants tend to concentrate in sediment rather than in the water column (Page 2-1).

NOTE Prior to conducting diving in CAT 1 contaminated water, diving supervisors should contact NAVSEA 00C3 for support in obtaining information on potential levels of contamination, specific procedures, and local support agencies (Page 4-1).

NOTE Prior to any CAT 1 diving, commands should contact NAVSEA 00C3 for advice on diving procedure and the supply of any necessary protective equipment. NAVSEA 00C3 will detail any exposure time limits on a case by case basis depending on the contaminant and based on the latest research available (Page 4-2).

NOTE Until tests have been completed on various commercial off the shelf decontamination solutions for CAT 1 CWD, NAVSEA 00C3 will provide tailored decontamination guidance prior to any CAT 1 dive being conducted (Page 5-1).

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CHAPTER 1
INTRODUCTION, SCOPE, AND PURPOSE

1-1 INTRODUCTION

Contaminated water is defined as water that contains any chemical, biological, or radioactive substance that poses an acute or chronic health risk to exposed personnel. Some degree of contamination and/or pollution is present in practically every body of water in the world. The contamination may be naturally occurring or come from a variety of sources including terrorist acts, leaking vessels, industrial discharges and/or sewer effluent. However, much of the contamination that enters the water is not readily apparent. The biggest concern is from relatively enclosed bodies of water, such as lakes, rivers, or harbors that are within close proximity to large populations and wrecks, where contamination can accumulate and/or concentrate.

These contaminants could present a health risk to divers and may additionally impact mission and operational readiness. The effects on personnel may become evident immediately (acute) or may be delayed for many years (chronic) especially in the case of exposures to carcinogenic (cancer-causing) substances. For most microbiological exposure, illness may not develop for several hours after diving and could possibly be delayed for days. With the exception of chemical/biological warfare agents, acute toxicity and/or incapacitation is unexpected for most chemical exposures. However, chronic sub-toxic exposure to a variety of chemical hazards may induce illnesses such as cancer, neurodegenerative disorders, hormonal dysregulation and others.

1-2 SCOPE

The purpose of this manual is to provide general guidance and basic procedures for diving in contaminated water. Because of the wide variability in contaminants, potential exposure levels and other variables, only general guidance and recommended best practice can be provided. It is recognized that this represents a capability gap, which warrants future research and development efforts. Until then, supervisory personnel are encouraged to contact local agencies to obtain information on local water contaminants and hazards. This manual is intended to be a living document, and will be updated as more information about diving equipment, water sampling, analysis, and exposure limits become available.

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CHAPTER 2
CONTAMINANTS AND HAZARDS

2-1 GENERAL

The four types of contaminants divers can expect to encounter are biological, industrial toxic/chemical, chemical/biological warfare agents and radiological. The potential routes of exposure for divers are inhalation, ingestion, absorption, and penetration (forcing of material into the body, such as through a wound). Unless the response is to a specific incident, quantitative data on the contaminants present in any specific body of water is rarely available or measurable. Real-time, or even near real-time, water analysis is not a current U.S. Navy capability. If a specific contaminant is suspected, information from various sources is available such as Safety Data Sheets (SDS), shipping manifests, or sampling and analysis. Additionally, for water bodies where diving will occur recurrently, water and sediment sampling and analysis can be coordinated to more completely inform divers regarding health hazards.

2-2 BIOLOGICAL CONTAMINANTS AND HAZARDS

Biological contaminants come from humans and animals, urban and industrial sewage, marine and fresh water organisms, commercial ships, hazardous waste sites, marinas, and agricultural runoff. The main source of biological contaminants in water is human sewage. The environmental source of most pathogens in water is unknown. It is prudent to assume water bodies contain the microbiological organisms of diseases present in a local population unless confidence is high in the effectiveness of the local wastewater treatment facilities. Such confidence is unjustified in underdeveloped areas and even in some areas of the United States after an unusually heavy rainfall. Biological agents with the potential to adversely affect diver health can be divided into two broad categories: pathogens and toxins.

NOTE Both Chemical and Biological Contaminants tend to concentrate in sediment rather than in the water column.

2-2.1 PATHOGENS. Pathogens are infectious agents that cause disease in humans, animals, or plants. These include bacteria, viruses, and parasites. While the vast majority of microorganisms are harmless or even helpful, there are many naturally occurring pathogens that are harmful to humans. Pathogens cause disease (e.g., infection) by entering the body through the lungs, digestive tract, skin, mucous membranes of body openings, and open wounds. Once they enter the body, pathogens multiply, overcome the body's natural defenses and produce disease. Symptoms commonly associated with pathogen infection involve the respiratory tract (flu or cold like symptoms, pneumonia), the gastrointestinal tract (vomiting, diarrhea) and the skin (rash, lesions). Some pathogens cause nervous system impacts such as headaches, paralysis, convulsions, or comas.

Bacteria are living microorganisms which, unlike viruses, are capable of reproduction outside living cells. If pathogenic bacteria enter the body and if the victim is not properly treated, the microorganism can multiply and incapacitate the host. Bacteria can be found in almost any environment. Seawater is estimated to contain up to one million bacteria per cubic centimeter. Bacteria sometimes concentrate in a thin layer on the water surface or a thin layer on the top of sediment. Examples of diseases caused by bacteria are cholera and anthrax. Escherichia coli (E. coli) is also a well-known bacterium that has been associated with contamination of processed meat

products. Some strains of E. coli are common inhabitants of the human intestine and are used as an indicator of water contamination from human sewage.

Viruses are very small biological agents which are able to reproduce. They typically consist of genetic material within a protein capsule. They cannot reproduce outside of a host cell. They can be dangerous after entering the human body, because they hijack cells to reproduce. Smallpox and influenza are examples of viruses. Viruses are difficult to detect and most hospital laboratories are not equipped to do so routinely. Viruses are difficult to treat after exposure since they are not susceptible to common drugs. Some virus protection can be gained by immunizations (e.g., Hepatitis A), but vaccines do not exist for most viruses.

Parasites are single or multi-celled organisms that live and feed on or in another animal. Well-known examples of human parasites are malaria and tapeworms. Most parasites are acquired by ingestion (e.g., such as eating raw meat), but some can gain entry into the human body by skin contact and through open wounds. Most water dwelling parasites that can cause disease are found in tropical fresh water as found in Central and South America and Southeast Asia. Salt water parasites rarely cause more than a rash and itching. Nevertheless, when working in areas where parasites are known to exist, contact can be prevented or minimized by wearing protective clothing (e.g., wet suit or some form of coverall) and also by bathing soon after exposure.

2-2.1.1 BLOOD-BORNE PATHOGENS AND HUMAN REMAINS RECOVERY. Though many blood borne pathogens are viruses, they are addressed separately here since they are generally passed from person to person through direct contact with an infected person's body fluids. Infectious blood-borne diseases (e.g., HIV and Hepatitis B) become a higher risk for divers when they are involved in the recovery of human remains, particularly if the diver has open wounds or broken skin. Divers may also be exposed through inadvertent contact with potentially infected material, such as hypodermic needles. Personnel should be trained in exposure control and safe handling of potentially infected material, similar to the training recommended for healthcare workers (currently referred to as Standard Precautions). This training can be obtained at any military medical treatment facility and dive planners should direct appropriate precautions.

Most known infectious agents pose a minimal risk to divers since the agents are fragile and do not survive long outside a host. The Hepatitis C virus is less fragile, but infectivity in underwater recovery situations is estimated to be low. Divers should complete the series of the standard immunizations required for healthcare workers, including those for Hepatitis A and B virus as well as Tetanus. Besides the immediate medical concerns, the fatigue and mental health issues associated with the recovery of human remains should be considered as part of operational planning.

2-2.2 TOXINS. Toxins are poisonous substances produced by microorganisms, plants, or some animals. Some toxins can be chemically synthesized or artificially produced with genetic engineering techniques. Toxins exert their incapacitating or even lethal effects by interfering with certain cell and tissue functions. Neurotoxins disrupt nerve impulses while cytotoxins destroy cells by disrupting cell respiration or metabolism. Early diagnosis for toxin exposure can be extremely difficult due to the vast range of associated signs and symptoms.

Harmful Algal Blooms (HABs) produce toxins that are released into the water. The most commonly known HAB is known as "Red Tide" but some are yellow, green and orange.

Algal outbreaks of human concern are usually associated with large fish kills. Toxin related to HABs can cause cognitive impairment as well as gastrointestinal, respiratory, and dermal distress. Common symptoms from exposure to HAB toxins are coughing, eye and skin irritation, runny nose, numbness around the mouth, and nausea.

2-3 INDUSTRIAL TOXIC/CHEMICAL CONTAMINANTS AND HAZARDS

The U.S. Environmental Protection Agency (EPA) lists more than 85,000 chemicals in its inventory of substances subject to the Toxic Substances and Control Act (TSCA). These chemicals vary widely in availability, solubility, toxicity, and permeability, and there is little to no information available on the acute or chronic toxicity associated with in-water exposure. The primary sources of industrial chemical contamination are industrial spills, urban and industrial sewage, commercial ships, hazardous waste sites, and agricultural runoff. It is estimated that every body of water in the world is contaminated to some degree.

If the presence of a specific chemical is confirmed, some information may be available to assess the risk. The National Institute of Occupational Safety and Health (NIOSH) publishes the *Pocket Guide to Chemical Hazards* (Ref: Appendix A). The Pocket Guide has been designed to provide chemical-specific data to supplement general industrial hygiene knowledge and includes recommended exposure limits (RELs) and permissible exposure limits (PELs) for 667 chemicals or substance groupings commonly found within the work environment. The Department of Transportation (DOT) publishes the *Emergency Response Guidebook* which is used by first responders during transportation incidents that involve dangerous goods or hazardous materials. Additional resources recognized as providing relevant toxicological information to assess the potential impacts from diver exposure to contaminated water and sediment include: The U.S. EPA Integrated Risk Information System (IRIS), the U.S. Department of Energy Risk Assessment Information System, and the State of California Acute Exposure Limits for Chemical Contaminants. The following paragraphs are a general list of chemicals that a diver can expect to encounter.

2-3.1 HYDROCARBONS. Hydrocarbons are chemicals composed principally of hydrogen and carbon with a wide range of molecular weights, volatility, and water solubility. Hydrocarbon mixtures can be comprised of gases, solvents, oils, fuels, and polycyclic aromatic hydrocarbons (PAHs). Several constituents of hydrocarbon mixtures (PAHs, phenols, cresols, benzene, others) pose a risk to diver health and precautions should be taken if their presence in a water body is known or suspected. Some, but not all, PAHs are known carcinogens. PAHs are some of the heaviest hydrocarbons able to evaporate and dissolve in water. Common hydrocarbons are complicated mixtures of chemicals and will have different compositions in different locations at different times. MIL-SPEC diesel fuel, hydraulic oil, and creosote are all complicated hydrocarbon mixtures that do not have full chemical specifications but contain human toxic constituents (e.g., PAHs, phenols, cresols). Coal tar creosote is a petroleum derivative that contains PAHs among other human toxins, and has been determined by the U.S. EPA and the International Agency for Research on Cancer (IARC) to be a probable human carcinogen. Coal tar creosote, the most widely used wood preservative in the U.S., has very low water solubility. The very small amount of creosote leaching from creosote-treated wood into adjacent water will decrease with time. As a result, newer pilings, dock supports, etc., may pose a greater health risk than those that have been in place for several years.

2-3.2 HEAVY METALS. In aquatic environments, metals can exist as dissolved ions, bound in insoluble complexes, sorbed onto other solids (e.g., clay or sediment), or chemically combined into an organic compound (e.g., methyl mercury). Many water quality criteria for metals are based on the dissolved form of the metal since that form generally has the

greatest toxicity to both aquatic organisms.

2-3.3 POLYCHLORINATED BIPHENYLS (PCBs). Polychlorinated Biphenyls (PCBs) are materials that were used as paint additives and electrical equipment coolants. Some PCBs have been demonstrated to play a role in carcinogenesis as well as having other adverse health effects. In 1977, PCBs were banned from production and use in North America due to concern over their potential toxicity and risk to public health. PCBs do not readily decompose and have been discovered in aquatic sediment. OPNAV Instruction 5100.23 addresses U.S. Navy occupational exposure to PCBs. Although not readily absorbed through the skin, prolonged dermal exposure to PCBs can pose a significant health risk.

2-4 CHEMICAL/BIOLOGICAL WARFARE AGENTS

Chemical/Biological warfare agents may present an extreme hazard to a diver. Every attempt should be made to identify the agent and mitigate the concentration/exposure prior to diving. The U.S. Army Techniques Publication (ATP) 3-11.9, *Potential Military Chemical/Biological Agents and Compounds*, has information on the chemical makeup and characteristics of specific agents; ATP 3-11.9 should be used as the initial reference source if tasked to respond to an incident involving a chemical or biological warfare agent. However, distribution of ATP 3-11.9 is limited to military and government agencies and it does not contain specific information on the environmental fate of these compounds in seawater. For information on current ATP 3-11.9 and Field Manuals (FM) or for information on chemical and biological warfare agents, refer to Appendix A.

2-5 RADIOLOGICAL CONTAMINANTS AND HAZARDS

2-5.1 Radiation/Contamination from Nuclear Power. When diving on any nuclear-powered ship or submarine, radiological controls (RADCON) must be observed. All divers will be briefed/trained according to NAVSEA S9213-33-MMA-000, Radiological Controls for Ships. The ship's RADCON team would normally provide support for this briefing/training, issuance of a thermoluminescent dosimeter (TLD), monitoring the diver(s) during the dive and upon surfacing, any decontamination if required, and providing the diver(s) with their exposure level recorded by the TLD or similar device. Prior coordination of responsibilities should be discussed with the vessel's RADCON Officer prior to deploying to the site.

2-5.2 Radiation/Contamination from Weapons. Divers may be required to respond to a location that has been contaminated by nuclear weapons (e.g., attack or accidental detonation or dirty bombs) or to search for unexploded weapons. For these cases, the type, source, and level of radiation/contamination must be determined. A RADCON/DECON Team may already be deployed/assigned to the area; therefore, divers should coordinate logistics with the local command in charge of the incident. Ensure all personnel on site are provided adequate personnel protective equipment and radiation monitoring devices. Use the Contaminated Water Diving (CWD) Standard Operating Procedure (SOP) to develop a dive/DECON plan. SSP OD 69206, Nuclear Weapons Radiological Controls Program, is the guiding directive for RADCON program management and emergency response related to nuclear weapons.

2-6 CATEGORIES OF CONTAMINATED WATER DIVING

Categories (CAT) 1 through 4 are assigned to contaminated waters based upon the risk to the

diver. Table 2-1 defines the level of contamination and risk, as well as recommendations for the type of diving equipment that will provide the best protection to the diver.

TABLE 2-1. CONTAMINATED WATER CATEGORIES AND DEFINITIONS.

Contaminated Water Categories (CAT)	Definitions
CAT 1	a. Grossly contaminated b. Extreme Risk of Injury or even Death (Note 1) c. Fully Encapsulated Diver with Surface Return Exhaust or Positive Pressure Free-Flow Helmet (Note 2) (Note 3)
CAT 2	a. Heavily contaminated b. High Risk of Injury (Note 4) c. Fully encapsulated Diver (Note 2) (Note 3)
CAT 3	a. Moderately contaminated b. Some risk of Injury especially if Ingested c. Full Face Mask (FFM) and Skin Covered as necessary (Note 5)
CAT 4	a. Baseline contamination (Note 6) b. Low risk of Injury (Note 7) c. Standard diving dress based on environmental conditions

Notes:

1. Diving is not recommended in CAT 1 environments and only properly qualified and equipped diving teams should dive CAT 1. The diving task must be mission essential and the dive team must have express approval from their Commanding Officer for the dive.

2. Fully encapsulated means a vulcanized rubber dry suit (or other CWD Authorized for Navy Use [ANU] approved dry suit) with integrated boots mated to dry glove with ring system. In addition, gloves must be taped and/or clamped to the suit. Equalization tubes between glove and cuff must not be used.

3. In water exhaust must be at minimum a quadruple exhaust valve (e.g., KM 37 (NS) or the KM 97).

4. Injuries may be major or minor and could include serious illnesses like Hepatitis or minor injuries like skin, eye or sinus irritation.

5. Positive Pressure whenever practicable.

6. Water considered “sufficient” or better under the EPA 2012 Recreational Water Quality Criteria (and subsequent updates, revisions, and reviews).

7. Low risk refers only to risk from contaminants and does not relate to any other aspect of the dive. A risk analysis is still required.

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CHAPTER 3
EQUIPMENT

3-1 GENERAL

There is no single equipment configuration or material that will protect the diver under all conditions or from all contaminants. The level of protection needed will be determined by the expected hazard, type of work, the urgency of the work, and the available equipment. The diving life support system selection should address both respiratory and physical protection. The standby diver must be equipped with a level of protection equal to or greater than the working diver's. The surface tenders and support personnel may experience as great a hazard as the divers; therefore, respiratory and physical protection must also be available for support personnel.

3-2 SCUBA EQUIPMENT

Diving with a standard Self-Contained Underwater Breathing Apparatus (SCUBA) ensemble, including a half face mask and a mouthpiece regulator, provides very little protection to a diver. The diver's mouth is in constant contact with the water, exposing the diver to contaminants that can enter around the mouthpiece or via water refluxed through the exhaust valve. The mucous membranes are highly susceptible regions on the body and, assuming intact skin, are some of the most vulnerable routes microorganisms have to enter and infect the body. Inhalation of microscopic water droplets from the area of the regulator mouthpiece and from its exhaust valve may allow contamination into the lungs and bloodstream. Therefore, isolating these vital areas from the source of contamination is the primary concern when diving in a biologically contaminated environment. SCUBA is not recommended for diving in CAT 1, 2 or 3 contaminated water.

3-2.1 FULL-FACE MASK. If the primary hazard is microbial, a full-face mask (FFM) may reasonably protect the mucous membranes of the diver's eyes, nose, and mouth. An advantage in using FFMs is the portability and relative ease of use as they can be configured to operate in SCUBA or Surface Supplied mode. In a SCUBA configuration, the diver is afforded unencumbered freedom of movement and moderate protection but is limited on the gas supply. In the Surface Supply configuration, the diver is afforded greater endurance in terms of gas supply, but mobility will be more restricted compared to the SCUBA configuration (see Section 3-3).

A FFM which incorporates a positive-pressure regulator will help eliminate water entering the mouth, but does not resolve the droplet inhalation concern. Additionally, FFMs offer no protection for the Diver's head, neck, or ears, all of which are potential sites for exposure to waterborne hazards. Although FFMs are used by both the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA) for contaminated water diving, an international diving survey found no commercial diving operations using them.

3-2.2 CLOSED/SEMI-CLOSED CIRCUIT REBREATHERS. Using a FFM with a rebreather (e.g., MK 16 or MK 25) mitigates exposure through exhaust valve reflux; however, currently, there is no closed circuit rig available for full encapsulation. Also, the cost and inability to efficiently decontaminate the equipment consequently eliminates this equipment from use in CAT 1 or CAT 2 CWD. However, in some mission essential scenarios, use of these apparatuses may be considered.

3-3 SURFACE SUPPLY DIVING SYSTEMS

Diving with a surface supplied diving system, either with a FFM or diving helmet, provides reasonable protection for the divers especially if the primary hazard is biological contaminants. The divers' mucous membranes are more protected from contaminants than in SCUBA and when utilizing a diving helmet, the entire head is protected. Diving is not recommended in CAT 1 contaminated waters without a surface supplied system with a return surface exhaust system which can mitigate the risk of water refluxed through the exhaust valve of the diving helmets.

3-3.1 MK 20 FULL-FACE MASK. The MK 20 FFM offers an added level of protection over the standard SCUBA half-masks and mouthpiece regulators. Operating the MK 20 in the positive-pressure mode will lessen the likelihood of water leaking into the mask; however, some water may enter under a poor-fitting face seal or as reflux through the exhaust valve. Therefore, the MK 20 is not recommended for use in CAT 1 or 2 contaminated water.

3-3.2 KM 37 (NS) and KM 97 DIVING HELMETS. The KM 37 (NS) and KM 97 with quadruple exhaust and mated to a vulcanized dry suit offers a good level of protection for divers in CAT 2 (or cleaner) contaminated waters. Note that the KM 97 is the base helmet for use with the regulated surface exhaust system currently under development for use in CAT 1 contaminated waters. It should be noted that the soft goods in the KM 37 (NS) and KM 97 helmet may be susceptible to degradation by petroleum products or other chemicals that may be present in grossly or heavily contaminated waters. Depending on the contaminants and in-water stay time, performance of additional maintenance (e.g., performing annual 24M level checks) may be required on a daily basis. Inspections should be performed on equipment in between dives and at the end of each diving day; particular attention should be paid to soft good replacements.

3-3.3 UMBILICALS. The gas supply hose of a standard diver umbilical is comprised of nitrile with a neoprene outer shell which is reasonably resistant to many chemicals; however, prolonged exposure to concentrated chemical contaminants (e.g., solvents) may lead to degradation of the hose. Inspections should be performed on the breathing gas hoses prior to and after diving in contaminated waters in accordance with PMS.

3-4 DIVING DRESS

The type of dress chosen should have strength, flexibility, ease of decontamination, and, most importantly, chemical resistance. It should prevent any contact between the human body and the contaminants. The type of diving dress selected will be based upon several factors including but not limited to water temperature, level of contamination, and type of contaminant. Some contaminants may cause such rapid deterioration of material or may be so difficult to clean from the diving dress, that a new suit and other equipment may be needed for each dive. Coated exterior fabric dry suits may be too difficult to decontaminate. This increase in required equipment should be included in operational planning.

Additional consideration should be given to protecting divers from scrapes, cuts, and abrasions which could introduce a higher risk of infection. No suit can protect a diver from all contaminants; however, a dry suit with attached gloves connected to a positive surface supplied helmet is the best protection for a diver in contaminated waters.

3-4.1 WET SUITS. Wet suits offer little to no protection in contaminated waters as the skin is directly exposed to the contaminants. Foam neoprene wetsuits can absorb large amounts of contaminated water which can degrade the suit and make

decontamination difficult. Wet suits are not recommended when diving in CAT 1 or 2 contaminated waters.

3-4.2 DRY SUITS. Dry suits, either variable or constant volume, are appropriate for diving operations in contaminated water. Intact skin is susceptible to many hazards including PAHs (in high concentrations in petroleum products), PCBs, pesticides, creosote, and some heavy metals; therefore, isolating a diver in a dry suit is highly recommended when these materials are present. Dry suits utilized for contaminated water diving should have a neck dam that creates a watertight seal when mated to a KM 37 (NS) or KM 97 and the number of penetrations should be minimized; therefore, a one-piece dry suit is preferred. Consideration should be made to ensure divers have properly fitted dry suits as improperly sized suits may allow leakage of water at the seams. Vulcanized dry suits offer substantial protection from all microbiological hazards and from many chemical hazards for extended periods of time.

An ANU approved dry suit should be used for all diving in CAT 1 or 2 contaminated water. Dry suit manufacturers publish data for resistance of their respective suits to a host of chemicals. When concentrations of known contaminants are available, this information should be referenced for maximum safe dwell times. The durability of other components of the diving ensemble (e.g., helmet, gloves, umbilical etc.) should also be considered when determining dwell times. Evidence of suit degradation from contaminant exposure is swelling of the material, color changes, tackiness, stiffness when dry, and exposure of underlying fabric. Suits demonstrating any of these changes should not be reused.

3-4.2.1 TESTING DRY SUITS. Prior to using a dry suit in CAT 1 or CAT 2 contaminated waters, the suit shall be tested for leaks. The test can be achieved by first sealing off the neck and cuffs; the suit may be sealed off using suitably sized bottles, balls or if available custom-built bungs; the cuffs should be sealed using the dry gloves intended for use during the dive. The suit should then be inflated and checked for leaks either with soapy water, a ‘snoop’ liquid or by submersing the suit in clean water and looking for bubbles.

3-4.3 GLOVES. Chemically resistant waterproof gloves shall be used when diving in contaminated water. Gloves should be positioned over cuff rings on the sleeves of the dry suit. For extra security, gloves should be taped, or zip tied to the dry suit sleeve above the cuff ring. Gloves should not be equalized with dry suits to minimize the possibility of contamination entering the entire suit in the event of a tear. Depending on the nature of the diving job, an over-glove may be used to protect against chafing and punctures. Over-gloves should be a color other than black to more easily identify contaminants. In cold water, thermal under-gloves may be necessary.

3-4.4 OVERSUITS. If the diver is expected to encounter bulky, adherent contaminants during a dive, a disposable oversuit (e.g., TYVEX®) may be used. Disposable oversuits can be secured to a diver after he has been outfitted with the entire diving rig. No effort to make the oversuit watertight should be attempted as it could create air pockets which would further complicate the diving operation.

3-5 COMPRESSORS

Since compressors are often used on site to compress diver quality gas, volatilized components (e.g., fuel oils, hydrocarbons, etc.) of waterborne hazards can potentially enter the gas supply via the compressor intake. Diving Supervisors should be careful to position

compressor intakes upwind of contamination although this might not always be feasible or reliable; therefore, compressing gas off the site may be a prudent alternative to mitigate the chances of contaminants entering diver gas supplies.

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CHAPTER 4
PRE-DIVE PLANNING

4-1 GENERAL

NOTE **Prior to conducting diving in CAT 1 contaminated water, diving supervisors should contact NAVSEA 00C3 for support in obtaining information on potential levels of contamination, specific procedures, and local support agencies.**

The majority of U.S. Navy diving will occur in water with few obvious signs of contamination. In the dive planning stage, operational risk management (ORM) techniques from OPNAVINST 3500.39 (Series) should be used to balance the risks of an operation against the potential risks to personnel and equipment. The potential routes of exposure for divers and topside personnel to chemical/biological contamination are inhalation, ingestion, absorption, and penetration. A good risk assessment will identify the expected route(s) of exposure, expected contaminant(s) and reasonable precautions necessary to minimize the exposure to both the diver and topside personnel.

Most chemical hazards to which divers are exposed cause limited immediate effects. For most microbiological exposures, illnesses will develop hours to days after exposure. However, chronic exposure to chemical hazards may cause/effect the occurrence of other illnesses such as cancer. Recognition and identification of substances is of paramount importance if adequate and appropriate monitoring of exposed personnel is to be conducted by medical authorities.

Diving in water heavily contaminated with pathogenic microbes may infect an otherwise seemingly innocuous skin wound. For this reason, divers with preexisting, unhealed wounds should be restricted from diving in contaminated water. Any injuries sustained during such diving should require the diver to surface for immediate medical attention.

WARNING During surface decompression operations, incomplete decontamination of divers may contaminate recompression chambers and present a fire hazard.

The expected decompression obligation and decontamination procedures to be implemented should be thoroughly briefed to the dive team during the planning phase. In order to limit the diver's exposure to waterborne hazards, dives in CAT 1 or 2 contaminated water should be scheduled so that in-water decompression is not required. Decontamination and diver undress procedures, within the five-minute time constraint, should be demonstrated to the Diving Officer before attempting dives relying on surface decompression. As described in the decontamination section, decontamination procedures are tedious and may require a prolonged time. Every effort must be taken to ensure thorough decontamination is achieved prior to recompressing divers because introducing contaminants to recompression chambers may present significant health and safety concerns.

4-2 MEASUREMENT AND MONITORING

Real-time, on-scene analysis of water for chemical and microbiological substances is not a current US Navy capability, however, testing and analysis techniques are available to establish a profile of potential contamination for water bodies where recurrent exposures to divers is expected to occur. Such analyses should be performed whenever possible. Simply sending the water sample “to the lab” will not give a complete picture of the contaminants present. Microbiological testing requires entirely different analytical methods than those that detect chemical contaminants. Furthermore, analysis of a water sample for the potential tens of thousands of suspected chemical contaminants is impracticable. Most laboratory techniques are not designed to scan for all possible contaminants at once, but rather must be focused narrowly to provide optimum results. The scope of testing should be limited by prior research of local conditions and concerns. There is also usually a 2 or 3-day lag between sampling and result reporting. There are available tests that can cover more than one substance (e.g., 8 metals, or 11 PAHs, etc.) at once, and the Navy and Marine Corps Public Health Center can be contacted for further information on testing.

Depending on the nature of a contaminant, it may float on the surface, suspend in the water column, or accumulate on the bottom. An accurate analysis requires samples throughout the entire water column and adjacent sediment. The validity of samples collected is also likely to be dependent on several other variables that change over time including current, tide, temperature, and weather. The variation in contamination across space and time is simply unknown. For these reasons, real or near-real time water analysis is not currently achievable.

Generally, only a qualitative water quality assessment is possible since a complete and reliable analysis of the contaminants present in the water is difficult, if not impossible, to obtain. Supervisors should obtain as much quantitative information as possible to aid in their assessment. This information may be available from various sources, including local water quality management offices, environmental regulation agencies, or environmental studies. If a specific contaminant or hazard is suspected, sampling and analysis should be completed prior to commencement of dive operations. In order to best protect personnel, a risk assessment should be thorough in evaluating several factors such as the nature of the contamination, urgency of the required operations, the natural environment, type of body of water, and the diving and protective equipment available.

4-3 LEVELS OF PROTECTIVE EQUIPMENT

Based upon the expected primary source of contamination, the chosen protective equipment should minimize the potential exposure routes. With the exception of CAT 1, the following paragraphs outline the recommended protective equipment associated with each category of contaminated water that is currently available and in accordance with the U.S. Navy ANU Program.

4-3.1 CATEGORY 1. For grossly contaminated waters that pose an extreme risk of injury or even death, divers must be fully encapsulated and dressed in accordance with Table 2-1 as follows:

NOTE Prior to any CAT 1 diving, commands should contact NAVSEA 00C3 for advice on diving procedure and the supply of any necessary protective equipment. NAVSEA 00C3 will detail any exposure time limits on a case by case basis depending on the contaminant and based on the latest research available

a. ANU dry suits with attached boots and neck dam.

b. Dry gloves attached with cuff ring. Tape and/or outer locking rings should be

used to ensure seal. Inner chemical protection gloves should also be worn. Outer glove color should be in accordance with Section 3-4.3.

WARNING The KM 37 (NS) and KM 97 helmets is not suitable for use in CAT 1 diving. Testing at NEDU confirms there is a risk of some water or vapor ingress into the helmet.

c. Diving helmets that utilize a surface return exhaust or a positive pressure free flow helmet. NAVSEA 00C3 is working with industry to develop a surface return exhaust system for the KM 37 (NS) and KM 97 which will greatly reduce the risk of contamination entering the helmet. The system also includes modifications for the dump valve on the dry suit which connects to the surface exhaust system thus fully encapsulating the diver. If a requirement to dive in CAT 1 water occurs prior to the introduction of this system, contact NAVSEA 00C3 for further guidance.

All CAT 1 diving equipment shall be tested for leaks and damage prior to diving (see Section 3-4.2.1). Diving Commands should maintain logs for all diving life support equipment exposed to CAT 1 contamination to include exposure times and details of the contaminant to which it was exposed to enable calculations of exposure times for future dives. With oil-based contamination, it is likely that silicone components will be the first to fail (see Section 4-3.2). NAVSEA 00C3 is working to provide replacement components that will last for hours rather than minutes in such environments. Breakthrough times are available for ANU dry suits.

Topside Dress will need to be tailored to meet the specific risks of the dive. It may also be possible to reduce topside dress protection to Level C as detailed by the Occupational Health and Safety Administration (OSHA) Standard 29 Code of Federal Regulations (CFR) 1910.120 Appendix B (See Appendix A). Level C is comparable with current Mission Oriented Protective Posture (MOPP) 4 chemical warfare suits and protective masks. Note that airborne substances must be known and monitored, and that Level C will not protect against toxic industrial chemicals (TIC). Normally for CAT 1 dives Level B protection will be required consisting of a non-encapsulating, chemical-resistant suit (i.e. splash suit) and self-contained breathing apparatus (SCBA) worn either inside or outside the suit. In some CAT 1 environments it may be necessary for topside personnel to adopt Level A (tender is fully encapsulated) protection. Topside dress requirements will be decided by the onsite commander in consultation with NAVSEA 00C3 until more permanent procedures are issued.

When a diver is fully encapsulated, overheating can rapidly become a problem if diving in warm water. A number of commercial systems are currently being developed. Traditional cooling systems are unsuitable for use during CWD as they use surface supplied water which introduces more potential points of failure to the suit and also runs the risk of the surface supply becoming contaminated. One unit in particular is a topside chiller unit connected via the divers umbilical to a closed loop, tube suit worn under the diver's dry suit. This would keep the divers, both working and standby, comfortable. Current best practice is to provide gel pack cooling vests or ice vests and to limit the duration of the dive. It is also vitally important that all divers and tenders remain well hydrated.

4-3.2 CATEGORY 2. For heavily contaminated waters that pose a high risk of injury, divers must be fully encapsulated and dressed in accordance with Table 2-1 as follows:

a. ANU dry suits with attached boots and neck dam.

b. Dry gloves attached with cuff ring. Tape and/or outer locking rings should

be used to ensure seal. Inner chemical protection gloves should also be worn. Outer glove color should be in accordance with Section 3-4.3.

c. The KM 37 (NS) and KM 97 helmet with quad exhaust.

Topside personnel will also require protection such as Tyvek suits or similar, rubber gloves meeting OSHA Standard 29 CFR 1910.120 APPENDIX B requirements, and face protection from splash hazards (e.g., a Perspex/acrylic face shield or protective glasses at the bare minimum). It is likely that tenders will not require the respiratory protection normally associated with OSHA Standard 29 CFR 1910.120 APPENDX B Level C dress; however, it may be necessary to wear an oral-nasal mask to protect against strong vapor. As was done for CAT 1 protection, diver and tender overheating must be considered.

Acceptable exposure times for CAT 2 diving will be dependent upon the local conditions; however, if diving in particularly concentrated oil-based contamination or other volatile chemical, dives longer than 22 minutes involve increased risk. Testing has shown that Jet A fuel will cause a catastrophic failure of the silicone diaphragm of KM 37 (NS) diving helmets within 22 minutes. Note that the testing to determine the acceptable exposure time was conservative as it involved 100% concentrations of Jet A fuel, which is highly unlikely outside of the laboratory.

Chemical distortion and weakening of diver-worn materials is considered a cumulative process; therefore, equipment used in CWD must be inspected more closely than other diving equipment. The following maintenance actions are to be conducted daily on equipment used for CAT 2 CWD:

a. KM 37 (NS) MIP Control Number 5921/163 Periodicity Code 24M-2, R-1, R-2, R-3, R-6, and R-7D, and if conditions warrant, complete 24M-1.

b. KM 97 (NS) MIP Control Number 5921/161 is pending release. Use U.S. Navy KM 97 Technical Manual, S6560-AL-TMM-010 and manufacturer's technical manual as required.

c. Dry Suit (COTS) MIP Control Number 5921/173 Periodicity Code R-1, R-2. KM 37 MIP Control Number 5921/163 Periodicity Code R-1, R-2, R-3, and if conditions warrant a complete A-1R. To prove the integrity of the diving equipment prior to any CAT 2 dive, in addition to any routine inspection dry suits should undergo a full leak test (see Section 3-4.1).

The diving supervisor may extend the duration of the dive for operational reasons if satisfied that concentrations of contaminants are low enough to justify the extended exposure. If required to dive in a tank or other similar small, contained body of water with high concentrations of oil-based contaminants or another corrosive material, the dive may be considered CAT 1 and NAVSEA 00C3 should be contacted for further guidance.

4-3.3 CATEGORY 3. For moderately contaminated water with some risk of injury especially if ingested, there are no additional procedures for diving in CAT 3 water over and above those contained in the U.S. Navy Diving Manual AA521-AG-PRO-010. Whether diving SCUBA, rebreathers or surface supply, a minimum of a FFM is recommended in accordance with Table 2-1. If diving MK 20 or other approved FFM, it is preferable to use it in the positive pressure mode which would increase the protection of the diver.

The level of skin protection is not presently mandated for CAT 3 diving but ORM principles must be followed in order to decide which level of diving dress is most

appropriate. If diving on the hull of a vessel, then a number of risks exist from abrasion hazards (e.g. barnacles) to the risk posed by special paints used on some ship hulls. A long-sleeved wetsuit coupled with gloves and a neoprene hood, or in some circumstances coveralls, should be considered if there is deemed to be such a risk.

4-3.4 CATEGORY 4. For baseline contamination there are no additional procedures for diving in CAT 4 water over and above those contained in Table 2-1 and the U.S. Navy Diving Manual AA521-AG-PRO-010.

CAUTION **Any breach of personal protective equipment used to conduct a dive in contaminated water should result in termination of the dive as soon as possible to limit exposure to the hazards.**

4-4 DETERMINING WATER QUALITY CATEGORIES

CAT 1 diving is very uncommon and it is unlikely that many divers will ever encounter CAT 1 waters unless faced with a major incident or highly unusual and specialized diving task. CAT 2 water is more common and can be encountered in industrial diving conditions or following accidents that involve chemicals or oils. Most operational diving will fall under CAT 3 where there is some risk of biological contamination and precautions should be taken to avoid ingesting the water.

The level of skin protection for CAT 3 dives will be dependent upon the dive location. If there is a risk of skin abrasion or irritation, then some form of wetsuit or coverall may be appropriate. It is permissible to dive without a wetsuit or coveralls in a CAT 3 environment if the only risk is from ingestion of water. CAT 4 diving will relate to training diving in fresh water and in water that:

a. Is used frequently (monthly or more often) and not known to pose a risk to divers; note that any recent detrimental environmental events (see Section 4-5) should be considered as increasing the risk of elevated levels of contamination.

b. Has undergone laboratory or field laboratory testing for water contaminants and is free from harmful contaminants, or; can be declared free from contaminants by a suitable local authority (e.g. harbor master, EPA, Coast Guard, NOAA, etc.)

c. Is open water, at least 400 yards away from any river or pipeline outfall, harbor mouth, or other inland waterway.

If in doubt or if diving in unfamiliar inland waterways or lakes for which there is no test data or suitable local knowledge available, then it must be assumed that the water is not CAT 4 and a suitable level of protection adopted.

Until a suitable decision-making matrix or field evaluation test kit can be developed, the decision on which CWD category is appropriate and the associated diving dress remains at the discretion of the dive supervisor. Supervisors are reminded of the requirement to contact 00C3 if CAT 1 contamination is suspected.

4-5 SPECIFIC DIVING SCENARIOS

Certain scenarios can increase the potential exposure to chemical/biological contamination and extra protective measures should be adopted:

4-5.1 AFTER RAINFALL. After appreciable rainfall, land-based contaminants may be washed into a watershed basin with the runoff. This phenomenon has been termed “first flush.” Dives planned during, or in the days immediately following, a large rainfall should anticipate exposure to a variety of chemical and microbiological

hazards when diving in an area with a reasonable expectation of “first flush” effects.

4-5.2 WORKING IN SEDIMENT. Most persistent contaminants with a density greater than water will accumulate in the sediment. Sediment routinely has significantly higher levels of both chemical and microbiological contamination than the adjacent water column. This contamination may include heavy metals and PCBs.

4-5.3 POINTS OF DISCHARGE. Water adjacent to points of discharge (e.g., drainage pipes and runoff channels) can contain increased levels of contamination.

4-5.4 HUMAN REMAINS RECOVERY. For divers and body handlers in the water, every effort should be made to protect personnel from injury and unnecessary exposure to body fluids and tissue. If the recovery is to be made around wreckage where there is a reasonable concern for injury, divers should wear reinforced gloves to minimize their exposure to potentially infectious materials.

4-6 EMERGENCY PROCEDURES

CWD operations require coordination of simultaneous tasks, methods of approach, personnel, and equipment. The dive team should be thoroughly briefed, assigned responsibilities, made aware of hazards and know the medical evacuation plan. The team should also be working from Standard Operating Procedures (SOPs) specific to contaminated water diving. As part of the SOPs, Emergency Procedures (EPs) should address or mitigate hazards identified during the ORM and Hazard Assessment process. Below are examples of EPs that may need to be revised or developed IAW ORM:

- Loss of breathing gas/contaminated breathing gas
- Loss of communications
- Fouled or entrapped diver
- Injured diver in the water or during the surface interval
- Diver extraction
- Hypothermia
- Heat exhaustion/Heat stroke
- Medical evacuation

4-7 SOURCES OF INFORMATION

For sources of information, refer to Appendix A for website and contact information. Appendix A is not a complete list and other organizations can be used to gather information as required.

- Refer to EPA sources for information on water quality, water quality criteria and for sewage outlets.
- You may also contact National Center for Medical Intelligence (NCMI) for information regarding local water quality. Such information may require a few weeks to compile. Requests should be initiated accordingly.
- For CONUS and OCONUS water testing operations contact the U.S. Navy and Marine Corps Public Health Center.
- When operating OCONUS, contact local authorities and the United States Defense Attaché Officer (USDAO) for assistance in identifying local points of contact.

4-8 PERSONNEL QUALIFICATIONS / TRAINING

A training program should thoroughly explain contaminants and their properties, precautions, effects of exposure, methods of protection, and emergency procedures. NAVSEA 00C3 has developed a U.S. Navy centric CWD familiarization training which is available on the NAVSEA 00C3 secure website (https://secure.supsalv.org/00c3/). When military training is unavailable, a commercial training course such as a Hazardous Waste Operations, Emergency Response (HAZWOPER) 40-hour course for Hazardous Materials Technician/Contaminated Water Diver is an option. Continuous refresher retraining is imperative to ensure divers remain competent in the procedures and use of equipment.

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CHAPTER 5
DIVE STATION DECONTAMINATION PROCEDURES

5-1 DECONTAMINATION

The aim of decontamination is to either rapidly and effectively render contamination harmless or remove it. The decontamination and monitoring process is unique to each accident/incident; therefore, the decontamination methods selected should be tailored to the hazard, responders on scene, location, and equipment available. The tasks performed do not change significantly between different types of contamination, but the procedures may vary depending on the nature of the accident/incident and the available equipment.

The objective of systematic decontamination procedures, which may include physical and/or chemical techniques, is to limit the spread of the contamination and reduce the levels of contaminants to the greatest extent possible in order to best protect personnel and equipment. Standard DoD decontamination procedures, as described in various manuals or instructions (e.g., U.S. Army FM 3-5 NBC Decontamination) can be effectively modified to work in diving scenarios. Familiarization and platform specific contaminated water diving drills should be conducted routinely. Such drills should encompass all aspects of diving in contaminated water including equipment selection, donning protective equipment, and decontamination procedures.

NOTE **Until tests have been completed on various commercial off the shelf decontamination solutions for CAT 1 CWD, NAVSEA 00C3 will provide tailored decontamination guidance prior to any CAT 1 dive being conducted.**

5-2 TOPSIDE PROTECTION

Tenders and other topside personnel may require protection from hazards while supporting CWD operations. A thorough hazard analysis will address the degree of protection required for topside personnel as well as the divers. Every effort should be made to position the “dive station” outside the contaminated area with a transition zone between the work area and the “dive station.” Some degree of contamination of the deck and topside equipment will occur and it is expected the umbilicals and line tenders will come into contact with contaminated water. Depending on the nature of the hazard, topside protection may involve the use of splash protection and face shields, impermeable rainsuits, cartridge respirators, disposable hazardous materials suits or a combination of all of the above. In warm weather, thermal stress can be a severe problem for personnel wearing protective dress. Close monitoring and short rotations of duty may be necessary. Industrial hygiene support from the local medical treatment facility (MTF), preventive medicine unit, or the Navy Marine Corps Public Health Center (NMCPHC) should be consulted for guidance on the necessity of respiratory protection for topside personnel.

For operations that involve the recovery of human remains, all body handlers should observe universal medical precautions and avoid unnecessary contact with potentially infectious material. All personnel should wear coveralls, thick disposable gloves, and protective eyewear. The same immunization recommendations for divers apply to tenders.

5-3 DECONTAMINATION STATION OVERVIEW

Even before CWD operations begin, the dive site should be divided into three zones for proper sequestration of contamination throughout the operations (See Figure 5-1). The zone immediately surrounding the point of water entry/exit should be considered an area of high contamination and is referred to as the 'hot zone'. The zone to which divers and gear progress after completing their initial decontamination is considered to have less contamination and is referred to as the 'warm zone'. The third zone into which divers progress after they have been decontaminated and had all their diving equipment removed is known as the 'clean zone'. If feasible, the clean zone should be positioned upwind from the contaminated zones. Positioning of topside personnel may need to be adjusted to keep from spreading contamination.

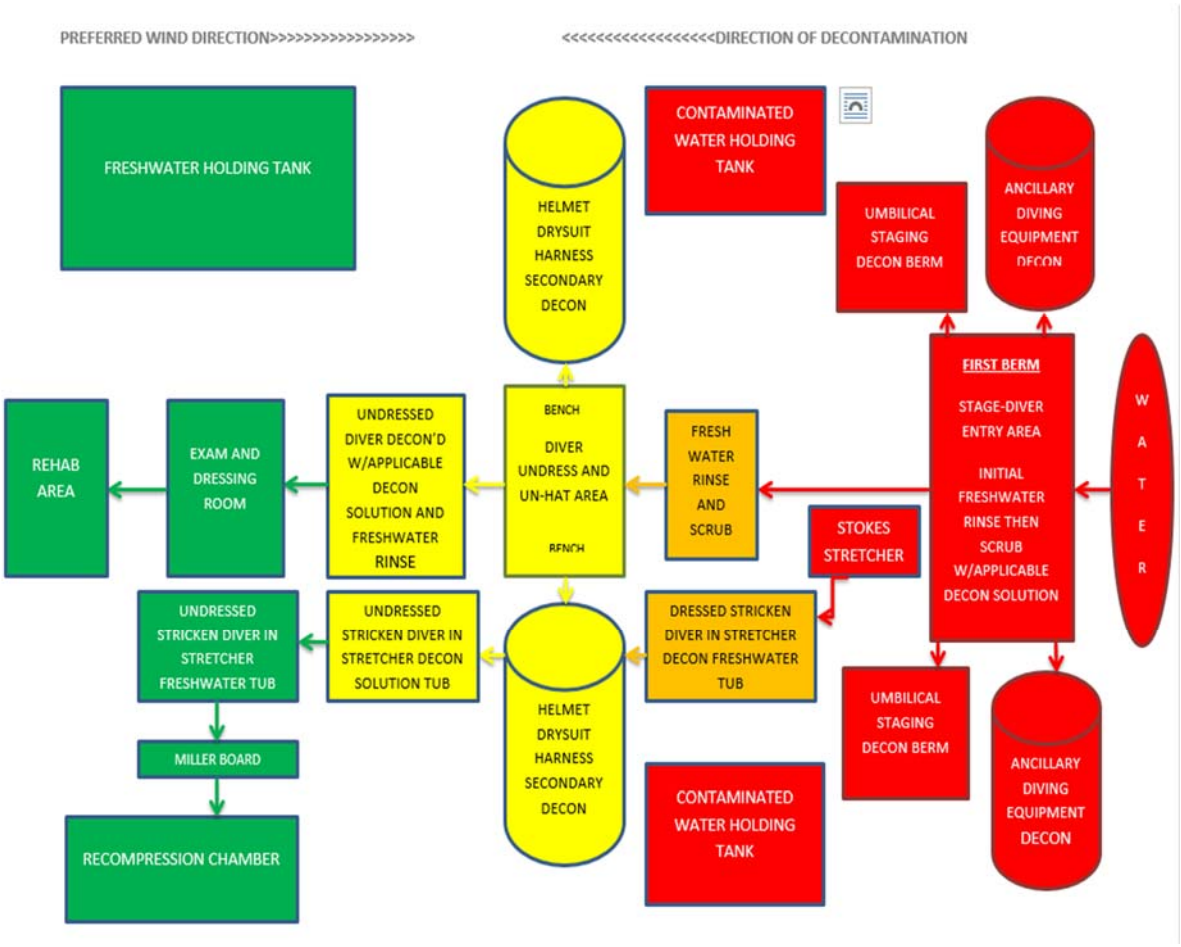

FIGURE 5 - 1 CONTAMINATED WATER DECONTAMINATION STATION

5-3.1 INITIAL DECONTAMINATION. During the initial decontamination phase, bulk contaminants should be sprayed off the diver with a 40-70 psi clean, fresh water rinse. Salt water may be used if fresh water is unavailable. The diver should not be initially rinsed until he or she is within a water-impermeable capturing area which may include a berm made of plastic sheeting or a child's wading pool. In some circumstances, all fluid used to rinse, wash, and re-rinse the diver and equipment needs to be captured for appropriate disposal as hazardous material; for these instances, the decontamination

procedure needs to be altered. After all decontamination procedures have been completed, all rinse fluids should be pumped or poured out of this capturing area and into appropriate storage and transport containers for proper disposal. If no effluent needs to be captured, the diver should be sprayed as he or she initially exits the water to limit the quantity of contaminants being transferred to the dive station. The diver should exit the water on steady flow to maintain positive pressure in helmet.

WARNING A high pressure rinse is not to be used during CAT 1 decontamination due to the increased risk of breaching the diver's personal protective equipment.

Attending technicians should be careful to direct water flow away from potential points of leakage (exhaust valves, seal junctions, etc.) in the diver's rig: a high-pressure jet of water directed at these potential breach points may inject contaminants into the diver's protective gear. Tenders should also exercise care to ensure that overspray does not spread contamination.

5-3.2 INITIAL EQUIPMENT REMOVAL AND WASHDOWN. After the initial decontamination, the diver's oversuit (if applicable) should be cut away so that the diving rig can be decontaminated. This may also be an appropriate time to remove ancillary dive gear such as harnesses, weight belts, emergency gas supply tanks, etc. for subsequent decontamination. After the diver has been initially rinsed and his ancillary gear and any oversuit removed, he should inflate his dry suit to remove folds. The tenders can then scrub the diver's suit and equipment with a stiff-bristle synthetic brush or scrubbing mitts and a cleaning solution. The composition of the cleaning solution should be appropriate for the contaminant to be removed.

Bleach solutions are adequate for most situations and should not degrade equipment when used for short periods of time and then rinsed away. Commercially available household bleach (Sodium hypochlorite) is usually approximately 6% concentration. A 5% solution of bleach (approximately six ounces mixed into a gallon of water) will kill most bacteria, fungi, and viruses on a hard, non-porous surface after a five-minute contact time. In order to overcome the consumption of free chlorine by organic matter in the site water, a 10% solution of bleach (12 ounces mixed in a gallon of water) should be used for diver decontamination with a 10 minute contact time.

Table 5-1 should be used when deciding on which decontamination solution is most appropriate. Sometimes a combination of solutions must be used (e.g. initial scrub down with Simple Green for oily contamination followed by bleach followed by potable water). For further advice on decontamination solutions, see the EPA Diving Safety Manual, Appendix Q, Attachment 1.

WARNING Do not use in tandem, series or combine any bleach solution with any Ammonia solution. This will result in the creation of chlorine gas, hydrochloric acid and liquid hydrazine. This is extremely hazardous and can cause injury or death.

TABLE 5-1. DECONTAMINATION SOLUTION EFFECTIVENESS/SAFETY

Decontamination Solution	Use against Biological Contaminants	Use against Chemical Contaminants	Safety for Diver Skin Contact	Dive Gear Compatibility
Potable Water	C	C	1	1
Antimicrobial Soap	A	C	1	1
Bleach	A	B	2	3
Betadine	A	C	2	2
Simple Green	B	B	1	1
Quaternary Ammonium (quats)	A	B	3	2
TSP	B	A	3	3
Alcohol	A	C	3	2
Easy DECON ™ Df 200	A	A	2	1
	Effectiveness: A = Very Effective B = Effective C = Somewhat Effective		**Safety/Compatibility:** 1 = Not Harmful 2 = Potentially Harmful 3 = Harmful if other precautions are not followed	

Notes:

1. This list is not all-inclusive. Other suitable decontamination solutions may be used at the dive supervisor's discretion.

2. Effectiveness includes both contaminant removal and neutralization.

3. Safety includes both physical harm to the diver and degradation/staining of equipment.

4. Dive gear compatibility is generalized based on normal decontamination solution concentrations and common dive gear materials. It is recommended that specific gear manufacturers be contacted to determine compatibility.

5. Mention of trade names does not imply product endorsement.

6. Do not use in tandem, series or combine any bleach solution with any ammonia solution. This will result in the creation of chlorine gas, hydrochloric acid and liquid hydrazine. This is extremely hazardous and can cause injury or death.

7. Ensure that any cleaning agent used for decontamination does not contain quaternary ammonia, if you are going to utilize it with any bleach solution (see note 6). The cleaning agent should have a warning if it contains ammonia.

5-3.3 UNDRESS. After the diver has been adequately decontaminated and moved into the 'warm zone', the dive gear should then be removed in a stepwise fashion. First, the locking mechanism from helmet to dry suit should be disconnected and the helmet removed. Second, the dry suit and gloves should be removed. Third, the dive gear undergarments should be removed. If nothing indicates that the diving rig has been breached during the dive, the diver may proceed to the clean zone and take a routine post dive shower, which should include washing of the entire body with soap/shampoo. The diver should use Domeboro Otic solution in each ear for a minimum of 60 seconds per side. Additionally, the area under each fingernail and toenail should be thoroughly scrubbed with soap and a nailbrush. The diver should use antiseptic mouthwash to rinse his mouth.

If there are indications of possible dermal exposure to contaminants, then additional decontamination steps will be required. These steps include scrubbing the bare skin with a 0.5% bleach solution for approximately 10 minutes and then washing with soap in a shower. The 0.5% solution can be prepared from a 1:9 dilution of the equipment decontamination solution already prepared. Label solutions carefully as applying 5% directly to a diver's skin can be very irritating. Care should be taken not to introduce decontamination solution into abdominal or central nervous system wounds, if present.

In hot environments, a method of cooling the diver should be provided. Shade and misting fans should be provided topside to prevent heat related injuries. In cold environments, warm water must be provided for the final wash and rinse phase for the undressed diver. If the water is too cold, the skin pores will close up and may trap contaminants in the skin. If the water is too hot, the skin pores may dilate and may allow residual contaminants easier entry into the body. A warm area should also be provided for drying, dressing, and medical evaluation.

All the diver's equipment must undergo secondary decontamination after it has been removed. This secondary decontamination procedure entails first rinsing bulk contamination from the equipment, then soaking it in a bleach-based solution for at least thirty minutes before actively scrubbing the equipment with soft bristle brushes. Drums or wading pools may be effective repositories for this process. After soaking and scrubbing, equipment should be rinsed thoroughly until no foaming occurs. Due to the possibility of cross-contamination, personnel assigned to accomplish the secondary decontamination of diver's equipment should not be the same as those assigned to undress of the divers. In the case of contaminants difficult to remove or highly toxic contaminants, assign a dedicated team to decontaminate equipment.

Soaking umbilicals in bleach-based solutions is not recommended. An alternative solution such as TSP or soap such as Simple Green should be used to thoroughly clean umbilicals. Impermeable Foreign Material Exclusion (FME) covers should be applied to avoid introducing cleaning solutions into the interior of diving umbilicals and other diving life support system breathing loops.

5-3.4 TENDER DECONTAMINATION. The tender decontamination procedure is the same as that for divers. The last person out of the contaminated zone will have to self-decontaminate.

5-4 MEDICAL SUPPORT

After completing a thorough decontamination, individuals should proceed to a medical evaluation station, if appropriate to the hazard or if the diver has any symptoms or complaints. The individual's vital signs are taken, documented, and compared with baseline information. Supervisory personnel may be required to help distinguish

between diving-related disorders and symptoms related to contaminant exposure. These symptoms may overlap, making diagnosis difficult. Any individual showing signs or symptoms from exposure or injury should be transported to a medical facility for appropriate treatment. Proper documentation on all individuals, methods of decontamination, and any exposures or injuries should be included. The medical treatment after exposure will be conducted in accordance with the specific medical emergency procedures directed by a competent medical team. Depending on the type of toxic substance encountered, it may be advisable to introduce short or long term biological and medical surveillance of exposed personnel. Once the individuals leave the on-scene medical evaluation area, the decontamination process is complete.

5-5 HAZARDOUS WASTE

5-5.1 MINIMIZATION. Federal, state, or local regulations may require that residue collected in the decontamination process be collected and disposed of as hazardous waste. This will require prior coordination with local officials to ensure compliance. Every effort should be made to minimize the amount of waste generated consistent with personnel safety.

5-5.2 DISPOSAL. When operating in the United States and its territories, dive operations should comply with all federal, state, and local regulations. To ensure compliance, disposal efforts should be coordinated with local agencies/officials.

Disposal of the HAZMAT generated and the decontamination effluent can be accomplished through the nearest military facility HAZMAT disposal program or by a commercial hazardous material disposal company. Submit all SDS's for the known or suspected contaminates along with decontamination solutions used with the HAZMAT and effluent generated for disposal.

When operating in foreign countries, contact local authorities and the United States Defense Attaché Officer (USDAO) for assistance in identifying local points of contact and industry resources.

5-6 DOCUMENTATION

5-6.1 DIVE LOGS. When recording dive logs in the Risk Management Information – Dive Jump Reporting System (RMI-DJRS) located on the U.S. Air Force's Safety Automated System, list the known contaminants and those that may be present as based upon pre-planning information in the drop-down boxes provided. Develop a standard response for the DJRS using standard terms and abbreviations found in the NIOSH Pocket Guide to Chemical Hazards, DHHS (NIOSH) Publication No. 2005-149.

5-6.2 MEDICAL RECORDS. Document known contaminants that the dive team is exposed to, exposure times, and the team member's assignment (e.g., diver, DECON team member); if the team member was assigned more than one job, list all for the duration of the mission. If other contaminants are suspected but no testing could be accomplished to confirm their presence, document the suspected contaminate and reason for their possible presence (e.g., informed by local authorities of chemical spill in past years). Medical personnel should evaluate dive personnel exposures and enter appropriate data in each medical record.

5-6.3 SAFETY DATA SHEETS (SDS). Maintain a file of SDSs for all contaminants known and/or suspected at the site.

5-6.4 HISTORICAL DATA COLLECTION. For CAT 1 and 2 CWD, provide NAVSEA 00C3 with complete record of the following:

- Provide narrative of mission, including: purpose, safety precautions taken, explanation of the dive and DECON process, and lessons learned.
- Specifically include data on known and suspected contaminants, including SDS and resources/testing used to determine contaminants.
- ORM plan.
- Description of any equipment issues encountered during the dive or DECON phase (if any); this may involve submitting a Failure Analysis Report (FAR) on the NAVSEA 00C3 secure website (https://secure.supsalv.org/00c3/).
- Equipment exposure times and details of the contaminants (for CAT-1 CWD only - to enable calculations of exposure times for future dives).
- Personnel issues encountered (if any); e.g., contamination, environmental stress. Personally Identifiable Information (PII) shall not be included.
- Disposition of HAZMAT generated at site and resources used for disposal.

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APPENDIX A
REFERENCE MATERIALS AND INFORMATION SOURCES

Code of Federal Regulations (CFR)

29 CFR 1910-120 Occupational Safety and Health Standards - Hazardous Materials, http://www.osha.gov.

29 CFR 1910 Subpart T Occupational Safety and Health Standards – Commercial Diving Operations, http://www.osha.gov.

40 CFR Part 260 – 273 Regulations governing hazardous waste identification, classification, generation, management and disposal. https://www.gpo.gov/fdsys/

Civilian/Commercial

*Diving in High-Risk Environments 4*th Ed., Steven M. Barsky, Hammerhead Press Santa Barbara, CA http://www.marinemkt.com.

Association of Diving Contractors International – http://www.adc-int.org/index.asp.

Environmental Protection Agency (EPA)

National Health and Environmental Effects Research Laboratory – resource to identify scientific research available on the effects of contaminants on human health. http://www.epa.gov/nheerl/.

U.S. Environmental Protection Agency (EPA). Lead contact information by region for the EPA can be found at https://www.epa.gov/lead/epa-region-lead-contacts.

For EPA websites on water quality, access the Microbial (Pathogen)/Recreational Water Quality Criteria at https://www.epa.gov/enforcement/national-enforcement-initiative-keeping-raw-sewage-and-contaminated-stormwater-out-our.

Recreational Water Quality Criteria at https://www.epa.gov/sites/production/files/2015-10/documents/rwqc2012.pdf

For the Watershed Assessment, Tracking and Environmental Results System (WATERS) at https://www.epa.gov/waterdata/.

EPA Diving Safety Manual Appendix Q Attachment 1 Decontamination Solutions https://www.navsea.navy.mil/Portals/103/Documents/SUPSALV/Diving/Appendix%20Q%20Decon.pdf?ver=2019-08-26-093431-387

National Institute for Occupational Safety and Health (NIOSH)

NIOSH *Pocket Guide to Chemical Hazards* contains general industrial hygiene information on several hundred chemicals/classes for workers, employers, and occupational health professionals. http://www.cdc.gov/niosh/npg.

Registry of Toxic Effects of Chemical Substances (RTECS®), Database of toxicological information compiled, maintained, and updated by the NIOSH. http://grc.ntis.gov/rtecs.htm - subscription fee required.

National Oceanic and Atmospheric Administration (NOAA)

NOAA Diving Manual, Chapter 16 – Polluted Water Diving available through Best Publication company. http://www.bestpub.com/.

NOAA Hazardous Materials and Assessment Division – provides tools and information for emergency responders and planners to understand and mitigate the effects of oil and hazardous materials in U.S. waters. http://response.restoration.noaa.gov/.

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Natural Resources Defense Council (NRDC)

Testing the Waters -Report Card on Coastal Conditions http://www.nrdc.org.

U.S. Army (USA)

Edgewood Chemical Biological Center Information on chemical and biological warfare agents at https://www.ecbc.army.mil/ or (410) 436-7118.

U.S. Army Field Manual (FM) 3-11.9 Potential Military Chemical/Biological Chemical Compounds available at http://www.apd.army.mil/epubs/DR_a/pdf/web/fm3_11x9.pdf.

National Center for Medical Intelligence (NCMI) Fort Dietrich MD. https://www.ncmi.detrick.mil/.

For current information on current FMs or ATP updates, http://www.wood.army.mil/chmdsd.

For information on chemical and biological warfare agents, http://www.ecbc.army.mil or (410) 436-7118.

U.S. Coast Guard (USCG)

Coast Guard Chemical Hazards Group – maintains the Chemical Hazard Response Information System (CHRIS) database. www.chrismanual.com.

U.S. Department of Transportation (DOT)

Emergency Response Guidebook, http://www.ems.gov/pdf/preparadness/resources.

U.S. National Library of Medicine

Toxicology Data Network (TOXNET) is a resource for searching databases on toxicology, hazardous chemicals, environmental health, and toxic releases. https://toxnet.nlm.nih.gov/

For chemical releases and mapping use (TOXMAP®) https://toxmap.nlm.nih.gov/toxmap/app/ which is a Geographic Information System (GIS) from the Division of Specialized Information Services of the US National Library of Medicine® (NLM) that uses maps of the United States to help users visually explore environmental health data from the US Environmental Protection Agency (EPA).

Toxics Release Inventory (TRI) https://toxnet.nlm.nih.gov/newtoxnet/tri.htm which is a set of publicly available databases containing information on releases of specific toxic chemicals and their management as waste, as reported annually by U.S. industrial and federal facilities.

U.S. Navy (USN)

Navy and Marine Corps Public Health Center at http://www.med.navy.mil/sites/nmcphc/Pages/Home.aspx. The Field Activities drop down tab will help connect you with the activity covering your area.

OPNAVINST 5100.19 Navy Safety and Occupational Health Program Manual for Forces Afloat.

OPNAVINST 5100.23 Navy Safety and +Occupational Health Program Manual.

Contaminated Water Diving Familiarization Training power point on the SUPSALV webpage at https://secure.supsalv.org/00c3/Default.asp?SystemID=18

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APPENDIX B

STANDARD OPERATING PROCEDURE

Guidelines for Risk Assessment, Pre-Dive Planning, Diving in Contaminated Water, Post-Dive Decontamination, Medical Evaluation, and Record Keeping

TABLE OF CONTENTS

STANDARD OPERATING PROCEDURE (SOP)

B-1 PURPOSE. This SOP provides general guidance and basic procedures for diving in contaminated water. Due to the broad spectrum and concentration of contaminants, potential exposure levels can vary; therefore, only general guidance can be provided.

B-2 APPLICABILITY. This SOP applies to all Military personnel assigned to a dive team as a diver and/or as support personnel.

B-3 RESPONSIBILITIES. The Commanding Officer (CO) is responsible to ensure all requirements of Operational Risk Management (OPNAVINST 3500.39 series), Navy Safety and Occupational Health (OPNAVINST 5100.23 series), and for Navy Safety and Occupational Health for Forces Afloat (OPNAVINST 5100.19 series) are met. This SOP is intended to supplement those references and provide further guidance for the safety of personnel. This SOP details the process of determining the contaminants expected, the personnel protection best suited for the contaminate(s), and the decontamination process.

This SOP establishes the minimum emergency procedures required and the minimum medical monitoring/evacuation/follow up. This SOP does not address how to determine the contaminant in the location of the dive or which contaminants for which to test. It is the Commanding Officer's responsibility to identify what contaminant is or may be present by contacting local, state, and federal organizations that monitor environmental conditions. In foreign countries with little or no environmental monitoring authorities, the best source may be local law enforcement, businesses, and citizens.

B-4 OBJECTIVES. The objectives of the CWD Manual, PowerPoint and SOP are to:

a. Establish safe practices for diving in contaminated water.
b. Provide guidelines for determining the hazards of CWD.
c. Provide resource contact information to ensure the safety of personnel.
d. Promote safety and ensure all team members are aware of the hazards.
e. Provide guidelines to help reduce or prevent contamination of personnel.
f. Provide guidelines for the best practices for personnel and equipment decontamination.
g. Provide guidelines for medical evaluation of personnel exposed to contaminants.
h. Provide guidelines for record keeping of exposure to contaminants.

B-5 REFERENCES.

a. NIOSH Pocket Guide to Chemical Hazards, DHHS (NIOSH) Publication No. 2005-149
b. OPNAVINST 5100.19 (Series), Navy Safety and Occupational Health Program Manual for Forces Afloat
c. Operational Risk Management, OPNAVINST 3500.39 (Series)
d. U.S. Navy Diving Manual, SS521-AG-PRO-010
e. Contaminated Water Diving PowerPoint (NAVSEA 00C)
f. Contaminated Water Diving Manual, SS521-AJ-PRO-010, Rev 2
g. OPNAVINST 5100.23 (Series), Navy Safety and Occupational Health Program Manual

B-6 PRE-DIVE PLANNING.

a. Determine the contaminate that is expected at the dive site either by testing or from local records/knowledge and obtain the Safety Data Sheet (SDS) for those contaminants. For known or expected contaminants, refer to reference (a) for exposure limits, personal protection and sanitation, exposure routes, and First Aid.

b. Determine and obtain the appropriate Personal Protective Equipment (PPE) for divers and topside support personnel in accordance with references (a) and (b).

c. Determine the diving platform and space available for the dive station/decontamination station.

d. Establish a perimeter control plan (for non-participants/general population exclusion)

e. Develop Operational Risk Management (ORM) Plan in accordance with references (c) and (d), including but not limited to:

- diving safety, including diver and equipment exposure time
- contamination prevention (personnel and spread of contamination)
- decontamination (personnel and equipment)
- on-site medical support
- emergency medical evacuation and treatment
- HAZMAT disposition

f. Build the team.

1) Consider using outside assistance from established and trained DECON teams, especially for CAT 1 diving/decontamination.

2) Additional tenders may be required for umbilical handeling.

3) The team should consist of members trained in accordance with reference (f).

g. Train the team. Use references (e) and (f).

h. Develop a dive station/decontamination footprint.

There is no single equipment configuration or material that will protect the diver under all conditions or from all contaminants.

The type of protection needed will be determined by the expected hazard, type of work, the urgency of the work, and the available equipment.

Refer to reference (f), Appendix C inventory for available equipment and model your decontamination station similar to the layouts shown. The layouts shown in Appendix C are not mandatory – they are provided as a guide for effective decontamination station set up.

Determine the DECON stations and equipment required and develop a detailed sketch of how to lay out the entire station using the decontamination equipment available. Ensure that the station provides for:

1) Wind direction (cold zone to hot zone)

2) Safe diver up and over phase
    a) Include container for harness, tools, and recovered items (if required)
3) Initial diver scrub and wash-down (dressed), with soap/DECON solutions (dry suit inflated to remove folds in suit)
4) Initial diver rinse (dressed)
5) Secondary scrub and rinse (if necessary)
6) Diver undress station
    a) station for helmet DECON
    b) container for diving dress and clothing
7) Diver decontamination (undressed)
8) Diver rinse (undressed)
9) Diver dressing station and medical evaluation
10) Umbilical management. (extra tenders may be necessary)
11) Emergency decontamination and treatment of a stricken diver
12) Decontamination of topside personnel/DECON team
13) Site Logistics
    a) Equipment and supplies
    b) Medical support/evacuation
    c) Management/disposition of contaminated waste water, material, and equipment

NOTE Excessively cold water may trap any contaminants in skin pores. Excessively hot water may open skin pores to residual contamination.

If diving in a cold environment, provide warm water for the undressed diver decontamination wash-down and rinse stations.

If diving in a tropical environment, shade may be required for any supply-water holding tanks to ensure it is not over heated by direct sunlight.

B-7 CONDUCTING THE DIVE.

a. Dive station and decontamination station set up.
    - Ensure DECON station hoses/lines/cords do not interfere with the diver's umbilical or work lines.
    - Set up the decontamination station and dive station according to your pre-dive planning sketch and modify as required (with appropriate authorization) to ensure safety and adequate decontamination of the divers and decontamination team.
    - Conduct multiple training walk through of the completed plan prior to commencing diving operations to ensure that all personnel are familiar with the procedures utilized.

b. Dive brief.
    - Diving safety
    - Maximum exposure times

- Decontamination station routine and emergency procedures
- Stricken/unconscious diver procedures (DECON and medical)

c. Execute the dive.

- Conduct diving operations in accordance with reference (d)

B-8 POST-DIVE ACTIONS.

a. Decontamination of divers and support personnel.

b. Disposition of contaminated materials, clothing, equipment, and waste water.

c. Medical examination of all personnel directly exposed to contaminants.

- Medical/supervisory personnel should observe the decontamination process (from a location that prevents contamination) and watch for signs of AGE, DCS, environmental stress (heat/cold), and symptoms of exposure to contaminants.
- If exposure to contamination is suspected, the affected person should be examined by Navy Occupational Health and Safety Services in accordance with references (b) and (g).

B-9 DOCUMENTATION.

a. Dive logs. Dive Jump Reporting System (DJRS). In the drop-down boxes provided, list the known contaminants and those that may be present based upon pre-planning information. Develop a standard response for the DJRS using standard terms and abbreviations found in reference (a).

b. Medical records. Document known contaminants that the dive team is exposed to and exposure times. Document the team member's assignment (e.g.; Diver, DECON team member), if the team member was assigned more than one job, list all for the duration of the mission. If other contaminants are possible, but no testing could be accomplished to prove/disprove them, document the suspected contaminate and reason for their possible presence (e.g., informed by local authorities of chemical spill in past years). Medical personnel evaluate everyone exposed to contaminants and enter appropriate data in each medical record.

c. Safety Data Sheets (SDS). Maintain a file of SDSs for all contaminants known and/or suspected at the site along with decontamination solution used. All SDS's must be included with the HAZMAT that is being disposed of.

d. Historical Data Collection. For CAT 1 and 2 CWD, provide NAVSEA 00C3 with complete record of the following:

- Provide narrative of mission, including: purpose, safety precautions taken, explanation of the dive and DECON process, and lessons learned.
- Specifically include data on known and suspected contaminants, including SDS and resources/testing used to determine contaminants.
- ORM plan.
- Description of any equipment issues encountered during the dive or DECON phase (if any); this may involve submitting a Failure Analysis Report (FAR) on the NAVSEA 00C3 secure website (https://secure.supsalv.org/00c3/).
- Equipment exposure times and details of the contaminants (for CAT-1 CWD only - to enable calculations of exposure times for future dives).
- Personnel issues encountered (if any); e.g., contamination, environmental stress. Personally Identifiable Information shall not be included.
- Disposition of HAZMAT generated at site and resources used for disposal.

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APPENDIX C

NAVSEA CWD DECONTAMINATION EQUIPMENT

C-1 CWD DECON Station Assemblies/Components. The following shows the NAVSEA 00C3 CAT 1 Decontamination Station Equipment and Dive Station Van available to augment severe U.S. Navy CWD operations. This equipment is intended to augment U.S. Navy Commands CWD inventories as provided in their Table of Allowances (TOAs) per their Required Operational Capabilities (ROC) and Projected Operational Environment (POE). This equipment is not intended for use in all CWD that are standard, day-to-day operations (e.g., diving in U.S. Navy Shipyards) but is for an initial response capability for a large-scale events (e.g., accident, spill, humanitarian response, etc.). The images below show only one example of how to place and configure the decontamination station. The configuration/foot-print of the DECON station may be modified to meet the needs of each situation following the guidelines of Figure 5-1. Refer to Section C-2 for an inventory list.

C-1.1 Equipment Weights and Shipping. The CONEX box that houses and is utilized to ship the DECON Station Assemblies has a combined shipping weight of 16,000 pounds. The entire assembly is requested to augment the requesting command's TOA for the CWD operation. If requesting the use of the NAVSEA FADS III Dive System and Trailer to augment the requesting command's dive capability for the CWD operation, the shipping weight is 14,000 lbs. Contact NAVSEA 00C3 for information when requesting the NAVSEA dive system and trailer.

FIGURE C-1 DECON Station Assembled

FIGURE C-2 4' X 9' X 9" Diver's Stage Berm with DECON Deck Grating

FIGURE C-3 Yellow Containment Barrel and Diver's Umbilical with Berm and DECON Deck Grating

FIGURE C-4 Wash Shower with Yellow Berm and DECON Deck Grating

FIGURE C-5 Rinse Showers with Yellow Berm and DECON Deck Grating

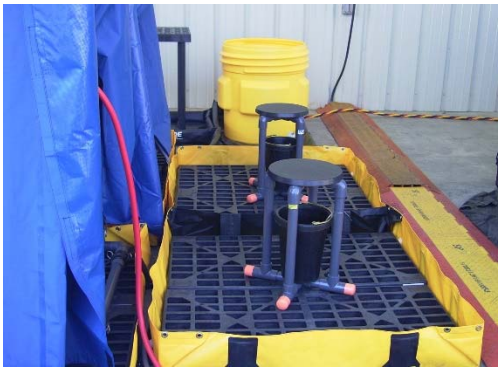

FIGURE C-6 Diver Undress Area. Table for Helmet DECON and Yellow Container for Dive Suit and Clothing. Berm, Seats, and DECON Deck Grating (privacy curtain not shown)

FIGURE C-7 12V Electric Submersible Pump for dewatering berms, 50' Grey Discharge Hose, 50' Electrical Power cord with On/Off Switch

FIGURE C-8 110V Electric Water Supply Pump with manifold, shut-off valves, with suction hose and red supply hoses to showers. White 50 gal clean water supply container

FIGURE C-9 Zumro DECON Tent Skin Wash and Rinse (two separate showers)

FIGURE C-10 Cold Zone, Final Dry/Dressing Berm (privacy panels not shown)

FIGURE C-11 Zumro DECON Tent Inflator Connection

FIGURE C-12 Zumro DECON Tent Dewatering 110V Electric Pump and Hoses

FIGURE C-13 Zumro DECON Tent Dewatering Strainer (inside)

FIGURE C-14 Emergency Wash Tub with Stokes Stretcher and Emergency Rinse Tub

FIGURE C-15 NAVSEA Dive System Trailer

C-2 CWD Equipment Inventory. The following Tables list the CAT 1 Decontamination Station Equipment and Dive Station Van as maintained by NAVSEA 00C3 via the Emergency Ship Salvage Material (ESSM) Facility in Williamsburg, VA. The inventory is subject to change and is not all inclusive for every CAT 1 contaminated diving scenario. This equipment is available to augment fleet capabilities and provide commands additional deployable assets if needed.

Table C-1 CWD Personal Protective Equipment (PPE) Inventory (Diver)

Description	U/I	Qty
KM-97	EA	5
Viking HAZTECH Contaminated Water Dry Suit, Size 00/SML (Note 1)	EA	2
Viking HAZTECH Contaminated Water Dry Suit, Size 01/MED (Note 1)	EA	3
Viking HAZTECH Contaminated Water Dry Suit, Size 02/LGE Wide (Note 1)	EA	3
Viking HAZTECH Contaminated Water Dry Suit, Size 03/EXL Wide (Note 1)	EA	2
Viking HAZTECH Contaminated Water Dry Suit, Size 04/XXL Wide (Note 1)	EA	2

Notes:
With HAZMAT Exhaust Valve, Steel-Toed Boots, KM 37 (NS) or KM 97 Neck Ring Installed, Glove Ring System, Good Grip Gloves, and HD Dry Gloves.

Table C-2 CWD PPE Inventory (Topside)

Description	U/I	Qty
Dupont TYCHEM 2000 Coverall, Size 4XL	EA	10
Nitrile Gloves 15 Mil-10	EA	10
Nitrile Gloves 15 Mil-11	EA	10
Butyl Gloves 7 Mil – Size L	EA	10
Butyl Gloves 7 Mil – Size XL	EA	10
Safety Goggle, Non-Vented	EA	50
OnGuard HAZMAX Knee Boots – Size 8	PR	4
OnGuard HAZMAX Knee Boots – Size 12	PR	6
OnGuard HAZMAX Knee Boots – Size 15	PR	6
Rain Gear Bottoms	EA	11
Rain Gear Tops	EA	7
Individual DECON Kits “DECON in a Bag”	EA	2
HAZMAT Protection Kit 2XL/#XL	EA	10
HAZMAT Protection Kit 4XL	EA	10
Doff-It Personal Privacy Kit - Adult	KIT	10

Table C-3 CWD Decontamination Station Equipment

Description	U/I	Qty
Dual DECON Backpack	EA	2
Chemical Payload	EA	2
GCE Surfactant	EA	12
Stage One DECON Shelter	EA	1
Surround Rinse Hose for Stage One	EA	1
Sump Pump Kit 110V with Case	EA	1
Grey Water Bladder 500 Gal	EA	1
8’ x 8’ Light Spill Berm	EA	1
DECON Spill Berm 4’ x 9’ x 8 inch (2CPT)	EA	4
4’ x 6’ Light Berm	EA	3
DECON Grating 2’ x 4’	EA	36
Yellow Containment Barrels	EA	8
Bristle Brushes	EA	17
DECON Bucket with Lid	EA	10
DECON Responder Brush	10	10
Chemical Resistant DECON Brush – Size 10”	EA	10
DECON Brush Handle	EA	10
Supersoft DECON Brush – Size 8”	EA	10
Telescoping Flow-Thru DECON Brush Handle	EA	5
Mascas Elevation Grid	EA	10
Manual Water Pump	EA	2
Overpack Container, 65 Gallon	EA	8
Indestructo DECON Shower	EA	1
Complete Rehab Solution Package	EA	1
DECON Utility Stool	EA	6
Storage Bin 34” x 24” x 20”	EA	10
Diver Stool w/Bucket	EA	6
DECON Sprayer, 2 Gallon	EA	10
DECON Wand	EA	4
Equipment Station System	EA	4
Standard Decontamination Shower System with Aluminum Pool	EA	2
Heavy Scrub Shower	EA	1
Submersible Pump, 12V	EA	1
Electric Water Pump, 110V	EA	2
Wastewater Hose, Grey	EA	10
Water Supply Hose, Red	EA	10
Fire Hose Reducer Coupling with Hose, Blue	EA	1
Elevation Grid	EA	11

Table C-4 CWD Cold Zone Clothing and Support Equipment

Description	U/I	Qty
Individual Cooling Towels	EA	10
Cooling Towel Kits	EA	10
Replacement Reservoir Bags	EA	30
T-Shirt RH2006-XL	EA	6
T-Shirt RH2006-XXXL	EA	5
Portable Dry Toilet System	EA	1
Waste Kits	PR	50
Drying Towel, Disposable	BX	1
Rubber Soled Slippers	PR	6
Purell Wipes	BX	1
No Rinse Bathing Wipes	EA	24
Sweat Shirts XXXL	EA	6
Sweat Shirts XL	EA	6
Sweat Pants XXXL	EA	6
Sweat Pants XXL	EA	6
Jersey Gloves (pack of 6)	PK	2
White Crew Socks (pack of 6)	PK	2
Stocking Caps	EA	6
Grey Blankets	EA	12
Emergency Warming Blankets	EA	25
Heater Stand 110VAC	EA	1
18” Misting Fan and Cooler	EA	1
Privacy Screen	EA	2
Core Cooling Chairs	EA	4
Army Cot	EA	1
Sack-It Clean Up Dispenser	EA	1
Folding Table	EA	1
REHAB Tool Box	EA	1
LED Work Lights	EA	2
Relaxation Chair	EA	4
Folding Stools	EA	2
Extension Cords	EA	2

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APPENDIX D

List of Acronyms

AGE	Arterial Gas Embolism
ANU	Authorized for Navy Use
ATP	Army Technical Publication
CAT	Category
CFR	Code of Federal Regulations
CO	Commanding Officer
CONUS	Continental United States
CWD	Contaminated Water Diving
DECON	Decontamination
DHHS	Department of Health and Human Services
DJRS	Dive Jump Reporting System
DoD	Department of Defense
DOT	Department of Transportation
E. Coli	Escherichia Coli
EGS	Emergency Gas Supply
EP	Emergency Procedure
EPA	Environmental Protection Agency
ESSM	Emergency Ship Salvage Material
EU	European Union
FAR	Failure Analysis Report
FFM	Full-Face Mask
FM	Field Manual
FME	Foreign Matter Exclusion
HAB	Harmful Algal Bloom
HAZMAT	Hazardous Material
HAZWOPER	Hazardous Waste Operations
IAW	In Accordance With
MIL-SPEC	Military Specification
MOPP	Mission Oriented Protective Posture
NAVSEA	Naval Sea Systems Command
NBC	Nuclear Biological Chemical
NCMI	National Center for Medical Intelligence
NEDU	Navy Experimental Diving Unit
NMCPHC	Navy Marine Corps Public Health Center
NIOSH	National Institute of Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NS	Navy Standard
OCONUS	Outside Continental United States
OPNAV	Office of the Chief of Naval Operations
OPNAVINST	Office of the Chief of Naval Operations Instruction
OSHA	Occupation Safety and Health Administration
ORM	Operational Risk Management
PCB	Polychlorinated Biphenyls
PHA	Polyaromatic Hydrocarbons
PMS	Planned Maintenance System
POE	Projected Operational Environment
PPE	Personal Protective Equipment
RADCON	Radiological Controls
ROC	Required Operational Capabilities
SCBA	Self-Contained Breathing Apparatus
SCUBA	Self-Contained Underwater Breathing Apparatus
SDS	Safety Data Sheet (formally Material Safety Data Sheet)
SOP	Standard Operating Procedure
TIC	Toxic Industrial Chemicals
TLD	Thermo-luminescent Dosimeter
TOA	Table of Allowance
TSP	Tri-Sodium Phosphate
USA	United States Army
USCG	United States Coast Guard
USDAO	United States Defense Attaché Office
USN	United States Navy

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Ref: NAVSEAINST 4160.3 NAVSEA S0005-AA-PRO-010/TMMP

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