Deep-Sea Diving: Lessening the Health Hazards

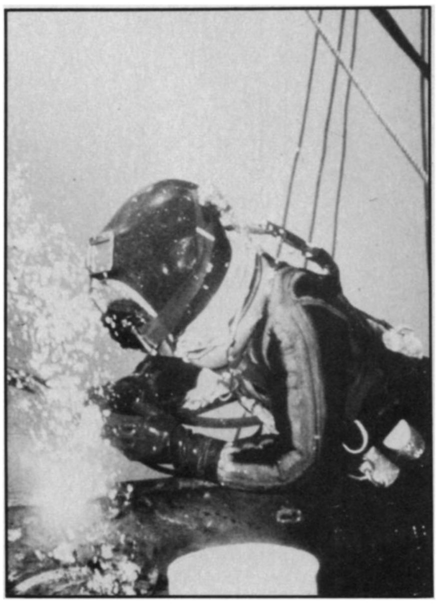
For the first time, a national plan tackles the risks of deep-sea diving

BY JOAN AREHART-TREICHEL

During the past few years, American oil companies' interest in exploiting oil from the ocean has skyrocketed. Thousands of square miles of ocean floor off the West Coast, East Coast and Gulf of Mexico have been leased for oil exploration. The key to companies' recovery of oil from these areas depends in part on deep-sea divers, and for this reason there are currently some 3,000 divers employed by American diving companies in search of oil. They work at ocean depths between 200 and 1,000 feet, setting up equipment to drill for oil and connecting oil-well heads to pipelines so that oil can flow into refineries. There are several ways they can carry out this work in the ocean.

To work at depths between 200 and 600 feet, a diver may put on a diving suit and enter a diving bell, from which he receives his life support. He and the bell are lowered from the oil rig to the desired ocean depth where he leaves the bell to which he is tethered and sets about working, breathing gases through a hose linked to the bell. After a period of work, he returns to the bell, climbs inside, the hatch is closed, and he and the bell are hoisted up to the deck of the oil rig where he enters a decompression chamber. This enclosure contains the same air pressure as the bell and of the depth of ocean he was working in, which is then gradually reduced so that the highly concentrated gases, absorbed by his body under the great pressures of the ocean, escape. If decompression is not conducted slowly, the highly concentrated gases will seriously damage his body or even kill him.

To work at greater depths—600 to 1,000 feet—a diver may first enter the oil rig decompression chamber and be exposed to increasing air pressures until his body becomes saturated with the same concentration of gases that he will experience at the ocean depth he'll be working in. The advantage of saturation diving is that he is ready to work when he gets down to the work site. Otherwise, he would have to spend an hour or two descending so that his body would gradually accustom itself to the increasing ocean pressures. He then enters a diving bell, which contains the same air pressure as the decompression chamber, and the bell is lowered to the appropriate ocean depth, where he opens the hatch, swims out and goes to work, once more getting his breathing gases from an umbilical cord attached to the bell. After several hours of work, he returns to the bell, closes the hatch, and the bell is raised and connected to the decompression chamber, where he decompresses.



Commercial diver welding underwater.

Although deep-sea divers assisting the search for oil from the ocean are tough, intelligent and supported by advanced technology, they often suffer accidental injury at the underwater site as they cut, weld and use explosives to join heavy pieces of metal together or physiological damage exerted by the ocean depths. Their occupational risks are hundreds of times greater than those facing the typical industrial worker. The dangers they face will probably become even greater during the next five years as they will be expected to stay in the ocean longer and perhaps even descend in diving bells to 1,500 feet or 2,000 feet.

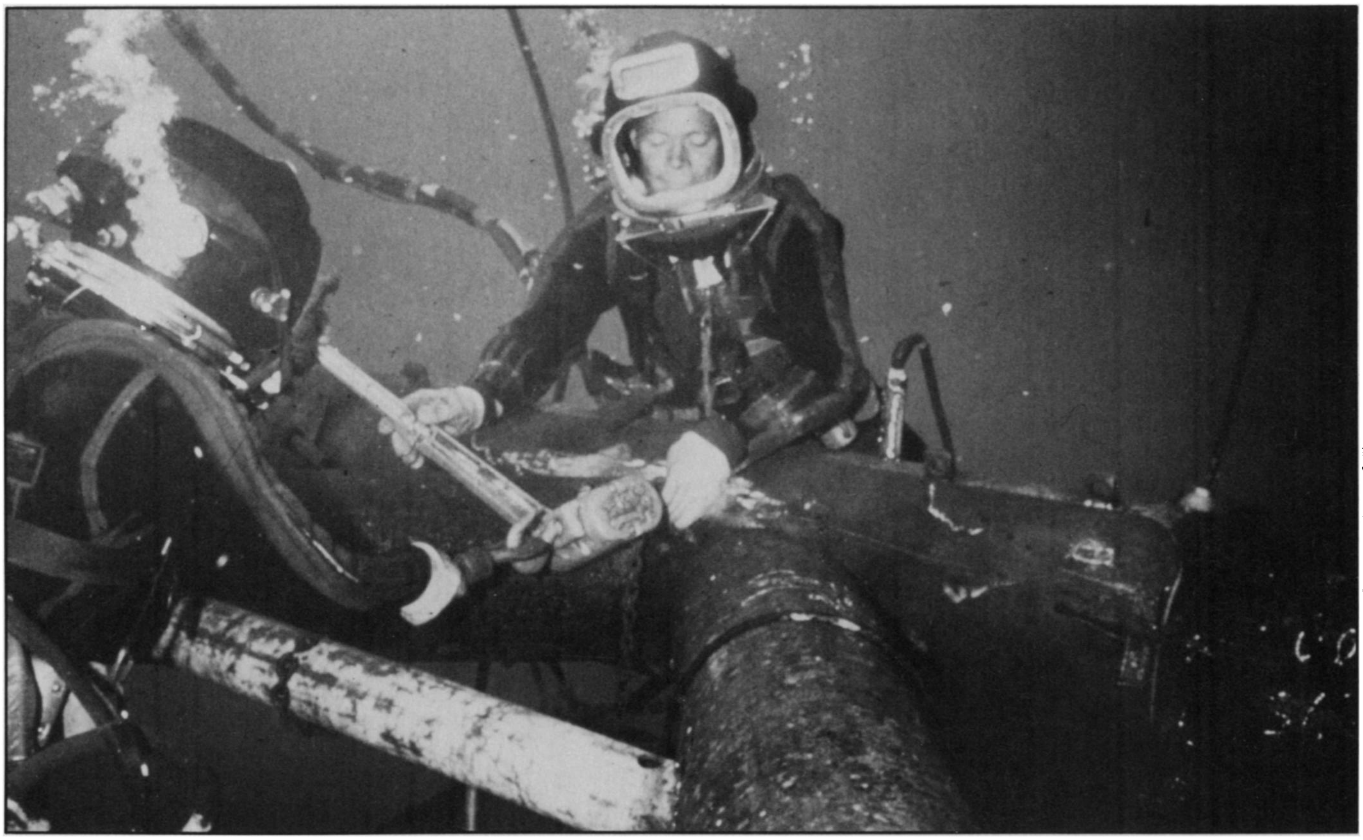
Last year the federal government —specifically the National Institute for Occupational Safety and Health, the Energy Research and Development Administration, the National Oceanic and Atmospheric Administration and the National Heart and Lung Institute—decided that the health risks facing these divers should be better defined and dealt with. Consequently, they contracted with the Undersea Medical Society in Bethesda, Md., to devise a "National Plan for the Safety and Health of Divers in Their Quest for Subsea Energy." The Undersea Medical Society is composed of some 1,000 physicians and doctors of science, most of them diving enthusiasts.

The society, under the auspices of C. W. Shilling, its executive secretary and a diving physician, has now completed the plan. It has been published by the government and is just now becoming available to industry, divers, scientists and other interested parties. This is the first time that a national effort has been made to cope with the health risks of deep-sea divers. Some of the plan's recommendations are already being implemented. Many of its recommendations will also benefit the nation's 1.5 million qualified scuba divers, who dive down to 200 feet for marine biological research, sport or other purposes.

The primary recommendation is that the deep-sea divers helping to get oil from the ocean be more carefully selected and trained to lessen the chances of accident and death. A second major recommendation is that medical emergency technicians be trained to work on oil rigs and to handle accidents or other medical problems that divers face. Divers, for instance, may experience minor trauma to their hands, backstrain, a crushing of the legs or chest, burns, electric shock, welding-fume poisoning, blast injuries or other accidents while working in the ocean. Or they may catch flu, pneumonia or other infectious diseases that can be exacerbated by the ocean environment. The medical emergency technicians would deal with these problems, even, if necessary, treating divers underwater.

Thanks to this recommendation, several oil companies are already training some of their divers to become emergency technicians. The Undersea Medical Society has conducted a workshop to determine the type of training for the Emergency Medical Technician/Diver.

The medical technicians working on rigs would not make all emergency treatment decisions alone. They would be in contact by radio or telex with physicians onshore. But since few physicians are familiar with the medical hazards of diving, or know what to do to treat divers, the plan recommends that some physicians practicing in states with offshore drilling be trained in diving medicine. (Currently, the only diving medicine course in the world offered to civilian physicians is in Australia.) The American College of Emergency Physicians has already agreed to cooperate in arranging lectures, setting up courses and publishing articles on diving medicine in their journal.



Photos: Jim Joiner, Commercial Diving Center, Wilmington, Calif.

Divers repair an underwater oil platform. Occupational risks are vastly greater than those facing an industrial worker on land.

Another vital area to which the plan addresses itself are problems that can arise when divers breathe various gases beneath the ocean. Oxygen is vital for human breathing, yet prolonged exposure to high concentrations of oxygen under increased pressure can lead to oxygen toxicity, which in turn can produce tremors, confusion, irritability, convulsions, blindness, permanent neurologic damage or even death. More scientific research is needed on the mechanisms of oxygen toxicity so that drugs might be found to protect divers against it. A better understanding of how such toxicity occurs might also lead to the development of techniques to identify persons who are especially sensitive to oxygen toxicity. That way such persons would be disqualified from becoming divers. More research, the plan says, is also needed to determine whether the stress of diving hastens oxygen toxicity. Stress certainly aggravates oxygen toxicity in experimental animals.

It is precisely because of oxygen toxicity, in fact, that the oxygen divers breathe must be diluted with inert gases. Yet these gases, too, pose hazards. Nitrogen, for example, is the inert gas of choice for all divers at depths of less than 150 to 200 feet. Beyond these depths, most divers feel the effects of nitrogen narcosis, which makes them feel so lightheaded and out of touch with reality that they can no longer function. Nitrogen is also highly soluble in body fluids and can therefore be difficult to breathe at increased pressure. Helium, on the other hand, is light, easy to breathe and not as narcotic. It is the gas of choice for diving deeper than 200 feet. There are, however, physiological problems for divers breathing helium. These include difficulty in communicating (helium makes divers' speech sound like Donald Duck), heat loss from the body (a diver breathing a helium-oxygen mixture at 600 feet can lose all the heat in his body into his breathing gas) and helium tremors, which are known in the medical trade as the high-pressure nervous syndrome.

So the plan recommends that other gases besides helium be explored for their potential use in diving mixtures. Although there is already ample scientific evidence on the physiological and behavioral effects of breathing helium or nitrogen under the ocean, less is known about neon and hydrogen, which may well prove superior. Hydrogen particularly looks promising since it is definitely known not to produce the high-pressure nervous syndrome and is available in unlimited quantities. (Helium, on the other hand, is becoming a scarce world resource.) There is also a possibility that liquids can be used as a breathing medium under certain conditions. The plan cautions, however, that much more research has to be done before liquid breathing becomes commercially available to divers.

Still another health risk that appears serious for divers is osteonecrosis (which divers indelicately refer to as "bone rot"). This condition can strike any diver who works in excess of 33 feet of sea water, but especially those who dive extensively. One study showed that 800 out of 3,800 professional divers were afflicted to some degree with this condition, which can lead to arthritis-like crippling of the joints. Osteonecrosis is essentially bone death resulting from a loss of blood to the bones. The blood loss in turn occurs because gas gets into tissues. But precisely how gas cuts off the blood supply to bones remains to be determined. The plan recommends that researchers try to determine exactly what brings about this condition and to come up with a treatment for it in its earliest stages, or better yet, a preventive for it. □