26 March, 2012

Gentlemen:

I have reviewed the following Occupational Safety & Health Administration (OSHA) regulations and submit the below information for permanent variance. The below request is based on current hyperbaric protocols, current standard of care for egress from a pressure environment and foremost individual safety.

1. **1926.803(e) Compression (5) No employee shall be subjected to pressure exceeding 50 pounds per square inch except in emergency.**

In reviewing both the US Navy Manual (rev6) Standard air decompression tables, French regulation air standard tables (2010), 29 CFR Part 1910, Subpart T Commercial Diving Operations and the, ADCI Consensus Standards for Commercial Diving and Underwater Operations. The request for pressures exceeding 50 psi have been employed throughout the diving industry with an incident rate of less than 1% both of the above references have pressure exposure greater than 75 psi (g) with a maximum pressure 133.5 psi (g) for an exposure of 25 minutes with a decompression time of 409 minute (on Air) or 180 minutes (on Oxygen) these table also give an option of hyperbaric chamber decompression therefore eliminating the possible risk of exposure in an water or air environment. In addition to innovations in tunnel excavation methods, research has greatly improved the scientific understanding of pressure related problem. The use of currently excepted decompression protocols a long with incorporating oxygen breathing has been proven to be more efficient, effective and safer to divers and tunnel workers working beyond the pressure of 50 psi (g). Pressures greater than 50 psi (g) have been employed in both Germany, France and Japan that exceed during decompression from pressures of 75 psi (g) or greater with an incidence rate of DCS was 0.6% in 3400 exposures. The combination of advances in technology along with a better understanding of hyperbaric medicine in conjunction with a project Hyperbaric Safety Plan, medical and hyperbaric supervision as well as trained lock tenders and hyperbaric workers has allowed tunnels to be safely constructed in geologies where hyperbaric pressures reach 75 psi, 50% higher than allowed by the existing OSHA Standard Number 1926.803.
2. **1926.803(g)(1)(xvii)** A special decompression chamber of sufficient size to accommodate the entire force of employees being decompressed at the end of a shift shall be provided whenever the regularly established working period requires a total time of decompression exceeding 75 minutes.

**1926.803(f) Decompression** (1) Decompression to normal condition shall be in accordance with the Decompression Tables in appendix A of this subpart.

In reviewing both the US Navy Manual (rev6) Standard air decompression tables and the French regulation air standard tables (2010), I find that these tables are very similar as it pertains to the decompression of the workers. Both allow for the uses of air or oxygen during decompression, both tables have approximately the same decompression times for the pressures exposures and both allow post decompression evaluation. I support the use of either table for the safe decompression of the compressed air workers. When reviewing the above tables and the pressure exposures times vs. the required decompression obligations to mitigate the possibility of having a pressure related injury I support decompression times greater than seventy-five (75) minutes. The decompression obligation should be based on the tables used and the pressure exposure. This will allow the medical personnel to decompress these workers based on physiological needs using both medically and scientific proven decompression tables. The increased decompression time can facilitate fewer exposures and a safer decompression profile. If we look at current decompression tables being referenced by OSHA we see pressures ranging from 14 psi(g) to 50 psi(g) with decompression times from six (6) minutes to three hundred and twenty nine (329) minutes. Operationally useful procedures take into account not only the decompression procedure required to avoid DCS but also factors such as the time required for decompression, the number of different breathing gases required, the complexity of the ascent profile, and other factors. This request for a time extension seems to follow within these guidelines. Increasing the decompression time will directly correlate to reduced pressure exposures and decrease the possibility of having a decompression injury.

I have also reviewed the attached supporting references and scientific articles and they support this request. If we look at the supporting documents and what is considered standard of care for an individual undergoing a decompression obligation or medical treatment, the standard of care for a hyperbaric medical treatment for the majority of hyperbaric indication require the patient be placed in a hyperbaric chamber for a time period of a minimum of approximately one hundred and twenty (120) minutes to four hundred and fifty five (455) minutes or more. This has been accomplished with an incident rate of < 0.0003% given the following facts:
In 2011 an estimated number of clinical hyperbaric exposures of 1,029,600 with the above incident rate, if we also add the fact that 100% of these people have major underlying medical problems that could potentiate decompression problems. The compressed air workers are required to follow strict guidelines before being allowed to enter a pressurized environment and have no underlying medical problems. By allowing the increased decompression time this could decrease the number of pressure exposures therefore decreasing the possibility of pressure related injuries and problems.

I have attached and cited the following references that help support this decision.
References

5. Health and Safety Executive. Oxygen Decompression Seminar; HSE Contract Research Report 126, 2003; London. Pages 6, 8, 12, 21, and 54
Predefined quality tolerance limits should be established, taking into consideration the medical and statistical characteristics of the variables as well as the statistical design of the trial, to identify systematic issues that can impact subject safety or reliability of trial results. Detection of deviations from the predefined quality tolerance limits should trigger an evaluation to determine if action is needed.

5.0.5 Risk Communication. The sponsor should document quality management activities. The sponsor should communicate quality management activities to those who are involved in or affected by such activities, to facilitate risk review and continual improvement during clinical trial execution. 5.0.6 Risk Review. Residual analysis refers to the process of: a. transforming models with variables in level to logarithmic functions so as to understand the effect of percentage changes in the independent variable on the dependent variable. b. calculating the squared sum of residuals to draw inferences for the consistency of estimates. c. examining individual observations to see whether the actual value of a dependent variable differs from the predicted value. d. sampling and collection of data in such a way to minimize the squared sum of residuals. e. During the compression of employees, the pressure shall not be increased to more than 3 p.s.i.g. within the first minute. The pressure shall be held at 3 p.s.i.g. and again at 7 p.s.i.g. sufficiently long to determine if any employees are experiencing discomfort. 1926.803(e)(3). After the first minute the pressure shall be raised uniformly and at a rate not to exceed 10 p.s.i. per minute. 1926.803(e)(4). 1926.803(e)(5). No employee shall be subjected to pressure exceeding 50 pounds per square inch except in emergency. Related Code Sections. 1926.803(e) Underground Construction, Caissons, Cofferdams, and Compressed Air, Compression. During the compression of employees, the pressure shall not be increased to more ... No employee shall be subjected to pressure exceeding 50 pounds per square inch except in emergency. 1926.803(f). Decompression. 1926.803(f)(1). Except in emergency, no employees employed in compressed air shall be permitted to pass from the working chamber to atmospheric pressure until after decompression, in accordance with the procedures in this subpart. 1926.803(g)(1)(iii). The lock attendant in charge of a man lock shall be under the direct supervision of the appointed physician. He shall be stationed at the lock controls on the free air side during the period of compression and decompression and shall remain at the lock control station whenever there are men in the working chamber or in the man lock. 1926.803(g)(1)(iii). Test weights should be certified using a certificated scale. The weighing should be performed close enough in time to the inclining test to ensure the measured weight is accurate. 2.21 Draught is the vertical distance from the moulded baseline to the waterline. 2.22 The inclining test involves moving a series of known weights, normally in the transverse direction, and then measuring the resulting change in the equilibrium heel angle of the ship. 2.1.6 Each ship shall be provided with a stability booklet, approved by the Administration, which contains sufficient information (see part B, 3.6) to enable the master to operate the ship in compliance with the applicable requirements contained in the Code.