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**The Fatal Diving Accident causing the Death of  
David Hoover  
at Skånevikfjorden on the West Coast of Norway  
on February 7<sup>th</sup> 1978**

*Assessment of the Event and Relevant Reports*

**A North Sea Divers Alliance Report  
(Nordsjødykker Alliansen - NSDA)**

*February 5<sup>th</sup>, 2003*

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## Referenced Attachments:

1. Documents from the President of USA
2. Report from Norwegian Directorate of Labour Inspection
3. Report from John Kohl, Taylor Diving, Diver (lock-out partner for David Hoover)  
This report is available in Norwegian translation only.
4. Report from Mike Cooke, Taylor Diving, Diver (bell-tender for D. Hoover and J. Kohl)
5. Report from George Deane, Taylor Diving, Operator of supply-system for breathing gas
6. Report from George Deane, Taylor Diving, Operator of supply-system for breathing gas
7. Report from Vern van Noren, Taylor Diving, Operator of racks containing breathing gas
8. Report from Norman McIver, Taylor Diving, Doctor of diving medicine
9. Report from Norman McIver, Taylor Diving, Doctor of diving medicine
10. Report from University in Bergen, Gades Institute (in Norwegian language only)
11. Report from local Sheriff (in Norwegian language only)
12. Log which is written by Norsk Hydro
13. Questions answered by John Kohl and Mike Cooke

# **1 Introduction**

## **1.1 Background**

Members of North Sea Divers Alliance (NSDA) have never been able to accept and settle down by official explanations of many diving accidents. This includes the investigation made after the death of the deep-sea diver David Hoover in 1978. The official investigations conclude that Hoover died by CO<sub>2</sub> poisoning/strangulation. This is not technically possible, not consistent with statements from witnesses, and not logic looking into the events.

NSDA is an organization of North Sea Pioneer Divers who have worked to bring to light the degraded living-conditions many of their ex-colleagues have suffered. Serious accidents, nerve breaking near misses, and long-term effects on their health, have left many pioneer divers with diminished health, and their dependants and loved ones in poverty.

For many years NSDA have been collecting and investigating the background material and papers related to this accident, and specific events have been checked and double-checked by our experts. To our surprise we have clear indications that evidence may have been tampered with to suit the official conclusion/explanation. The implication is that a widow and the family of David Hoover have been denied the compensation and reparations to which they are legally entitled.

The persons and groups responsible for this experimental dive, the safety procedures, the equipment, and the fatal death of David Hoover, have never had to face their crimes in a court of law and the State has saved a fortune. The deceased diver was indirectly blamed for the accident, but never there to tell his story and defend himself. Divers have died in the aftermath because safety regulations and procedures have remained largely unchanged. Others lives could have been saved if the cause of the David Hoovers death had been known. The oil-industry continues to run its business on the very same lines.

## **1.2 Purpose and how the work has been organized**

The purpose of this report is to evaluate the available documents and analyze the events related to the accident that caused the death of diver David Hoover at Skåneviksfjorden in 1978. We will further give our conclusion about the cause of this accident.

This report is prepared by NSDA-advisers and verified by experts in the NSDA-network. NSDA is a network of the most experienced deep-sea divers in the world with many years of deep-sea diving experience. In addition to the most experienced deep-sea divers in the world, the network also includes many experts within related and specific fields.

The description of the accident below is based on assessment of different relevant reports and logs. But there is little technical information available about the system and equipment that was used. Detailed and accurate calculations are therefore difficult to carry out. No tests, checks, calculations or simulation of the events prior to accident, were carried out during the investigation of the accident. Clarifying questions to the witnesses were mild and superficial.

When we have found that reports and logs are conflicting, are lacking exact information or have been tampered with, the most probable events based on a total analysis, are discussed. Because of the numerous mistakes and misleading information in the reports, we cannot discuss it all in detail. To keep the scope of this report limited, we have had to ignore and give no further comments to many of the discrepancies at this stage.

## **2 New conclusion to cause of death**

### **2.1 Official explanation of death cause**

The official conclusion after the accident from the Norwegian Directorate of Labour Inspection to the cause of death was as follows [2]:

“There can be no certain conclusion to the cause of death of Mr. Hoover. Drowning and lack of breathing gas can be excluded according to the post mortem examination. Accumulation of CO<sub>2</sub> is assumed to be the most probable cause of death. Cold is not assumed to have been an important factor.”

This official conclusion is also based on the report from the post mortem examination, which was:

"Thursday February the 9<sup>th</sup> a forensic necropsy was undertaken by prof. Giertsen at Gades Institute of Pathology in Bergen. Present were Dr. Calder, Dr. Grimstad and Dr. Eidsvik. The preliminary necropsy report concludes as follows: There were no mechanical injuries. There were no signs of congenital malfunctions or acquired diseases. No signs indicating drowning or oxygen-deficiency as the cause of death were found. It was found a slight degree of cerebral oedema as well as lung oedema (increased amount of fluid in these organs). Further it was found slightly increased amount of blood in the intestines. It is worth mentioning that by necropsy of divers who have died under such pressure, the gas emitted in the tissues after the decompression of the body, will make it difficult to interpret the findings that are made. Conclusion: An unambiguous explanation concerning the cause of death was not found. However, it was found changes consistent with accumulations of carbon dioxide before the diver died. This view is held by all mentioned doctors present."

### **2.2 New evaluation of death cause makes earlier conclusions invalid**

If the above findings from the post mortem examination is combined with the observations that was made by the bell-tender, Mike Cooke: "I pulled his mask of and there was a pink froth coming from his mouth" and "there was bright red blood at he back of his mouth", we believe that the official cause of death is incorrect and impossible. This blood can only come from the diver's lungs, and in this diving situation there is only one possibility to cause damage to the lungs, and that is by excessive use of oxygen.

Our analyzes from the accident show that David Hoover, at the moment when he died, received a breathing gas that may have contained up to 50% oxygen, corresponding to a partial pressure of 16 bar O<sub>2</sub>.

Our evaluation indicates very clearly that diver David Hoover was killed by an excessive concentration of oxygen in his breathing gas.

## **3 The Skånevik Dive's importance in national Norwegian and in international politics**

The Skånevik project was one of the most important operations ever undertaken in the North Sea. It had both national and international implications and ramifications. We can prove that it was a part of a vital strategy to avoid European countries becoming dependent on energy supplies from the Soviet Union. It is therefore of importance to understand that a fatal

accident at such an event, could have meant years of delays, lost income and far reaching international political implications.

It was therefore of both national and international interest that the “accident” which killed David Hoover was buried with his body. This unwanted event should not become a barrier for the further development of the oil and gas on the Norwegian shelf, especially the Troll field.

Norwegian Government had already entered into agreements regarding sale of the Troll field oil and gas in 1976 [1]. President Ronald Reagan announced at a press conference in New York that he had granted assistance to the allied in Western Europe based solely on supplies of gas from Norway. He would not have done this without a commitment for such supplies.

However there was a major sea depth obstacle between success and failure to deliver on his promises. The pipeline on the sea-bed transporting the oil/gas to land were at depths of more than 350 meters.

To ensure the construction, maintenance and repair of any leakage, divers would have to work at such depths. The Skånvik affair was designed to prove this possible beyond doubt and the loss of one American life was definitely not going to get in the way of the oil and power race.

Little Norway had gotten a key role to ensure that the huge countries in Europe remained independent from gas supplies from the Soviet Union.

## **4 The Experimental Diving at Skånviksfjorden**

### **4.1 Organizations/companies involved and their involvement**

The experimental welding trial was carried out by Taylor Diving & Salvage Company, who was diving from Brown & Root’s derrick/lay barge, “Barge 324”. Their client was Norsk Hydro, who was operator for this work on behalf of the Frigg-group and the Statoil/Mobil-group.

The following companies and regulatory bodies were involved in the control of the safety aspects of the diving operation and integrity testing of the welds that was going to be performed at the seabed by the divers: Directorate of Labour Inspection, Det norske Veritas (DNV), Norsk Undervannsinstitutt (NUI), etc.

None of the above companies and regulatory bodies had any expertise in such offshore diving operations.

At the time of this accident, Norwegian diving experts were managing some of the worlds biggest diving operations in the North Sea. Many of them had superior knowledge about such deep diving as we can see in this operation, and they would not have accepted the equipment that was used and the poor planning and preparations process. Norwegian diving experts were kept away from this diving operation, away from the investigation after the accident, and everybody was denied a post event learning or evaluation process.

### **4.2 Costs and financial aspects of the dive**

The oil-companies and the Norwegian state were investing a total of 190 MNOK (25 MUSD) in a program to qualify welding-operations at water-depth of 1000 feet. The total cost of this particular experimental dive / welding operation was 60 MNOK. Norsk Hydro was the Client

and Operator on behalf of the “Frigg-group” and the “Statoil/Mobil-group”, who had been financing this experiment. This means that most oil-companies engaged in the Norwegian Sector of the North Sea, were involved.

Taylor Diving and Brown & Root were making good profit on this operation. It was extremely well paid, and it was carried out in the low activity season. It is also clear that the company that was first able to carry out such a diving operation in a safe manner would have a competitive edge in this market. This would also be an important step towards catching huge contracts in the future when the Troll-field was going to be developed and the pipelines across the Norwegian trench were going to be laid.

For the Operator, Norsk Hydro, it was very important to establish an image as an offshore operator that was mastering technical challenges at deep-water oil and gas-fields. Other smaller companies involved in this operation had gotten a rare possibility to take a step up the ladder and mingle with the experts within this highly specialized discipline.

The two inspectors from the Directorate of Labor Inspection were caught with a diving operation where the plans had been changed and promises had been forgotten. They seem to have accepted it unwillingly, because they did not have the in-depth knowledge of diving technology to justify stopping or shutting it down. With the tremendous interests from all involved parties to go through with the experiment, to hush up the scandal, and to carry on with the dive after the accident, the inspectors had to accept it with some minor window-dressing changes.

#### **4.3 Equipment in use**

Brown & Root’s “Barge 324” was a combined derrick / lay barge with a standard diving system from Taylor Diving & Salvage Co. Between the lines in the reports we can read that vital equipment were not in good order, and there was a culture onboard that is not consistent with safe deep diving operations.

The hot water system supplying hot water to heat the diving bell and the divers’ suits was breaking down with regular intervals. Repairs seem to have been of temporary character. The capacity of the system was so low, that two units had to be run in parallel. Thus the promised redundant setup was lost. The communication system between the divers, diving bell and surface control room was not of good quality, or had not been maintained well.

The compressor on top of the diving bell, for circulating breathing gas through the divers’ helmets, did not work as expected. The divers had to change from the planned C-D helmets with “closed circuit” to the “open circuit” full-face masks, Kirby Morgan Band mask (KMB-18). All advantages of this change are discussed in the report after the accident, but the disadvantage is not mentioned. From the reports we can read that the added consumption of breathing gas with the “open circuit” system, was straining both gas-supplying equipment and operators on the surface.

Taylor Diving had applied for and received a regulatory dispensation to carry out such diving operation without supplying the divers with spare bail-out bottles. In such case they should ensure that the welding habitat was equipped to establish and analyze a breathing atmosphere inside it as soon as possible, and onboard premix with bibs, in order to have at least one back-up supply of breathing gas available for the welder-divers. Back-up breathing gas may have remedied the gas-cut and saved the life of David Hoover.

To our surprises we also find that they were using a gas-mixer on-line for supply of breathing gas to the divers. This seems to be a result of a diving management with very little technical insight. We would not recommend such a set-up for any diving operation, even in shallow waters. The margins for technical and operational mistakes are extremely narrow, with fatal accident as a probable result. The unit is suitable to prepare pre-mixed breathing gas to be analyzed and stored for later consumption, only.

#### **4.4 Persons involved and their tasks**

The following key persons were involved in the diving operation:

|                  |                                                                                                                                                |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Bjørn Weiby,     | Norsk Hydro, Project Manager                                                                                                                   |
| Kjell Andersen,  | Norsk Hydro, Client Inspector                                                                                                                  |
| Erik Archer,     | Norsk Hydro, Client Inspector                                                                                                                  |
| T. Brandsæter,   | Statoil, Client Inspector                                                                                                                      |
| Olav Hagland,    | Statoil, Client Inspector                                                                                                                      |
| <br>             |                                                                                                                                                |
| Olav Hermansen,  | Hordaland Police District, Local Sheriff in Etne                                                                                               |
| Ragnar Winsnes,  | Directorate of Labor Inspection, Staff Engineer                                                                                                |
| N.J. Holmeset,   | Directorate of Labor Inspection, Senior Engineer                                                                                               |
| <br>             |                                                                                                                                                |
| John Kohl,       | Taylor Diving, Diver (lock-out partner for David Hoover)                                                                                       |
| Mike Cooke,      | Taylor Diving, Diver (bell-tender for David Hoover and John Kohl)                                                                              |
| Dennis Webb,     | Taylor Diving, Diving Supervisor                                                                                                               |
| George Deane,    | Taylor Diving, Operator of supply-system for breathing gas                                                                                     |
| Vern van Noren,  | Taylor Diving, Operator of racks containing breathing gas                                                                                      |
| John V. Harter,  | Taylor Diving, Project Coordinator                                                                                                             |
| David Gilley,    | Taylor Diving, Welding Supervisor                                                                                                              |
| Norman McIver,   | Taylor Diving, Doctor of diving medicine                                                                                                       |
| Arthur Mandible, | Taylor Diving, Diving Superintendent                                                                                                           |
| Gøsta Fahlman,   | Taylor Diving, Safety Officer                                                                                                                  |
| John Berschot,   | Taylor Diving, Diver (acting as diver/nurse inside saturation chamber)                                                                         |
| Ian Calder,      | Department of Pathology, London Hospital, Doctor of diving medicine<br>(We believe that he represented Taylor Diving during the investigation) |

## **5 The Diving Accident of David Hoover**

### **5.1 Planned dive, events and operation**

The main purpose of the dive was to demonstrate that it was possible to join two pipelines together by welding at 320 meters water depth. The description of the accident below is based on assessment of different reports with various levels of details and some conflicting information. If reports are conflicting or misleading, and if they are missing exact information, we have used our experience from similar operations and with similar equipment, to give a professional evaluation of the events.

The dive that resulted in the accident, started at 18.01 hours on the 7<sup>th</sup> February 1978, with two lock-out divers, David Hoover and John Kohl, and one bell-tender, Mike Cooke. The work at the seabed consisted of standard preparations for the welding operation that was going to take place.

The divers were lining up the two 36” pipes by using line-up frames. Between the line-up frames, over the two pipe ends that were going to be joined, a welding habitat was installed. The habitat was sealed at each end around the outside of the pipe-walls to keep the sea water out. The divers had to seal the inside of the two pipes by installing an inflatable pig (plug) in each pipe. The total habitat compartment was going to be drained for water during the actual welding operation.

At the time of the accident, the habitat was half full of water. The upper half, above the pipes, was already filled with a mixture of helium and compressed air (oxygen and nitrogen). The air was remaining in the habitat from the surface. This atmosphere had not been analyzed yet, and therefore not confirmed to be breathable. After the pigs had been installed, the habitat was going to be filled completely with a mixture of helium and oxygen. The plan was further that after emptying the habitat completely for water, the pipe ends were going to be pre-heated and then joined together, by welding a 2 – 3 feet long piece of 36” pipe between them.

The divers’ work progressed as expected for nearly 4 hours. However, the operation was characterized by problems with supply of hot water for the heating of diving bell and diving suits, and by pure communication between the divers and their supervisor on surface. From the logs and reports we can see that this have been well known disturbing factors throughout this diving operation.

## **5.2 Hot water problems**

At 2157 hours, the divers experienced another cut in the supply of hot water to their suits. They were told by the supervisor to return to the diving bell. John Kohl, who was inside the pipe installing the pig, started crawling backwards out of the pipe. When he came back into the habitat, he started to move towards the entrance tunnel and he saw David Hoover just in front of him, leaving the habitat.

John Kohl found that his umbilical, which contained hose for breathing gas, hose for hot water, and cable for communications, was twisted around the hose for air supply to the inflatable pig. He had to return to clear it before he was able to leave the habitat.

## **5.3 Gas-cut**

When John Kohl was working to clear his umbilical, he experienced a sudden drop in the supply of breathing gas at 2200 hours. He stopped work and tried to control his breathing, but after 30 seconds he had to take his mask off and breathe from the atmosphere in the habitat. The gas in the habitat had not yet been analyzed and confirmed to be breathable. The supervisor who saw on the habitat-TV that the diver took his mask off, commanded him to put the mask back on. After nearly four minutes, the diver put the mask back on. The supervisor then put pre-mixed helium/oxygen breathing gas into the habitat, presumably to ensure that it was safe to breathe if this should be needed again.

When John Kohl reported problems to clear his umbilical, the supervisor had asked David Hoover to return to the habitat to assist John. He wanted the divers to clear the umbilical without cutting he air hose to the pig.

But David Hoover never returned to the habitat. On his way from the habitat to the bell, he must have experienced the same failure in the supply of breathing gas as his diving-partner. A natural reaction from an experienced diver would be to calm down, open mask free flow valve and press the free-flow button on the demand valve to get the last gas available in the supply-lines, and hope that the gas-supply would come back. In such situation, he would use as little

energy as possible, but we believe that the message “gas-cut” have been groaned, but never noticed by his supervisor.

#### **5.4 New gas mixture**

This gas-cut could have lasted long enough for David Hoover to lose consciousness, but we doubt that it did. John Kohl had first struggled with insufficient gas supply for approximately 30 seconds, and then had his mask off for three to four minutes.

According to the post mortem examination, David Hoover died suddenly, and he did not seem to have been lacking oxygen. What can explain this?

Onboard the barge, the work to provide breathing gas to the divers had been very exhausting throughout this operation. Both the operator of the gas panel, George Deane, and the Rack operator, Vern Norton, had been very busy and worked hard. At the time of the accident, the situation had been “out of control” for a few minutes. First the oxygen supply to the mixer went low, and it was changed to a new oxygen-bank with high pressure. Then the helium supply to the mixer went low, but before it was changed, the high oxygen supply flooded the mixer, causing the high oxygen alarm to shut off the mixer’s supply of gas to the divers.

The only supply to the divers was then the spare premixed breathing gas that was connected to the divers supply panel as backup. But the valve for this supply was only “cracked” open. This had been done earlier to compensate for the insufficient capacity of the main supply from the mixer. When the main supply, the mixer, shut off, the divers on the seabed experienced insufficient gas supply or a gas-cut. For 30 to 60 seconds, their only breathing gas came from the spare premixed gas, through a valve that was only “cracked” open.

During this gas-cut the mixer was flooded with pure oxygen. Due to the time-delay of the shutoff system, the pipes between the solenoid shutoff valve and the non-return valves had been filled with a gas-mixture that consisted of almost pure oxygen. During the period with low gas-pressure to the divers, this highly oxygen enriched gas-mixture was drained past the non-return valve, and formed a life-threatening “gas-plug” in the supply-line to the divers. When the valve for premixed gas was opened fully, the pressure buildup closed the non-return valves, but the highly dangerous gas-plug was already on its way and was pushed further in the supply lines to the divers on the seabed.

John Kohl never received his share of the dangerous, highly oxygen-enriched, breathing gas. During these critical seconds, he had simply taken his mask off, and was breathing from the habitat atmosphere. John Kohl was neither the first nor the last diver who had been extremely, almost unbelievably lucky when his support crew on the surface have made fatal mistakes and had no knowledge of proper emergency procedures.

We anticipate that David Hoover has received a small volume of gas that may have reached a concentration of up to 50% oxygen, in his breathing gas. The reports we have do not provide technical information to give a more accurate figure.

When the gas-operator drained the mixer for excess oxygen and restarted it, he drained the oxygen upstream of the solenoid valve only. The remaining oxygen that had been trapped in the supply-line was in the same seconds entering the diving mask of David Hoover and killed him almost instantly. The time was 2203 hours, and inside the welding habitat John Kohl was putting his diving mask on again to continue his dive.

## 6 Analysis of Reports and Accident

Reports and logs show clearly that three events happened within a total timeframe of four to five minutes in this diving operation at Skånevikfjorden:

1. The operation of the supply-system for breathing gas to the divers had been characterized by high level of activity. Both the supply-panel operator and the rack operator were very busy, and they were improvising their work to handle the problems. In this chaotic situation, they lost control for a few minutes.
2. Diver John Kohl experienced a gas shortage, took his mask off and was breathing from the atmosphere in the welding habitat for nearly four minutes.
3. Diver David Hoover died in the water on the outside of the habitat.

### 6.1 Reports and logs:

The official report from the accident is written by Staff Engineer R. Winsnes from the Norwegian Directorate of Labour Inspection [2]. In his analyses and conclusion regarding the accident, Winsnes claims that there was no interconnection between these three events. On the contrary, the fact that John Kohl did not black out or die is used as a “proof” that there was nothing wrong with the breathing gas to the divers.

Our assessment and conclusion is based on information in several reports and logs. These documents are of variable quality and not all of them have a value for the investigation of this accident. However, they show the under-laying cause of the accident: key people’s level of knowledge, the technology in use, the philosophy related to maintenance of equipment, and other aspects of the culture of the involved companies. A full analysis of all these aspects is not within the scope of this document.

The reports are lacking detailed technical information, and some are misleading and contain direct mistakes. Most reports are “biased” by the writers. They do not want to dwell on details that may be to their disadvantage. Some places they are also hiding facts. A big challenge is to synchronize the statements and events from the various witnesses, in time. We also find it peculiar that the reports and statements from diving supervisor, diving superintendent and others from operations management have no information that are of interest to the investigation of this accident.

We have read many “strange” documents from Norwegian Officials about deep diving. But the report after this accident from The Norwegian Directorate of Labour Inspection is almost unbelievable. The referenced text from other reports and logs are correct enough, but apart from this we have difficulties finding any correct analyzes of variances, evaluations or statements.

The first proof above was that nothing was wrong with the breathing because John Kohl had been breathing the same gas. The second proof was that there had been no gas-cut [2]:”In this report, Dr. McIver’s statement with respect to the sequence of events when he heard the oxygen alarm go is taken as a proof that the gas-supply was not decreased. In Rotterdam on the 16<sup>th</sup> of March he told me that he had not heard the oxygen alarm for the mixer, because he at that time was outside the doghouse.” So much for proof number two.

We do not know if the representatives from the Directorate of Labour Inspection had lost confidence in their own conclusion or just wanted to blame somebody else when reading the following [2]: “During a meeting on board Barge 324 where representatives from Taylor,

Directorate of Labour Inspection, the Local Police in Etne, and Dr. Ian Calder, Department of Pathology, the London Hospital, did take part. Dr. Calder, who did attend the post mortem examination, very strongly expressed the opinion, that retention of carbon dioxide was the cause of the death of Mr. Hoover. He asked if Hoover was carrying a beard, and it was confirmed that this was the case. It was also stated that the type of beard he had was not compatible with his breathing mask. This may count for a build up of CO<sub>2</sub> in his mask.”

Why did Dr. Calder ask if David Hoover was carrying a beard? He came directly from the post mortem examination, and had just seen it. He should know this very well without asking anybody. We believe that there was a hidden instruction to the representatives from Taylor Diving, in this question. They should confirm at the meeting that this highly scientific beard problem was well known in Taylor Diving. Sadly enough they had forgotten it for a moment, but only on this one occasion.

Even Taylor Diving’s standards logs are inaccurate and superficial. Important details are therefore missing. We must therefore use the log from the Client (Norsk Hydro) [12] as main reference. However, this log must be used with caution. Persons, who had little knowledge about the ongoing diving-operation, have written it, and from experience, they can easily make wrong observations and even be misled by others.

When the local Sheriff arrived on the scene shortly after the accident, he found that recording of the video pictures from the welding habitat was not done, for unknown reasons. Peculiarly enough, the tape for recording the communication between the divers and their supervisor, had run out 10 minutes before the accident.

The short report from the local Sheriff [11] is in our opinion the best document written after the accident. He was early on the scene and through direct and tough questioning of witnesses he received facts. In the last section of his report he says (our translation): “It may be expected that the cause of this accident has to do with the error at the mixer for gas and that the divers for a short moment have received too little or wrong mixture of gas, since diver Kohl also had problems at the same time as diver Hoover deceased, and it was at this time the error at the mixer happened.”

Unfortunately when the “experts” from the Directorate of Labour Inspection arrived on the barge, the local Sheriff had to leave the investigation to them after a few hours. He was then half through the investigation and on the right track, but his findings and report was put to side and disregarded in the further investigation.

### **6.1.1 Example 1:**

To illustrate the above discrepancies in reports, we will look at some statements from three witnesses:

1. The operator of the gas-panel, George Deane, said in his report [5]; “approximately 20 minutes later WADS House reports unconscious diver (time factor is not clear to me – could have been 10 – 20 mins. after habitat HeO<sub>2</sub> blow down)”. Later when Mr. Deane was dictating a report, adding some more details, he was a little braver and stated [6]: “..., it seems about 20 minutes later that WADS House reports an unconscious diver”.
2. The Rack-operator Vern Noren said in his report [7]; “about 5 minutes later dive station reported unconscious diver being returned to SDC.”
3. Dr. McIver said in his report [8]; “Noren appeared quickly and I stood outside the Doghouse on the same level talking to a tender for a few minutes (probably less than two minutes) and returned when Noren left again moving quickly. Deane was

standing at the instruments panel for the DDC when I entered and told me there was an unconscious diver”.

The spread in time is 20, 5 and 2 minutes. Notice that it was Mr. Deane himself that told Dr. McIves about the unconscious diver after “less than two minutes”, but in his own report he states that it took 20 minutes.

One may argue that the reference points for these three statements are not the same. But from the reports we can see that the reference points differ with maximum a couple of minutes. All the “interesting” events, with oxygen alarm, gas-cut, blow down of habitat, and the fatal accident itself, happened within a total timeframe of maximum 5 minutes. We believe that the person that felt, or knew, that he had directly caused the fatal accident, was trying to make the time difference between the situation when he lost control and the accident itself as big as possible.

### **6.1.2 Example 2:**

Another illustration of the above, is statements related to the gas-cut:

1. John Kohl states in his report [3]; “Upon standing there, trying to entangle myself I experienced a lack in the air supply. Tried to control my breathing, but it seemed to me that I was not getting enough air. Standing up at this time I removed my mask”.
2. The supervisor “tells” John Kohl that he had “over-breathed his mask”, and all nearby witnesses repeats this conclusion in their reports.

John Kohl experienced a sudden decrease in the supply of breathing gas when he was inside the habitat, and the responsibility for this event is immediately linked to him. He is told by his supervisor that “he was over-breathing his mask”, and it seems as if he reluctantly accepts this. He knows that he should not argue or make any trouble about this “fact”. On one side he may get a negative reputation for over-breathing his mask, and on the other side he may be marked as a person that argues too much against his supervisor. When he was commanded to put the mask back on immediately in the habitat, he did not do so, but took his time. None of these things will count to his advantage next time a saturation team is put together.

John Kohl had to be careful, but stated in his report [8]: “...I experienced a lack in the air supply”, and when questioned later [13], he states that the breathing difficulty “came suddenly”. However, he is trying to minimize the time he was off the mask. “I took 5 – 6 breaths from the habitat atmosphere”. The reports indicate that it was difficult for him to untangle himself from the air hose of the inflatable pig. We believe that when the mask was already taken off, he unhooked the umbilical, untangled it from the air hose, and then put the mask and hooked the umbilical back on. Logs and reports indicate that it took nearly four minutes.

At the time of the reporting and questioning after the accident, we believe that the supervisors knew that if they were able to minimize John Kohl’s gas-cut and the time he was not breathing from his diving mask, he could be used as a “proof” that there was nothing wrong with the breathing gas to the divers. Everybody would agree that John Kohl was breathing the same gas, and he had no problems.

### **6.1.3 Example 3:**

The gas supply operator, George Deane, explains very carefully in his reports [5] [6], that mixer no.1 was supplying breathing gas to the divers, and mixer no.2 was supplying breathing gas to the Haskel-pump and to the blow-down of the welding habitat. He assures that there was no connection between the supply of breathing gas to the divers and the supply of breathing gas to the welding habitat. The sketch of the gas system arrangement in his report also confirms his written statement.

When the unannounced blow-down of the welding habitat occurred, he states that he immediately fully opened the valve from premix no.1, to the divers. This valve had earlier only been “cracked” open and thus partly supplying the divers with breathing gas in parallel with mixer no.1.

Here we have to stop with a question to Mr. Deane’s story. Why did he immediately fully open the valve from the premix? According to his report, such blow-down of the habitat should not have any influence on the divers’ supply of breathing gas. His immediate reaction to this blow-down that he describes is not likely to be true.

We believe that Mr. Deane really opened the valve from premix no.1 fully, but for a different reason. Mixer no.1 had in our opinion been automatically shut off by high oxygen alarm, and the divers at the seabed were experiencing a gas-cut. The divers gas supply was at this moment through a valve that was only “cracked” open, and nobody opens a valve “immediately”, Mr. Deane. Even an automatic system has a certain time delay, and we believe that this gas-cut lasted between 30 and 60 seconds.

We believe that George Deane used the unannounced blow-down of the habitat that actually happened for all that it was worth. He linked all problems and lack of control related to the supply of divers’ breathing gas, to this event. By slightly changing the sequence of events and the time between the events, to fit the purpose, he was able to create a “new story”. Due to this unannounced blow-down, his story was believable enough to confuse the investigators who did not have in-depth diving knowledge. They were led to believe that the lack of control on the gas supply was only related to the blow-down of the habitat, and had nothing to do with the divers’ problems on the seabed.

### **6.1.4 Example 4:**

From the reports of George Deane [5] [6], we can read the following sequence of events: The supervisor carried out an unannounced blow-down of the welding habitat, and immediately, George Deane says, he fully opened the valve for premix to the divers. The pressure from this premix shut the none-return valves on the outlet from the mixer and with no flow, the high-oxygen alarm went off, and it shut the solenoid valve on the mixer outlet. Because of the two barriers, solenoid valve and none-return valves, he claims that there is no harmful breathing gas coming from the mixer to the divers. Due to his “immediate” reaction, the gas to the divers was of the correct mixture and pressure all the time, and the gas-cut on the bottom did not occur. John Kohl’s problem was that he had been over-breathing his mask.

Our analysis shows that the following are most likely to have happened: The oxygen supply to the mixer went low and George Deane changed it to a bank with full pressure. Shortly afterwards he found that the helium supply went low as well, and started to change this supply too, but he got disturbed and something went wrong. He somehow shut off the helium supply to the mixer, and it was flooded with oxygen. The high oxygen alarm shut off the mixer, but

there is a time delay in the solenoid valve. Such valves may handle a gradual increase up to the setting of 3.5% oxygen, but this was a sudden flooding of the unit with 100% oxygen. Before the mixer had shut itself off, an amount of pure oxygen had passed through the solenoid valve.

Unlike Mr. Deane's story, the non-return valve did not block the oxygen from entering into the supply line to the divers. The consumers at the seabed "experiencing a lack in the air supply", because they were only being supplied through a valve that was "cracked" open. Because of this, the pressure downstream the non-return valve was very low, and hence the oxygen passed the non-return valve and formed a small "oxygen plug" in the supply line to the divers.

## 6.2 Evaluation of Accident:

The report from the post mortem examination [10] says that David Hoover did not drown, he died suddenly and he did not show any signs from lack of oxygen.

Based on this, it is obvious that something was wrong with his breathing gas. The divers were normally breathing a mixture of approximately 2% oxygen and 98% helium when they were working on the seabed. The total pressure at the seabed was approximately 33 bar and this corresponds to a partial pressure of 0.66 bar oxygen and partial pressure of 32.34 bar helium.

In general there are several ways the breathing gas can become dangerous for the diver if it gets out of control:

1. Gas-cut: A gas-cut can be troublesome if it is short, and with some length it can make the diver unconscious, but with possibility to recover if resuscitation is started soon enough. A longer gas-cut may kill the diver.
2. Pure Helium: If the mixture of breathing gas is out of control, and pure helium is distributed, the diver will pass out, but chances to revive the diver is good if the situation is controlled soon enough. At the actual water-depth for this dive, we believe that the diver will be unconscious if the oxygen falls below 0.4%.
3. Pure Oxygen: If the mixture of breathing gas is out of control, and too much oxygen is distributed, the diver will experience twitching, throwing up, convulsion, and passing out. At the actual water-depth for this dive, we believe that the diver will be in the danger zone if the content of oxygen is above 5%. If the oxygen content is 15% - 20% at 320 meters of water depth, corresponding to 5.0 - 6.6 bar partial pressure of oxygen, the diver will be killed.
4. Carbon Dioxide: Build-up of carbon dioxide, which is produced by the diver's own breathing in his mask, in his helmet, in the welding habitat or in the diving bell, may cause breathing problems, headache, and finally unconsciousness and death.
5. Contaminations: Various contaminations may enter the supply of breathing gas. For example traces of freon from cleaning the gas-distribution pipes and hoses, oil from pumps or compressors, and talcum powder from preservation of hoses could be candidates. Sabotage against divers gas-supply, where a poisonous gas has been put into the bottles for divers breathing gas, is also known to have happened.

There is no reason to suspect any contaminations or sabotage of the breathing gas as described under 5 above. The system was used before and after the accident without any indication of contamination. Build-up of carbon dioxide as described under 4 above, is technically impossible to have happened. The mask can be adjusted to free-flow if the diver

feels uncomfortable, and the exhaust gas will take the route with least resistance, which is out of the mask and into the water.

Problems described under 1, 2 and 3 above are mostly caused by mistakes that happen with the supply of breathing gas at the surface. We know that a gas-cut happened at the same time, or just before, David Hoover died. From the reports it is clear to us that it was caused at the supply end, by the gas-operator on the surface, even if he does not admit it in his report. The gas operator's report is thus not correct, leaving the questions: What is correct, and what is wrong in his report?

The first observation of David Hoover after he was dead was made by the bell-tender Mike Cooke after he had pulled the diver into the diving bell. This is a difficult operation inside such small diving bells, so the observation could be 10 to 15 minutes after death occurred [4]: "I pulled his mask off and there was a pink froth coming from his mouth. I did several things at this point. I cleared the area around his mouth and opened it to check the passageway. There was bright red blood at the back of his mouth."

This observation was never discussed among doctors during the post mortem examination, or in the official report after the accident. This is a direct observation made by the person who was "first at the scene". Being inside the chamber whilst the report was written, it was difficult for his supervisors to notice the "error" and "tell" him what he had really seen. The "experts" did not dare to touch this observation later in the "investigation", because it simply did neither fit the official story nor their interests. Nobody even tried to explain what could have caused pink froth and bright red blood in a divers mouth.

From the official report we can read the conclusion of the observations from the post mortem examination [2]: "There were no mechanical injuries. There were no signs of congenital malfunctions or acquired diseases. No signs indicating drowning or oxygen-deficiency as the cause of death were found. It was found a slight degree of cerebral edema as well as lung edema (increased amount of fluid in these organs). Further it was found slightly increased amount of blood in the intestines."

These findings should have been matched with the observations made by the bell-tender, but instead the official report is tracking off as it continues [2]: "It is worth mentioning that by necropsy of divers who have died under such pressure, the gas emitted in the tissues after the decompression of the body, will make it difficult to interpret the findings that are made."

It is known that if a diver is poisoned by oxygen, he will experience twitching increasing to convulsion and possibly froth in the mouth. In such situation a diver may well drown in his own spew if he has a mask on. There is no sign that this has happened with David Hoover. But what are the symptoms of a more serious, absolute acute, oxygen poisoning, where a diver is exposed to a partial pressure of more than say 5 to 10 bar.

Nobody seems to have exact information about such poisoning, because this is simply something that is not allowed to happen. It is far beyond people's imagination. But people with insight into both poisoning and diving, can lead us through the theoretical symptoms: As soon as the oxygen enters the lungs, the lungs will start "boiling", the veins in the brain will contract immediately, and the body will go into a state of instant and intense convulsion. Shortly afterwards, the diver will be dead.

Pink froth and bright red blood at a divers mouth can only come from the divers lungs. But what can cause damage to a diver's lungs under these diving conditions. Vacuum, squeeze or rapid pressure changes due to excursions are not likely to have happened at this water-depth

and under these diving conditions. But oxygen at an unbelievable high partial pressure will “burn”, or “boil” the lungs and cause serious damage.

The report from the post mortem examination has it all [10]: Lung edema from the damaging of the lungs, cerebral edema from the rapid contraction of the veins in the brain, and increased amount of blood in the intestines due to the intense convulsion of the body just before the diver died. If this is combined with the observations from the bell-tender: “pink froth coming from his mouth” and “bright red blood at the back of his mouth,” there is only one possible explanation for the cause of this fatal diving accident. He was killed by oxygen supplied from the surface.

## **7 Conclusion**

After analyzing the reports and logs of the fatal accident onboard "Barge 324" at Skåneviksfjorden in 1978, where diver David Hoover was killed, we will conclude as follows:

Some very important information is not included in the report from the Norwegian Labor Inspection after the investigation of the fatal accident. The bell-tender Mike Cooke observed approximately 10 - 15 minutes after death had occurred according to his own statement [4]:

"I pulled his mask off and there was a pink froth coming from his mouth. I did several things at this point. I cleared the area around his mouth and opened it to check the passageway. There was bright red blood at the back of his mouth."

This report was written only a few hours after the accident, presumably before any of the witnesses had compared notes. But this observation from Mike Cooke is not consistent with the cause of death, which was concluded in the report from the Directorate of Labor Inspection [2], which was “accumulation of carbon-dioxide in the diver’s mask”. This information is also one of the crucial factors allowing us to conclude on the cause of death today.

During the investigation after the accident, ”Barge 324” was laying idle and waiting on the fjord. The cost of this Barge was NOK 1 – 2 millions per day, and both the owner (Brown & Root) and the client (Norsk Hydro) were anxiously waiting for a conclusion. They wanted to lift the frame and welding habitat from the seabed and continue to the next location with as little delay and disturbance as possible.

The official report concludes that there were no signs indicating that the diver drowned, he died instantly, and there were no signs that he had been lacking oxygen. Further it concludes that because the diver had a beard, he has not obtained a proper seal on the oral-nasal mask in the Kirby-Morgan full-face mask. He had therefore gotten the whole volume of the full-face mask as additional dead-space in his breathing cycle. Because of this he died due to the accumulation of carbon dioxide in the gas of this increased dead-space.

The report from the Directorate of Labor Inspection says that the findings from the post mortem examination at Gades Institute may be consistent with the above conclusion, and that all doctors present held this view. We can add that the findings were very difficult to interpret clearly, and they become guessing when vital information from the first observation of the deceased diver was omitted and the reports from the operator of the gas-supply and other witnesses were misleading.

The reports and logs from the events on the surface, shows that the diver received an “oxygen plug” in the hose that supplied his breathing gas. We believe that this “plug” contained a

concentration of oxygen that may have been as high as 50%. If the diver has been breathing this 50% concentration, or if he has died when he received the oxygen-concentration rapidly increasing from the normal mixture of 2% oxygen, is uncertain.

50% oxygen corresponds to a partial pressure of approximately 16 bar at this water-depth. Our opinion is that the diver has been exposed to oxygen poisoning, much more intense and severe than we have ever known from ordinary diving medicine or any known event.

Our experts of diving medicine support our conclusion that both the observations made by the tender in the diving bell; "pink froth coming from his mouth" and "bright red blood at the back of his mouth", and the findings from the post mortem examination; "slight degree of cerebral edema as well as lung edema (increased amount of fluid in these organs). Further it was found slightly increased amount of blood in the intestines", fully supports our conclusion regarding the cause of death, and makes the official explanation impossible.

From our evaluation of the reports and logs, we believe that the supervisors were putting pressure on John Kohl, to convince him that he had been over-breathing his mask and only had his mask off for a very short time. We also believe that George Deane has deliberately given false statements in his report after the accident.

Evidence, such as videos and communication tapes, were not available when the Local Sheriff arrived after a few hours. It is possible that they disappeared because they could have given information that did not fit into the official story. We are also surprised that the findings and report from the Local Sheriff, based on his questioning of witnesses short time after the accident, was disregarded in the further investigation.

Our evaluation indicates that David Hoover may have survived if he had carried a bail-out bottles with spare breathing gas. We also find it strange that nobody other than Mike Cooke observed blood near or in the divers mouth. Were no traces of this blood left at the post mortem examination or had it been carefully removed?

After the accident and the following investigation, "Barge 324" was towed to Scotland, where the experimental dive and welding of pipes were carried out at 316 meters water-depth. The same equipment and procedures were used, but without identifying the correct cause of this fatal accident, all necessary corrective actions had not been taken. This is another example showing how the Norwegian Authorities let the oil-companies and their so-called "experts" get away, and continue their irresponsible activities, even though an innocent man had been killed.

### **Referenced Attachments:**

1. Documents from the President of USA
2. Report from Norwegian Directorate of Labour Inspection
3. Report from John Kohl, Taylor Diving, Diver (lock-out partner for David Hoover)  
This report is available in Norwegian translation only.
4. Report from Mike Cooke, Taylor Diving, Diver (bell-tender for D. Hoover and J. Kohl)
5. Report from George Deane, Taylor Diving, Operator of supply-system for breathing gas
6. Report from George Deane, Taylor Diving, Operator of supply-system for breathing gas
7. Report from Vern van Noren, Taylor Diving, Operator of racks containing breathing gas
8. Report from Norman McIver, Taylor Diving, Doctor of diving medicine
9. Report from Norman McIver, Taylor Diving, Doctor of diving medicine
10. Report from University in Bergen, Gades Institute (in Norwegian language only)
11. Report from local Sheriff (in Norwegian language only)
12. Log which is written by Norsk Hydro
13. Questions answered by John Kohl and Mike Cooke

