



## SAFE DIVING IN CONTAMINATED WATER

Since 1974, the U.S. Coast Guard Office of Marine Environment and Systems has recorded over 450 large spills or release incidents, involving a total of over 209,000 lb of hazardous substances in our nations waterways. In addition to these accidental incidents, many bodies of water are subject to continuous dumping of effluents either through design or neglect.

Periodically, divers are required to enter environments where there is a high degree of contamination. Divers may also be asked to enter more controlled, but no less hazardous environments, for instance, performing repairs within nuclear reactors.

To effectively isolate the diver from exposure to harmful materials, it is imperative precautionary measures be employed. Conventional SCUBA (Self Contained Underwater Breathing Apparatus) is totally inadequate for this application. Regulator mouthpieces permit water seepage at the lips. Traditional forms of surface supplied commercial diving apparatus are also unsatisfactory. Standard helmets permit backflow of contaminants through the exhaust mechanisms. The helmet must also be coupled directly with an acceptable dry suit to effectively protect the diver's skin.

Extensive research and testing by divers from NOAA (National Oceanic and Atmospheric Administration) and EPA, has established a protocol for contaminated water operations. Commonly spilled hazardous chemicals were evaluated based upon their solubility as well as their tendency to either float or sink. While it will be rare for a diver to come into direct contact with concentrated or pure chemical product, due to the inherent diluting characteristics of water, such potential still exists. Extremely dangerous situations occur within the holds of sunken vessels where drums of material may be stored, and around ruptured pipelines. Similarly, hydrogen sulfide accumulates in high concentrations near the point of discharge of municipal and industrial wastes. Inhalation and ingestion of petroleum products can cause burns and damage, as well as chronic effects like skin cancer and central nervous system damage.

In searching for a practical system for potential use in hazardous environments, one of the helmet/suit combinations tested was the SuperLite-17 helmet manufactured by Diving Systems International and the Viking Dry Suit from Viking Scavenger A/S.

It is not sufficient that a dry suit merely keep the diver dry, it must also have other key features. Essential characteristics include a sealing system with wrist seals of adequate thickness to avoid punctures; attached boots with hard soles, with steel toes and shanks an option. The preferred material for the suit's outer surface must be a non-absorbent material, such as EPDM. Suits of woven fabric material are difficult to decontaminate. Upon ascent, any air that has been introduced into the diver's suit will expand. Consequently, the suit must be equipped with an automatic valve that will vent pressure without changing the diver's buoyancy. The suit system must include gloves that mate directly to the suit and seal watertight.

Dry diving helmets are the best method of preventing the inhalation and/or ingestion of contaminants since in addition to covering eyes, nose and mouth, head and ears as well are covered. The exhaust valves of the helmet must be "stacked" one on top of the other to prevent backflow of contaminants through these valves.