

DECONTAMINATION PROTOCOLS

SPECIAL NOTE: The following information is taken from DUI's Exposure Protection for Public Safety Divers Presentation. Diving in contaminated water is a complicated issue and requires specialized training. No diver should attempt diving in contaminated water without this training.

Regardless of the drysuit material, all dive teams should have detailed decontamination procedures. The following are some examples of typical protocols in commercial and public safety diving which include creating three zones at the diving site:

HIGH CONTAMINATION ZONE

This is the area surrounding the point of water entry/exit. In this area, you will need a decontamination shower and/or high pressure fresh water rinse with cleaning solutions such as betadine, tincture of green soap, Simple Green, or DF200 foam. Containment of all water and any other cleaning agents will usually be required. After the initial cleaning, the diver can remove his/her SCUBA equipment with the help of the tender. That equipment should be put into an airtight bag or container with a label on the outside that indicates the item inside, date of use, type and length of exposure, and type of contaminant. It should be kept in the low contamination zone until it is returned to the facility where it will undergo definitive decontamination.

LOW CONTAMINATION ZONE

This is the area to which divers and equipment will be directed after initial decontamination. In this zone, one or more decontamination showers should be constructed which in most cases will also require containment pools. Cleaning agents such as betadine and tincture of green soap should be on hand as well as disposable brushes and other cleaning supplies. Use an alkaline agent such as sodium bicarbonate to neutralize acids. Conversely, an acid can be used to neutralize alkaline agents such as chlorine. The diver should enter with their drysuit and helmet or full face mask still on. This equipment will be removed in this zone.

CLEAN ZONE

This area is where all divers will be directed after undergoing decontamination and removing all of their equipment. Medical equipment should be kept here unless needed. This area should be upwind of the high contamination zone if possible. At the last shower, the diver must scrub the body thoroughly for at least 5 minutes. Towels used also go into a disposal bag. Diver should change into clean clothes and undergo a medical evaluation if they have been exposed to higher levels of contamination. Water and cleaning solutions used in the decontaminating procedure should be disposed of properly and treated as hazardous material. Personal protection equipment used by surface personnel must also be treated in the same way.

All of the typically used decontamination solutions must be contained as they do not neutralize

the contaminant being washed off and in some cases are environmentally hazardous themselves, such as bleach and TSP. Large amounts of water are required to wash the person down and that effluent is all considered contaminated and must be disposed of properly. The cost and hassle factor mean that many dive teams do not properly decontaminate their equipment. The end result is their gear does not last as long and there is the likelihood of cross contamination between the suit and BCD, etc.

While the Navy uses 5% bleach as a cleaning solution, bleach and TSP are both toxic to the environment, the diver and the diver's equipment. Nor is it as effective as we would like. A 5% solution has only a 97% kill rate of biological contamination after 30 minutes of soaking. Usually very high concentrations, 10%-20%, are required to effectively neutralize biological contaminants to a 99.99999% kill which increases the harmful effect. It is also difficult to keep the bleach solution on the diver during the initial decontamination process for that 30 minute dwell time.

It can also be difficult to get the required dwell time with antimicrobial soap so scrubbing is important as well as lots of water. This solution is often used by the EPA as it is more environmentally friendly and more effective than bleach at removing hydrocarbons. The required scrubbing and amount of water is often not practical for many smaller teams. Betadine, TSP and Simple Green are other decontamination solutions but they all have the disadvantage of not working with both chemical and biological contamination.

DF200 is a new solution developed for the US military making decontamination more effective and practical. Originally designed to neutralize weapons of mass destruction such as Anthrax and various nerve gases, it is also extremely effective against all biological contaminants and most chemical contaminants. It is biodegradable, EPA approved, and non corrosive to the equipment. It actually neutralizes the contaminants and breaks them down into harmless components. A 99.99999% kill rate can be achieved in 1-3 minutes for most biological contaminants. A dwell time of 15 minutes may be required for some concentrated chemical contaminants. This new decontamination solution means it is much easier to effectively decontaminate any type of suit material as well as the other parts of the dive equipment. While it does not neutralize hydrocarbons, it does act as a surfactant and will wash off hydrocarbons as with other surfactants. The effluent will need to be contained and properly disposed of.

The importance of proper decontamination must be a significant part of any public safety program. Proper decontamination will improve safety as well as equipment longevity. Decontamination is done on the dive site to remove and/or neutralize surface contaminants from protective equipment such as a diving suit. This is done to allow the diver to take the suit off without becoming contaminated. Typically this does not render the equipment contaminate free and the equipment should be handled as if still contaminated.

Definitive decontamination is rendering the equipment safe and contaminate free. Depending on the contaminate type and level, this process is highly variable. In the case of diving in fuel-contaminated water, all rubber components are replaced on breathing equipment. With severely chemically contaminated suits and equipment, the equipment may need to be disposed of as hazardous waste. This process will usually be done after the dive and will involve specifically scrubbing the suit and other equipment with the appropriate cleaning solution. If using DF200, this process can be skipped for most contaminants. Depending on the length and type of

exposure, different cleaning agents should be used. For many biological exposures, products such as Simple Green, betadine, and tincture of green soap should be adequate for cleaning. PPE equipment should be worn when decontaminating equipment. Here are a few simple things to watch out for:

- Scrub the suit with the appropriate cleaning solution. Use plenty of water and make sure to pay particular attention to areas where dry glove rings or helmet yokes may trap water. It is important to clean the drysuit as soon as possible after the dive in order to prevent any mildew or mold from forming.
- Seals, latex hoods, zippers and the diaphragm inside the exhaust valves are particularly vulnerable to contamination. Depending on the level and type of contamination, you may need to replace seals after a single use. Check for delamination of the seals from the suit, discoloration, and stickiness.
- Use a toothbrush and the cleaning solution to wash the zipper. Zippers are very susceptible to fuel contamination and should be checked after every dive.
- Flush water and cleaning solution through valves. Remove valves from suit for further cleaning if necessary. Valves may need to be replaced if diving in fuel-contaminated water as the rubber diaphragm is particularly susceptible.
- Base suit material should be checked continuously for cracks, abrasions, bubbling, discoloration, delamination or other defects that may indicate damage from contaminants or may weaken the material to a degree that further use is not recommended. Suits can be weakened so that further use in a particular contaminant will cause a catastrophic failure. Vulcanized rubber is particularly vulnerable to delamination as the waterproof layer is on the outside of the suit and exposed to nicks etc. Once the exterior develops nicks and flaws, it is easy for contaminants to enter and get between the rubber and fabric lining.

Dive teams who operate in contaminated water must continually evaluate their equipment for deterioration from contaminants. Even proper decontamination procedures may not be enough to clean everything. The effect on the equipment of cumulative exposure to contaminants is unknown. It is likely that repeated exposure will result in a decreasing ability to protect the diver from aggressive contaminants. There is just no practical way to test for everything.

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