BILLING CODE: 4510-26-P

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

[Docket No. OSHA-2022-0007]

McNally/Kiewit Shoreline Storage Tunnel Joint Venture; Application for Permanent Variance and Interim Order; Grant of Interim Order; Request for Comments

AGENCY: Occupational Safety and Health Administration (OSHA), Labor.

ACTION: Notice.

SUMMARY: In this notice, OSHA announces the application of McNally/Kiewit Shoreline Storage Tunnel (SST) Joint Venture for a permanent variance and interim order from provisions of OSHA standards that regulate work in compressed air environments and presents the agency's preliminary finding on McNally/Kiewit's application and announces the granting of an interim order. OSHA invites the public to submit comments on the variance application to assist the agency in determining whether to grant the applicant a permanent variance based on the conditions specified in this application.

DATES: Submit comments, information, documents in response to this notice, and request for a hearing on or before [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. The interim order described in this notice will become effective on [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER], and shall remain in effect until the completion of the SST project for Cleveland, Ohio or the interim order is modified or revoked.

ADDRESSES:

Electronically: You may submit comments and attachments electronically at: *http://www.regulations.gov,* which is the Federal eRulemaking Portal. Follow the instructions online for submitting comments.

Facsimile: If your comments, including attachments, are not longer than 10 pages, you may fax them to the OSHA Docket Office at (202) 693-1648.

Mail, hand delivery, express mail, messenger, or courier service: When using this method, you must submit a copy of your comments and attachments to the OSHA Docket Office, Docket No. OSHA-2022-0007, Occupational Safety and Health Administration, U.S. Department of Labor, Room N-3653, 200 Constitution Avenue NW, Washington, DC 20210. Deliveries (hand, express mail, messenger, and courier service) are accepted during the Docket Office's normal business hours, 10:00 a.m. to 3:00 p.m., ET.

Instructions: All submissions must include the agency name and OSHA docket number (OSHA-2022-0007). All comments, including any personal information you provide, are placed in the public docket without change, and may be made available online at *http://www.regulations.gov.*

Docket: To read or download comments or other material in the docket, go to *http://www.regulations.gov* or the OSHA Docket Office at the above address. All documents in the docket (including this Federal Register notice) are listed in the *http://www.regulations.gov* index; however, some information (e.g., copyrighted material) is not publicly available to read or download through the website. All submissions, including copyrighted material, are available for inspection at the OSHA Docket Office. You may also contact Kevin Robinson, Director Office of Technical Programs and Coordination Activities (OTPCA) at the below address.

FOR FURTHER INFORMATION CONTACT: Information regarding this notice is available from the following sources:

Press inquiries: Contact Mr. Frank Meilinger, Director, OSHA Office of Communications, U.S. Department of Labor; telephone: (202) 693-1999; email: *meilinger.francis2@dol.gov*.

General and technical information: Contact Mr. Kevin Robinson, Director, Office of Technical Programs and Coordination Activities, Directorate of Technical Support and Emergency Management, Occupational Safety and Health Administration, U.S. Department of Labor; telephone: (202) 693-2110; email: *robinson.kevin @dol.gov*.

Copies of this Federal Register notice. Electronic copies of this *Federal Register* notice are available at *http://www.regulations.gov.* This *Federal Register* notice, as well as news releases and other relevant information, also are available at OSHA's webpage at *http://www.osha.gov.*

Hearing Requests. According to 29 CFR 1905.15, hearing requests must include: (1) a short and plain statement detailing how the proposed Variance would affect the requesting party; (2) a specification of any statement or representation in the Variance application that the commenter denies, and a concise summary of the evidence offered in support of each denial; and (3) any views or arguments on any issue of fact or law presented in the variance application.

SUPPLEMENTARY INFORMATION:

I. Notice of Application

OSHA's standards in subpart S of 29 CFR part 1926 govern underground construction, caissons, cofferdams, and compressed air. On November 12, 2021, McNally/Kiewit SST Joint Venture ("McNally" or "the applicant"), 800 Westpoint Parkway, Suite 1130, Westlake, Ohio 44145, submitted under Section 6(d) of the Occupational Safety and Health Act of 1970 (OSH Act; 29 U.S.C. 655) and 29 CFR 1905.11 (variances and other relief under section 6(d)) an application for a permanent variance from several provisions of the OSHA standard that regulates work in compressed air, 1926.803 of 1926 Subpart S - Underground Construction, Caissons, Cofferdams, and Compressed Air, and an interim order allowing it to proceed while OSHA considers the request for a permanent variance (OSHA-2022-0007-0001). This notice addresses McNally's application for a permanent variance and interim order for construction of the SST Project in Cleveland, Ohio, only and is not applicable to future McNally or McNally-related joint venture tunneling projects.

Specifically, this notice addresses McNally's application for a permanent variance and interim order from the provisions of the standard that: (1) prohibit compressed-air worker exposure to pressures exceeding 50 pounds per square inch (p.s.i.) except in an emergency (29 CFR 1926.803(e)(5)); [1] (2) require the use of the decompression values specified in decompression tables in Appendix A of the compressed-air standard for construction (29 CFR 1926.803(f)(1)); and (3) require the use of automated operational controls and a special decompression chamber (29 CFR 1926.803(g)(1)(iii) and .803(g)(1)(xvii), respectively).

---

[1]The decompression tables in Appendix A of subpart S express the maximum working pressures as pounds per square inch gauge (p.s.i.g.), with a maximum working pressure of 50 p.s.i.g. Therefore, throughout this notice, OSHA expresses the 50 p.s.i. value specified by 29 CFR 1926.803(e)(5) as 50 p.s.i.g., consistent with the terminology in Appendix A, Table 1 of subpart S.

OSHA has previously approved nearly identical provisions when granting several other very similar variances, as discussed in more detail in Section II. OSHA preliminarily concludes that the proposed variance is appropriate, grants an interim order temporarily allowing the proposed activity, and seeks comment on the proposed variance.

Background

The applicant is a contractor that works on complex underground tunnel projects using innovations in tunnel-excavation methods. The applicant's workers engage in the construction of tunnels using advanced shielded mechanical excavation techniques in conjunction with an earth pressure balanced micro-tunnel boring machine (TBM). Using shielded mechanical excavation techniques, in conjunction with precast concrete tunnel liners and backfill grout, TBMs provide methods to achieve the face pressures required to maintain a stabilized tunnel face through various geologies, and isolate that pressure to the forward section (the working chamber) of the TBM.

McNally asserts that generally it bores tunnels using an TBM at levels below the water table through soft soils consisting of clay, silt, and sand. TBMs are capable of maintaining pressure at the tunnel face, and stabilizing existing geological conditions, through the controlled use of a mechanically driven cutter head, bulkheads within the shield, ground-treatment foam, and a screw conveyor that moves excavated material from the working chamber. The forward-most portion of the TBM is the working chamber, and this chamber is the only pressurized segment of the TBM. Within the shield, the working chamber consists of two sections: the forward working chamber and the staging chamber. The forward working chamber is immediately behind the cutter head and tunnel face. The staging chamber is behind the forward working chamber and between the man-lock door, and the entry door to the forward working chamber.

The TBM has twin man-locks located between the pressurized working chamber and the non-pressurized portion of the machine. Each man-lock has two compartments. This

configuration allows workers to access the man-locks for compression and decompression, and medical personnel to access the man-locks if required in an emergency.

McNally's variance application indicated that the maximum pressure to which it is likely to expose workers during project interventions for the SST Project is 55 p.s.i. Therefore, to work effectively, McNally must perform hyperbaric interventions in compressed air at pressures 10 percent higher than the maximum pressure specified by the existing OSHA standard, 29 CFR 1926.803(e)(5), which states: "No employee shall be subjected to pressure exceeding 50 p.s.i.g. except in emergency" (see footnote 1).

McNally employs specially trained personnel for the construction of the tunnel. To keep the machinery working effectively, McNally asserts that these workers must periodically enter the excavation working chamber of the TBM to perform hyperbaric interventions during which workers would be exposed to air pressures up to 55 p.s.i., which exceeds the maximum pressure specified by the existing OSHA standard at 29 CFR 1926.803(e)(5). These interventions consist of conducting inspections or maintenance work on the cutter-head structure and cutting tools of the TBM, such as changing replaceable cutting tools and disposable wear bars, and, in rare cases, repairing structural damage to the cutter head. These interventions are the only time that workers are exposed to compressed air. Interventions in the working chamber (the pressurized portion of the TBM) take place only after halting tunnel excavation and preparing the machine and crew for an intervention.

During interventions, workers enter the working chamber through one of the twin man-locks that open into the staging chamber. To reach the forward part of the working chamber, workers pass through a door in a bulkhead that separates the staging chamber from the forward working chamber. The man-locks and the working chamber are designed to accommodate three people, which is the maximum crew size allowed under

the proposed variance. When the required decompression times are greater than work times, the twin man-locks allow for crew rotation. During crew rotation, one crew can be compressing or decompressing while the second crew is working. Therefore, the working crew always has an unoccupied man-lock at its disposal.

McNally asserts that these innovations in tunnel excavation have greatly reduced worker exposure to hazards of pressurized air work because they have eliminated the need to pressurize the entire tunnel for the project and would thereby reduce the number of workers exposed, as well as the total duration of exposure, to hyperbaric pressure during tunnel construction. These advances in technology substantially modified the methods used by the construction industry to excavate subaqueous tunnels compared to caisson work.

In addition to the reduced exposures resulting from the innovations in tunnel-excavation methods, McNally asserts that innovations in hyperbaric medicine and technology improve the safety of decompression from hyperbaric exposures. These procedures, however, would deviate from the decompression process that OSHA requires for construction in 29 CFR 1926.803(e)(5) and (f)(1) and the decompression tables in Appendix A of 29 CFR 1926, subpart S. Nevertheless, according to McNally, their use of decompression protocols incorporating oxygen is more efficient, effective, and safer for tunnel workers than compliance with the decompression tables specified by the existing OSHA standard.

McNally therefore believes its workers will be at least as safe under its proposed alternatives as they would be under OSHA's standard because of the reduction in number of workers and duration of hyperbaric exposures, a better application of hyperbaric medicine, and the development of a project-specific Hyperbaric Operations Manual (HOM), (OSHA-2022-0007-0002) that requires specialized medical support and

hyperbaric supervision to provide assistance to a team of specially trained man-lock attendants; and hyperbaric or compressed-air workers (CAWs).

Based on an initial review of McNally's application for a permanent variance and interim order for the construction of the SST Project in Cleveland, Ohio, OSHA has preliminarily determined that McNally has proposed an alternative that would provide a workplace at least as safe and healthful as that provided by the standard.

II. The Variance Application

Pursuant to the requirements of OSHA's variance regulations (29 CFR 1905.11), the applicant has certified that it notified its workers[2] of the variance application and request for interim order by posting, at prominent locations where it normally posts workplace notices, a summary of the application and information specifying where the workers can examine a copy of the application. In addition, the applicant informed its workers and their representatives of their rights to petition the Assistant Secretary of Labor for Occupational Safety and Health for a hearing on the variance application.

A. OSHA History of Approval of Nearly Identical Variance Requests

OSHA has previously approved several nearly identical variances involving the same types of tunneling equipment used for similar projects. OSHA notes that it granted five subaqueous tunnel construction permanent variances from the same provisions of OSHA's compressed-air standard (29 CFR 1926.803(e)(5),(f)(1), (g)(1)(iii), and (g)(1)(xvii)) that are the subject of the present application: (1) Impregilo, Healy, Parsons, Joint Venture (IHP JV) for the completion of the Anacostia River Tunnel in Washington, DC (80 FR 50652 (August 20, 2015)); (2) Traylor JV for the completion of the Blue Plains Tunnel in Washington, DC (80 FR 16440, March 27, 2015)); (3) Tully/OHL USA Joint Venture for the completion of the New York Economic Development Corporation's

[2]See the definition of "Affected employee or worker" in section V. D of this Notice.

New York Siphon Tunnel project (79 FR 29809, May 23, 2014)); and (4) Salini-Impregilo/Healy Joint Venture for the completion of the Northeast Boundary Tunnel in Washington, DC (85 FR 27767, May 11, 2020). OSHA has also granted interim orders to two applicants, Ballard Marine for the Suffolk County Outfall Tunnel project in West Babylon, New York (86 FR 5253, January 19, 2021) and Traylor Shea Joint Venture for the Alexandria RiverRenew Tunnel Project in Alexandria, Virginia and Washington, D.C. (87 FR 54536, September 6, 2022). The proposed alternate conditions in this notice are nearly identical to the alternate conditions of the previous permanent variances. OSHA is not aware of any injuries or other safety issues that arose from work performed under these conditions in accordance with the previous variances.

B. Variance from Paragraph (e)(5) of 29 CFR 1926.803, Prohibition of Exposure to Pressure Greater than 50 p.s.i.g. (see footnote 1)

The applicant states that it may perform hyperbaric interventions at pressures up to 55 p.s.i.g. in the working chamber of the TBM; this pressure exceeds the pressure limit of 50 p.s.i. specified for nonemergency purposes by 29 CFR 1926.803(e)(5). The TBM has twin man-locks, with each man-lock having two compartments. This configuration allows workers to access the man-locks for compression and decompression, and medical personnel to access the man-locks if required in an emergency.

TBMs are capable of maintaining pressure at the tunnel face, and stabilizing existing geological conditions, through the controlled use of a mechanically driven cutter head, bulkheads within the shield, ground-treatment foam, and a screw conveyor that moves excavated material from the working chamber. As noted earlier, the forward-most portion of the TBM is the working chamber, and this chamber is the only pressurized segment of the TBM. Within the shield, the working chamber consists of two sections: the staging chamber and the forward working chamber. The staging chamber is the section of the working chamber between the man-lock door and the entry door to the

forward working chamber. The forward working chamber is immediately behind the cutter head and tunnel face.

McNally will pressurize the working chamber to the level required to maintain a stable tunnel face. Pressure in the staging chamber ranges from atmospheric (no increased pressure) to a maximum pressure equal to the pressure in the working chamber. The applicant asserts that they may have to perform interventions at pressures up to 55 p.s.i.

During interventions, workers enter the working chamber through one of the twin man-locks that open into the staging chamber. To reach the forward part of the working chamber, workers pass through a door in a bulkhead that separates the staging chamber from the forward working chamber. The maximum crew size allowed in the forward working chamber is three. At certain hyperbaric pressures (i.e., when decompression times are greater than work times), the twin man-locks allow for crew rotation. During crew rotation, one crew can be compressing or decompressing while the second crew is working. Therefore, the working crew always has an unoccupied man-lock at its disposal.

Further, the applicant asserts that it has developed a project-specific HOM (OSHA-2022-0007-0002) that describes in detail the hyperbaric procedures, the required medical examination used during the tunnel-construction project, the standard operating procedures and the emergency and contingency procedures. The procedures include using experienced and knowledgeable man-lock attendants who have the training and experience necessary to recognize and treat decompression illnesses and injuries. The attendants are under the direct supervision of the hyperbaric supervisor and attending physician. In addition, procedures include medical screening and review of prospective compressed-air workers (CAWs). The purpose of this screening procedure is to vet prospective CAWs with medical conditions (e.g., deep vein thrombosis, poor vascular

circulation, and muscle cramping) that could be aggravated by sitting in a cramped space (e.g., a man-lock) for extended periods, or by exposure to elevated pressures and compressed gas mixtures. A transportable recompression chamber (shuttle) is available to extract workers from the hyperbaric working chamber for emergency evacuation and medical treatment; the shuttle attaches to the topside medical lock, which is a large recompression chamber. The applicant believes that the procedures included in the HOM provide safe work conditions when interventions are necessary, including interventions above 50 p.s.i.g.

OSHA comprehensively reviewed the project-specific HOM and determined that the safety and health instructions and measures it specifies are appropriate, conform with the conditions in the variance, and adequately protect the safety and health of the CAWs.

C. Variance from Paragraph (f)(1) of 29 CFR 1926.803, Requirement to Use OSHA Decompression Tables

OSHA's compressed-air standard for construction requires decompression in accordance with the decompression tables in Appendix A of 29 CFR 1926, subpart S (see 29 CFR 1926.803(f)(1)). As an alternative to the OSHA decompression tables, the applicant proposes to use newer decompression schedules (the 1992 French Decompression Tables) that rely on staged decompression and supplement breathing air used during decompression with air or oxygen (as appropriate).[3] The applicant asserts decompression protocols using the 1992 French Decompression Tables for air or oxygen as specified by the SST Project-specific HOM are safer for tunnel workers than the decompression protocols specified in Appendix A of 29 CFR 1926, subpart S. Accordingly, the applicant would commit to following the decompression procedures

---

[3] In 1992, the French Ministry of Labour replaced the 1974 French Decompression Tables with the 1992 French Decompression Tables, which differ from OSHA's decompression tables in Appendix A by using: (1) staged decompression as opposed to continuous (linear) decompression; (2) decompression tables based on air or both air and pure oxygen; and (3) emergency tables when unexpected exposure times occur (up to 30 minutes above the maximum allowed working time).

described in that HOM, which would require it to follow the 1992 French Decompression Tables to decompress compressed-air worker (CAWs) after they exit the hyperbaric conditions in the working chamber.

Depending on the maximum working pressure and exposure times, the 1992 French Decompression Tables provide for air decompression with or without oxygen. McNally asserts that oxygen decompression has many benefits, including (1) keeping the partial pressure of nitrogen in the lungs as low as possible; (2) keeping external pressure as low as possible to reduce the formation of bubbles in the blood; (3) removing nitrogen from the lungs and arterial blood and increasing the rate of nitrogen elimination; (4) improving the quality of breathing during decompression stops so that workers are less tired and to prevent bone necrosis; (5) reducing decompression time by about 33 percent as compared to air decompression; and (6) reducing inflammation.

In addition, the project-specific HOM requires a physician certified in hyperbaric medicine to manage the medical condition of CAWs during hyperbaric exposures and decompression. A trained and experienced man-lock attendant is also required to be present during hyperbaric exposures and decompression. This man-lock attendant is to operate the hyperbaric system to ensure compliance with the specified decompression table. A hyperbaric supervisor (competent person), who is trained in hyperbaric operations, procedures, and safety, directly oversees all hyperbaric interventions, and ensures that staff follow the procedures delineated in the HOM or by the attending physician.

D. Variance from Paragraph (g)(1)(iii) of 29 CFR 1926.803, Automatically Regulated Continuous Decompression

McNally is applying for a permanent variance from the OSHA standard at 29 CFR 1926.803(g)(1)(iii), which requires automatic controls to regulate decompression. As noted above, the applicant is committed to conducting the staged decompression

according to the 1992 French Decompression Tables under the direct control of the trained man-lock attendant and under the oversight of the hyperbaric supervisor.

Breathing air under hyperbaric conditions increases the amount of nitrogen gas dissolved in a CAW's tissues. The greater the hyperbaric pressure under these conditions and the more time spent under the increased pressure, the greater the amount of nitrogen gas dissolved in the tissues. When the pressure decreases during decompression, tissues release the dissolved nitrogen gas into the blood system, which then carries the nitrogen gas to the lungs for elimination through exhalation. Releasing hyperbaric pressure too rapidly during decompression can increase the size of the bubbles formed by nitrogen gas in the blood system, resulting in decompression illness (DCI), commonly referred to as "the bends." This description of the etiology of DCI is consistent with current scientific theory and research on the issue (see footnote 12 in this notice discussing a 1985 NIOSH report on DCI).

The 1992 French Decompression Tables proposed for use by the applicant provide for stops during worker decompression (i.e., staged decompression) to control the release of nitrogen gas from tissues into the blood system. Studies show that staged decompression, in combination with other features of the 1992 French Decompression Tables such as the use of oxygen, result in a lower incidence of DCI than the use of automatically regulated continuous decompression.[4] In addition, the applicant asserts that staged decompression

---

[4] See, e.g., Dr. Eric Kindwall, EP (1997), Compressed air tunneling and caisson work decompression procedures: development, problems, and solutions. *Undersea and Hyperbaric Medicine*, 24(4), pp. 337-345. This article reported 60 treated cases of DCI among 4,168 exposures between 19 and 31 p.s.i.g. over a 51-week contract period, for a DCI incidence of 1.44 percent for the decompression tables specified by the OSHA standard. Dr. Kindwall notes that the use of automatically regulated continuous decompression in the Washington State safety standards for compressed-air work (from which OSHA derived its decompression tables) was at the insistence of contractors and the union, and against the advice of the expert who calculated the decompression table and recommended using staged decompression. Dr. Kindwall then states, "Continuous decompression is inefficient and wasteful. For example, if the last stage from 4 p.s.i.g. . . . to the surface took 1h, at least half the time is spent at pressures less than 2 p.s.i.g. . . . , which provides less and less meaningful bubble suppression . . . ." In addition, Dr. Kindwall addresses the continuous-decompression protocol in the OSHA compressed-air standard for construction, noting that "[a]side from the tables for saturation diving to deep depths, no other widely used or officially approved

administered in accordance with its HOM is at least as effective as an automatic controller in regulating the decompression process because the HOM includes a hyperbaric supervisor (a competent person experienced and trained in hyperbaric operations, procedures, and safety) who directly supervises all hyperbaric interventions and ensures that the man-lock attendant, who is a competent person in the manual control of hyperbaric systems, follows the schedule specified in the decompression tables, including stops.

E. Variance from Paragraph (g)(1)(xvii) of 29 CFR 1926.803, Requirement of Special Decompression Chamber

The OSHA compressed-air standard for construction requires employers to use a special decompression chamber of sufficient size to accommodate all CAWs being decompressed at the end of the shift when total decompression time exceeds 75 minutes (see 29 CFR 1926.803(g)(1)(xvii)). Use of the special decompression chamber enables CAWs to move about and flex their joints to prevent neuromuscular problems during decompression.

Space limitations in the TBM do not allow for the installation and use of an additional special decompression lock or chamber. The applicant proposes that it be permitted to rely on the man-locks and staging chamber in lieu of adding a separate, special decompression chamber. Because only a few workers out of the entire crew are exposed to hyperbaric pressure, the man-locks (which, as noted earlier, connect directly to the working chamber) and the staging chamber are of sufficient size to accommodate all of the exposed workers during decompression. The applicant uses the existing man-locks, each of which adequately accommodates a three-member crew for this purpose when decompression lasts up to 75 minutes. When decompression exceeds 75 minutes, crews

---

diving decompression tables use straight line, continuous decompressions at varying rates. Stage decompression is usually the rule, since it is simpler to control."

can open the door connecting the two compartments in each man-lock (during decompression stops) or exit the man-lock and move into the staging chamber where additional space is available. The applicant asserts that this alternative arrangement is as effective as a special decompression chamber in that it has sufficient space for all the CAWs at the end of a shift and enables the CAWs to move about and flex their joints to prevent neuromuscular problems.

III. Agency Preliminary Determinations

After reviewing the proposed alternatives, OSHA has preliminarily determined that the applicant's proposed alternatives on the whole, subject to the conditions in the request and imposed by this interim order, provide measures that are as safe and healthful as those required by the cited OSHA standards addressed in section II of this document.

In addition, OSHA has preliminarily determined that each of the following alternatives are at least as effective as the specified OSHA requirements:

A. 29 CFR 1926.803(e)(5)

McNally has developed, and proposed to implement, effective alternative measures to the prohibition of using compressed air under hyperbaric conditions exceeding 50 p.s.i. The proposed alternative measures include use of engineering and administrative controls of the hazards associated with work performed in compressed-air conditions exceeding 50 p.s.i. while engage in the construction of a subaqueous tunnel using advance shielded mechanical-excavation techniques in conjunction with the TBM. Prior to conducting interventions in the TBM's pressurized working chamber, McNally halts tunnel excavation and prepares the machine and crew to conduct the interventions. Interventions involve inspection, maintenance, or repair of the mechanical-excavation components located in the working chamber.

B. 29 CFR 1926.803(f)(1)

McNally has proposed to implement, equally effective alternative measures to the requirement in 29 CFR 1926.803(f)(1) for compliance with OSHA's decompression tables. The HOM specifies the procedures and personnel qualifications for performing work safely during the compression and decompression phases of interventions. The HOM also specifies the decompression tables the applicant proposes to use (the 1992 French Decompression Tables). Depending on the maximum working pressure and exposure times during the interventions, the tables provide for decompression using air, pure oxygen, or a combination of air and oxygen. The decompression tables also include delays or stops for various time intervals at different pressure levels during the transition to atmospheric pressure (i.e., staged decompression). In all cases, a physician certified in hyperbaric medicine will manage the medical condition of CAWs during decompression. In addition, a trained and experienced man-lock attendant, experienced in recognizing decompression sickness or illnesses and injuries, will be present. Of key importance, a hyperbaric supervisor (competent person), trained in hyperbaric operations, procedures, and safety, will directly supervise all hyperbaric operations to ensure compliance with the procedures delineated in the project-specific HOM or by the attending physician.

As it did when granting the five previous tunneling permanent variances to IHP JV, Traylor JV, Tully JV Salini-Impregilo Joint Venture, and Ballard, OSHA conducted a review of the scientific literature and concluded that the alternative decompression method (i.e., the 1992 French Decompression Tables) McNally proposed would be at least as safe as the decompression tables specified by OSHA when applied by trained medical personnel under the conditions that would be imposed by the proposed variance.

Some of the literature even indicates that it may be safer, concluding that decompression performed in accordance with these tables resulted in a lower occurrence of DCI than decompression conducted in accordance with the decompression tables specified by the standard. For example, H. L. Anderson studied the occurrence of DCI at

maximum hyperbaric pressures ranging from 4 p.s.i.g. to 43 p.s.i.g. during construction of the Great Belt Tunnel in Denmark (1992-1996).[5] This project used the 1992 French Decompression Tables to decompress the workers during part of the construction. Anderson observed 6 DCI cases out of 7,220 decompression events, and reported that switching to the 1992 French Decompression tables reduced the DCI incidence to 0.08 percent compared to a previous incidence rate of 0.14 percent. The DCI incidence in the study by H. L. Andersen is substantially less than the DCI incidence reported for the decompression tables specified in Appendix A.

OSHA found no studies in which the DCI incidence reported for the 1992 French Decompression Tables were higher than the DCI incidence reported for the OSHA decompression tables.[6]

OSHA's experience with the five previous tunneling permanent variances, which all incorporated nearly identical decompression plans and did not result in safety issues, also provide evidence that the alternative procedure as a whole is at least as effective for this type of tunneling project as compliance with OSHA's decompression tables. The experience of State Plans[7] that either granted variances (Nevada, Oregon and Washington)[8] or promulgated a new standard (California)[9] for hyperbaric exposures occurring during similar subaqueous tunnel-construction work, provide additional evidence of the effectiveness of this alternative procedure.

---

[5]Anderson HL (2002). Decompression sickness during construction of the Great Belt tunnel, Denmark. *Undersea and Hyperbaric Medicine*, 29(3), pp. 172-188.

[6]Le Péchon JC, Barre P, Baud JP, Ollivier F (September 1996). Compressed air work - French Tables 1992 - operational results. *JCLP Hyperbarie Paris, Centre Medical Subaquatique Interentreprise, Marseille: Communication a l'EUBS*, pp. 1-5 (see Ex. OSHA-2012-0036-0005).

[7] Under Section 18 of the OSH Act, Congress expressly provides that States and U.S. territories may adopt, with Federal approval, a plan for the development and enforcement of occupational safety and health standards. OSHA refers to such States and territories as ''State Plan States'' Occupational safety and health standards developed by State Plan States must be at least as effective in providing safe and healthful employment and places of employment as the Federal standards (29 U.S.C. 667).

[8] These state variances are available in the docket for the 2015 Traylor JV variance: Exs. OSHA-2012-0035-0006 (Nevada), OSHA-2012-0035-0005 (Oregon), and OSHA-2012-0035-0004 (Washington).

[9]See California Code of Regulations, Title 8, Subchapter 7, Group 26, Article 154, available at *http://www.dir.ca.gov/title8/sb7g26a154.html.*

C. 29 CFR 1926.803(g)(1)(iii)

McNally developed, and proposed to implement, an equally effective alternative to 29 CFR 1926.803(g)(1)(iii), which requires the use of automatic controllers that continuously decrease pressure to achieve decompression in accordance with the tables specified by the standard. The applicant's alternative includes using the 1992 French Decompression Tables for guiding staged decompression to achieve lower occurrences of DCI, using a trained and competent attendant for implementing appropriate hyperbaric entry and exit procedures, and providing a competent hyperbaric supervisor and attending physician certified in hyperbaric medicine to oversee all hyperbaric operations.

In reaching this preliminary conclusion, OSHA again notes the experience of previous nearly identical tunneling variances, the experiences of State Plan States, and a review of the literature and other information noted earlier.

D. 29 CFR 1926.803(g)(1)(xvii)

McNally developed, and proposed to implement, an effective alternative to the use of the special decompression chamber required by 29 CFR 1926.803(g)(1)(xvii). The TBM's man-lock and working chamber appear to satisfy all of the conditions of the special decompression chamber, including that they provide sufficient space for the maximum crew of three CAWs to stand up and move around, and safely accommodate decompression times up to 360 minutes. Therefore, again noting OSHA's previous experience with nearly identical tunneling variances including the same alternative, OSHA preliminarily determined that the TBM's man-lock and working chamber function as effectively as the special decompression chamber required by the standard.

Pursuant to section 6(d) of the Occupational Safety and Health Act of 1970 (29 U.S.C. 655), and based on the record discussed above, the agency preliminarily finds that when the employer complies with the conditions of the previously granted interim order, or the conditions of the proposed variance, the working conditions of the employer's

workers would be at least as safe and healthful as if the employer complied with the working conditions specified by paragraphs (e)(5), (f)(1), (g)(1)(iii), and (g)(1)(xvii) of 29 CFR 1926.803.

IV. Grant of Interim order, Proposal for Permanent Variance, and Request for Comment

OSHA hereby announces the preliminary decision to grant an interim order allowing McNally's CAWs to perform interventions in hyperbaric conditions not exceeding 55 p.s.i.g. during the SST Project, subject to the conditions that follow in this document. This interim order will remain in effect until completion of the SST Project or until the agency modifies or revokes the interim order or makes a decision on McNally's application for a permanent variance. During the period starting with the publication of this notice until completion of the SST Project, or until the agency modifies or revokes the interim order or makes a decision on its application for a permanent variance, the applicant is required to comply fully with the conditions of the interim order as an alternative to complying with the following requirements of 29 CFR 1926.803 (hereafter, "the standard") that:

1. Prohibit Exposure to Pressure Greater than 50 p.s.i. (29 CFR 1926.803(e)(5));
2. Require the use of decompression values specified by the decompression tables in Appendix A of the compressed-air standard (29 CFR 1926.803(f)(1));
3. Require the use of automated operational controls (29 CFR 1926.803(g)(1)(iii)); and
4. Require the use of a special decompression chamber (29 CFR 1926.803(g)(1)(xvii)).

In order to avail itself of the interim order, McNally must: (1) comply with the conditions listed in the interim order for the period starting with the grant of the interim order and ending with McNally's completion of the SST Project (or until the agency

modifies or revokes the interim order or makes a decision on its application for a permanent variance); (2) comply fully with all other applicable provisions of 29 CFR part 1926; and (3) provide a copy of this *Federal Register* notice to all employees affected by the proposed conditions, including the affected employees of other employers, using the same means it used to inform these employees of its application for a permanent variance.

OSHA is also proposing that the same requirements (see above section III, parts A through D) would apply to a permanent variance if OSHA ultimately issues one for this project. OSHA requests comment on those conditions as well as OSHA's preliminary determination that the specified alternatives and conditions would provide a workplace as safe and healthful as those required by the standard from which a variance is sought. After reviewing comments, OSHA will publish in the *Federal Register* the agency's final decision approving or rejecting the request for a permanent variance.

V. Description of the Specified Conditions of the Interim Order and the Application for a Permanent Variance

This section describes the alternative means of compliance with 29 CFR 1926.803(e)(5),(f)(1), (g)(1)(iii), and (g)(1)(xvii) and provides additional detail regarding the proposed conditions that form the basis of McNally's application for an interim order and for a permanent variance. The conditions are listed in Section VI. For brevity, the discussion that follows refers only to the permanent variance, but the same conditions apply to the interim order.

Proposed Condition A: Scope

The scope of the proposed permanent variance would limit coverage to the work situations specified. Clearly defining the scope of the proposed permanent variance provides McNally, McNally's employees, potential future applicants, other stakeholders, the public, and OSHA with necessary information regarding the work situations in which

the proposed permanent variance would apply. To the extent that McNally exceeds the defined scope of this variance, it would be required to comply with OSHA's standards.

Pursuant to 29 CFR 1905.11, an employer (or class or group of employers)[10] may request a permanent variance for a specific workplace or workplaces. If OSHA approves a permanent variance, it would apply only to the specific employer(s) that submitted the application and only to the specific workplace or workplaces designated as part of the project. In this instance, if OSHA were to grant a permanent variance, it would apply to only the applicant, McNally/Kiewit SST Joint Venture and only the Shoreline Storage Tunnel Project. As a result, it is important to understand that if OSHA were to grant McNally a permanent variance, it would not apply to any other employers, such as other joint ventures the applicant may undertake in the future. However, 29 CFR 1905.13 contains provisions for future modification of permanent variances to add or include additional employers if future joint ventures are established.

Proposed Condition B: Duration

The interim order is only intended as a temporary measure pending OSHA's decision on the permanent variance, so this condition specifies the duration of the order. If OSHA approves a permanent variance, it would specify the duration of the permanent variance as the remainder of the SST Project.

Proposed Condition C: List of Abbreviations

Proposed condition C defines a number of abbreviations used in the proposed permanent variance. OSHA believes that defining these abbreviations serves to clarify and standardize their usage, thereby enhancing the applicant's and its employees' understanding of the conditions specified by the proposed permanent variance.

---

[10]A class or group of employers (such as members of a trade alliance or association) may apply jointly for a Variance provided an authorized representative for each employer signs the application and the application identifies each employer's affected facilities.

Proposed Condition D: Definitions

The proposed condition defines a series of terms, mostly technical terms, used in the proposed permanent variance to standardize and clarify their meaning. OSHA believes that defining these terms serves to enhance the applicant's and its employees' understanding of the conditions specified by the proposed permanent variance.

Proposed Condition E: Safety and Health Practices

This proposed condition requires the applicant to develop and submit to OSHA an HOM specific to the SST Project at least six months before using the TBM for tunneling operations. The applicant must also submit, at least six months before using the TBM, proof that the TBM's hyperbaric chambers have been designed, fabricated, inspected, tested, marked, and stamped in accordance with the requirements of ASME PVHO-1.2019 (or the most recent edition of *Safety Standards for Pressure Vessels for Human Occupancy*). These requirements ensure that the applicant develops hyperbaric safety and health procedures suitable for the project.

The submission of the HOM to OSHA, which McNally has already completed, enables OSHA to determine whether the safety and health instructions and measures it specifies are appropriate to the field conditions of the tunnel (including expected geological conditions), conform to the conditions of the variance; and adequately protect the safety and health of the CAWs. It also facilitates OSHA's ability to ensure that the applicant is complying with these instructions and measures. The requirement for proof of compliance with ASME PVHO-1.2019 is intended to ensure that the equipment is structurally sound and capable of performing to protect the safety of the employees exposed to hyperbaric pressure.

Additionally, the proposed condition includes a series of related hazard prevention and control requirements and methods (e.g., decompression tables, job hazard analyses (JHA), operations and inspections checklists, incident investigation, and recording and

notification to OSHA of recordable hyperbaric injuries and illnesses) designed to ensure the continued effective functioning of the hyperbaric equipment and operating system.

Proposed Condition F: Communication

This proposed condition requires the applicant to develop and implement an effective system of information sharing and communication. Effective information sharing and communication are intended to ensure that affected workers receive updated information regarding any safety-related hazards and incidents, and corrective actions taken, prior to the start of each shift. The proposed condition also requires the applicant to ensure that reliable means of emergency communications are available and maintained for affected workers and support personnel during hyperbaric operations. Availability of such reliable means of communications would enable affected workers and support personnel to respond quickly and effectively to hazardous conditions or emergencies that may develop during TBM operations.

Proposed Condition G: Worker Qualification and Training

This proposed condition requires the applicant to develop and implement an effective qualification and training program for affected workers. The proposed condition specifies the factors that an affected worker must know to perform safely during hyperbaric operations, including how to enter, work in, and exit from hyperbaric conditions under both normal and emergency conditions. Having well-trained and qualified workers performing hyperbaric intervention work is intended to ensure that they recognize, and respond appropriately to, hyperbaric safety and health hazards. These qualification and training requirements enable affected workers to cope effectively with emergencies, as well as the discomfort and physiological effects of hyperbaric exposure, thereby preventing worker injury, illness, and fatalities.

Paragraph (2)(e) of this proposed condition requires the applicant to provide affected workers with information they can use to contact the appropriate healthcare professionals

if the workers believe they are developing hyperbaric-related health effects. This requirement provides for early intervention and treatment of DCI and other health effects resulting from hyperbaric exposure, thereby reducing the potential severity of these effects.

Proposed Condition H: Inspections, Tests, and Accident Prevention

Proposed Condition H requires the applicant to develop, implement and operate a program of frequent, and regular inspections of the TBM's hyperbaric equipment and support systems, and associated work areas. This condition would help to ensure the safe operation and physical integrity of the equipment and work areas necessary to conduct hyperbaric operations. The condition would also enhance worker safety by reducing the risk of hyperbaric-related emergencies.

Paragraph (3) of this proposed condition requires the applicant to document tests, inspections, corrective actions, and repairs involving the TBM, and maintain these documents at the jobsite for the duration of the job. This requirement would provide the applicant with information needed to schedule tests and inspections to ensure the continued safe operation of the equipment and systems, and to determine that the actions taken to correct defects in hyperbaric equipment and systems were appropriate, prior to returning them to service.

Proposed Condition I: Compression and Decompression

This proposed condition would require the applicant to consult with the designated medical advisor regarding special compression or decompression procedures appropriate for any unacclimated CAW and then implement the procedures recommended by the medical consultant. This proposed provision would ensure that the applicant consults with the medical advisor, and involves the medical advisor in the evaluation, development, and implementation of compression or decompression protocols appropriate for any CAW requiring acclimation to the hyperbaric conditions encountered

during TBM operations. Accordingly, CAWs requiring acclimation would have an opportunity to acclimate prior to exposure to these hyperbaric conditions. OSHA believes this condition would prevent or reduce adverse reactions among CAWs to the effects of compression or decompression associated with the intervention work they perform in the TBM.

Proposed Condition J: Recordkeeping

Under OSHA's existing recordkeeping requirements in 29 CFR part 1904 regarding Recording and Reporting Occupational Injuries and Illnesses, McNally must maintain a record of any recordable injury, illness, or fatality (as defined by 29 CFR part 1904) resulting from exposure of an employee to hyperbaric conditions by completing the OSHA Form 301 Incident Report and OSHA Form 300 Log of Work Related Injuries and Illnesses. The applicant did not seek a variance from this standard and therefore must comply fully with those requirements.

Examples of important information to include on the OSHA Form 301 Injury and Illness Incident Report (along with the corresponding question on the form) are:

Q14

- the task performed;
- the composition of the gas mixture (e.g., air or oxygen);
- an estimate of the CAW's workload;
- the maximum working pressure;
- temperature in the work and decompression environments;
- unusual occurrences, if any, during the task or decompression

Q15

- time of symptom onset;
- duration between decompression and onset of symptoms

Q16

- type and duration of symptoms;
- a medical summary of the illness or injury

Q17

- duration of the hyperbaric intervention;
- possible contributing factors;
- the number of prior interventions completed by the injured or ill CAW; and the pressure to which the CAW was exposed during those interventions. [11]

Proposed Condition J would add additional reporting responsibilities, beyond those already required by the OSHA standard. The applicant would be required to maintain records of specific factors associated with each hyperbaric intervention. The information gathered and recorded under this provision, in concert with the information provided under proposed Condition K (using OSHA Form 301 Injury and Illness Incident Report to investigate and record hyperbaric recordable injuries as defined by 29 CFR 1904.4, 1904.7, 1904.8 - 1904.12), would enable the applicant and OSHA to assess the effectiveness of the permanent variance in preventing DCI and other hyperbaric-related effects.

Proposed Condition K: Notifications

Under the proposed condition, the applicant is required, within specified periods of time, to notify OSHA of: (1) any recordable injury, illness, in-patient hospitalization, amputation, loss of an eye, or fatality that occurs as a result of hyperbaric exposures during TBM operations; (2) provide OSHA a copy of the hyperbaric exposures incident investigation report (using OSHA Form 301 Injury and Illness Incident Report) of these

---

[11]See 29 CFR 1904 Recording and Reporting Occupational Injuries and Illnesses *(http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9631)*; recordkeeping forms and instructions *(http://www.osha.gov/recordkeeping/RKform300pkg-fillable-enabled.pdf*); and OSHA Recordkeeping Handbook *(http://www.osha.gov/recordkeeping/handbook/index.html*).

events within 24 hours of the incident; (3) include on OSHA Form 301 Injury and Illness Incident Report information on the hyperbaric conditions associated with the recordable injury or illness, the root-cause determination, and preventive and corrective actions identified and implemented; (4) provide the certification that affected workers were informed of the incident and the results of the incident investigation; (5) notify OSHA's Office of Technical Programs and Coordination Activities (OTPCA) and the Cleveland Ohio OSHA Area Office within 15 working days should the applicant need to revise the HOM to accommodate changes in its compressed-air operations that affect McNally's ability to comply with the conditions of the proposed permanent variance; and (6) provide OTPCA and the Cleveland Ohio Area Office, at the end of the project, with a report evaluating the effectiveness of the decompression tables.

It should be noted that the requirement for completing and submitting the hyperbaric exposure-related (recordable) incident investigation report (OSHA 301 Injury and Illness Incident Report) is more restrictive than the current recordkeeping requirement of completing OSHA Form 301 Injury and Illness Incident Report within 7 calendar days of the incident (1904.29(b)(3)). This modified, more stringent incident investigation and reporting requirement is restricted to intervention-related hyperbaric (recordable) incidents only. Providing rapid notification to OSHA is essential because time is a critical element in OSHA's ability to determine the continued effectiveness of the variance conditions in preventing hyperbaric incidents, and the applicant's identification and implementation of appropriate corrective and preventive actions.

Further, these notification requirements also enable the applicant, its employees, and OSHA to assess the effectiveness of the permanent variance in providing the requisite level of safety to the applicant's workers and based on this assessment, whether to revise or revoke the conditions of the proposed permanent variance. Timely notification permits OSHA to take whatever action may be necessary and appropriate to prevent

possible further injuries and illnesses. Providing notification to employees informs them of the precautions taken by the applicant to prevent similar incidents in the future.

Additionally, this proposed condition requires the applicant to notify OSHA if it ceases to do business, has a new address or location for the main office, or transfers the operations covered by the proposed permanent variance to a successor company. In addition, the condition specifies that the transfer of the permanent variance to a successor company must be approved by OSHA. These requirements allow OSHA to communicate effectively with the applicant regarding the status of the proposed permanent variance, and expedite the agency's administration and enforcement of the permanent variance. Stipulating that an applicant is required to have OSHA's approval to transfer a variance to a successor company provides assurance that the successor company has knowledge of, and will comply with, the conditions specified by proposed permanent variance, thereby ensuring the safety of workers involved in performing the operations covered by the proposed permanent variance.

VI. Specific Conditions of the Interim order and the Proposed Permanent Variance

The following conditions apply to the interim order OSHA is granting to McNally/Kiewit SST Joint Venture for the Shoreline Storage Tunnel Project. These conditions specify the alternative means of compliance with the requirements of paragraphs 29 CFR 1926.803(e)(5), (f)(1), (g)(1)(iii), and (g)(1)(xvii). In addition, these conditions are specific to the alternative means of compliance with the requirements of paragraphs 29 CFR 1926.803 (e)(5),(f)(1), (g)(1)(iii), and (g)(1)(xvii) that OSHA is proposing for McNally's permanent variance. To simplify the presentation of the conditions, OSHA generally refers only to the conditions of the proposed permanent

variance, but the same conditions apply to the interim order except where otherwise noted.[12]

The conditions would apply with respect to all employees of McNally exposed to hyperbaric conditions. These conditions are outlined in this Section:

A. Scope

The interim order applies, and the permanent variance would apply, only when McNally stops the tunnel-boring work, pressurizes the working chamber, and the CAWs either enter the working chamber to perform an intervention (i.e., inspect, maintain, or repair the mechanical-excavation components), or exit the working chamber after performing interventions.

The interim order and proposed variance apply only to work:

1. That occurs in conjunction with construction of the SST Project, a tunnel constructed using advanced shielded mechanical-excavation techniques and involving operation of an TBM;

2. In the TBM's forward section (the working chamber) and associated hyperbaric chambers used to pressurize and decompress employees entering and exiting the working chamber; and

3. Performed in compliance with all applicable provisions of 29 CFR part 1926 except for the requirements specified by 29 CFR 1926.803(e)(5),(f)(1), (g)(1)(iii), and (g)(1)(xvii).

B. Duration

The interim order granted to McNally will remain in effect until OSHA modifies or revokes this interim order or grants McNally's request for a permanent variance in

[12]In these conditions, OSHA is using the future conditional form of the verb (e.g., "would"), which pertains to the application for a permanent variance (designated as "permanent variance") but the conditions are mandatory for purposes of the interim order.

accordance with 29 CFR 1905.13. The proposed permanent variance, if granted, would remain in effect until the completion of McNally's Shoreline Storage Tunnel Project.

C. List of Abbreviations

Abbreviations used throughout this proposed permanent variance would include the following:

1. CAW – Compressed-air worker
2. CFR – Code of Federal Regulations
3. DCI – Decompression Illness
4. DMT – Diver Medical Technician
5. TBM –Tunnel Boring Machine
6. HOM – Hyperbaric Operations Manual
7. JHA – Job hazard analysis
8. OSHA – Occupational Safety and Health Administration
9. OTPCA – Office of Technical Programs and Coordination Activities

D. Definitions

The following definitions would apply to this proposed permanent variance. These definitions would supplement the definitions in McNally's project-specific HOM.

1. *Affected employee or worker* – an employee or worker who is affected by the conditions of this proposed permanent variance, or any one of his or her authorized representatives. The term "employee" has the meaning defined and used under the Occupational Safety and Health Act of 1970 (29 U.S.C. 651 *et seq*.).

2. *Atmospheric pressure* – the pressure of air at sea level, generally 14.7 pounds per square inch absolute (p.s.i.a)., 1 atmosphere absolute, or 0 p.s.i.g.

3. *Compressed-air worker* – an individual who is specially trained and medically qualified to perform work in a pressurized environment while breathing air at pressures not exceeding 50 p.s.i.g.

4. *Competent person* – an individual who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.[13]

5. *Decompression illness* – an illness (also called decompression sickness or "the bends") caused by gas bubbles appearing in body compartments due to a reduction in ambient pressure. Examples of symptoms of decompression illness include, but are not limited to: joint pain (also known as the "bends" for agonizing pain or the "niggles" for slight pain); areas of bone destruction (termed dysbaric osteonecrosis); skin disorders (such as cutis marmorata, which causes a pink marbling of the skin); spinal cord and brain disorders (such as stroke, paralysis, paresthesia, and bladder dysfunction); cardiopulmonary disorders, such as shortness of breath; and arterial gas embolism (gas bubbles in the arteries that block blood flow).[14]

Note: Health effects associated with hyperbaric intervention, but not considered symptoms of DCI, can include: barotrauma (direct damage to air-containing cavities in the body such as ears, sinuses, and lungs); nitrogen narcosis (reversible alteration in consciousness that may occur in hyperbaric environments and is caused by the anesthetic effect of certain gases at high pressure); and oxygen toxicity (a central nervous system condition resulting from the harmful effects of breathing molecular oxygen (O_2) at elevated partial pressures).

6. *Diver Medical Technician* – Member of the dive team who is experienced in first aid.

---

[13]Adapted from 29 CFR 1926.32(f).

[14]See Appendix 10 of "A Guide to the Work in Compressed-Air Regulations 1996," published by the United Kingdom Health and Safety Executive available from NIOSH at *http://www.cdc.gov/niosh/docket/archive/pdfs/NIOSH-254/compReg1996.pdf*

7. *Earth Pressure Balanced Micro Tunnel Boring Machine* – the machinery used to excavate a tunnel.

8. *Hot work* – any activity performed in a hazardous location that may introduce an ignition source into a potentially flammable atmosphere.[15]

9. *Hyperbaric* – at a higher pressure than atmospheric pressure.

10. *Hyperbaric intervention* – a term that describes the process of stopping the TBM and preparing and executing work under hyperbaric pressure in the working chamber for the purpose of inspecting, replacing, or repairing cutting tools and/or the cutterhead structure.

11. *Hyperbaric Operations Manual* – a detailed, project-specific health and safety plan developed and implemented by McNally for working in compressed air during the SST Project.

12. *Job hazard analysis* – an evaluation of tasks or operations to identify potential hazards and to determine the necessary controls.

13. *Man-lock* – an enclosed space capable of pressurization and used for compressing or decompressing any employee or material when either is passing into, or out of, a working chamber.

14. *Pressure* – a force acting on a unit area. Usually expressed as pounds per square inch (p.s.i.).

15. *p.s.i.a.* – pounds per square inch absolute, or absolute pressure, is the sum of the atmospheric pressure and gauge pressure. At sea-level, atmospheric pressure is approximately 14.7 p.s.i.a. Adding 14.7 to a pressure expressed in units of p.s.i.g. will yield the absolute pressure, expressed as p.s.i.a.

---

[15]Also see 29 CFR 1910.146(b).

16. *p.s.i.g.* – pounds per square inch gauge, a common unit of pressure; pressure expressed as p.s.i.g. corresponds to pressure relative to atmospheric pressure. At sea-level, atmospheric pressure is approximately 14.7 p.s.i.a Subtracting 14.7 from a pressure expressed in units of p.s.i.a. yields the gauge pressure, expressed as p.s.i.g. At sea level the gauge pressure is 0 psig.

17. *Qualified person* – an individual who, by possession of a recognized degree, certificate, or professional standing, or who, by extensive knowledge, training, and experience, successfully demonstrates an ability to solve or resolve problems relating to the subject matter, the work, or the project.[16]

18. *Working chamber* – an enclosed space in the TBM in which CAWs perform interventions, and which is accessible only through a man-lock.

E. Safety and Health Practices

1. McNally would have to adhere to the project-specific HOM submitted to OSHA as part of the application (see OSHA-2022-0007-0002). The HOM provides the minimum requirements regarding expected safety and health hazards (including anticipated geological conditions) and hyperbaric exposures during the tunnel-construction project.

2. McNally would have to demonstrate that the TBM on the project is designed, fabricated, inspected, tested, marked, and stamped in accordance with the requirements of ASME PVHO-1.2019 (or most recent edition of *Safety Standards for Pressure Vessels for Human Occupancy*) for the TBM's hyperbaric chambers.

3. McNally would have to implement the safety and health instructions included in the manufacturer's operations manuals for the TBM, and the safety and health

[16]Adapted from 29 CFR 1926.32(m).

instructions provided by the manufacturer for the operation of decompression equipment.

4. McNally would have to ensure that there are no exposures to pressures greater than 55 p.s.i.g.

5. McNally would have to ensure that air or oxygen is the only breathing gas in the working chamber.

6. McNally would have to follow the 1992 French Decompression Tables for air or oxygen decompression as specified in the HOM; specifically, the extracted portions of the 1992 French Decompression tables titled, "French Regulation Air Standard Tables."

7. McNally would have to equip man-locks used by employees with an air or oxygen delivery system, as specified by the HOM, for the project. McNally would be required not to store in the tunnel any oxygen or other compressed gases used in conjunction with hyperbaric work.

8. Workers performing hot work under hyperbaric conditions would have to use flame-retardant personal protective equipment and clothing.

9. In hyperbaric work areas, McNally would have to maintain an adequate fire-suppression system approved for hyperbaric work areas.

10. McNally would have to develop and implement one or more Job Hazard Analysis (JHA) for work in the hyperbaric work areas, and review, periodically and as necessary (e.g., after making changes to a planned intervention that affects its operation), the contents of the JHAs with affected employees. The JHAs would have to include all the job functions that the risk assessment[17] indicates are essential to prevent injury or illness.

---

[17]See ANSI/AIHA Z10-2012, American National Standard for Occupational Health and Safety Management Systems, for reference.

11. McNally would have to develop a set of checklists to guide compressed-air work and ensure that employees follow the procedures required by the proposed permanent variance and this interim order (including all procedures required by the HOM approved by OSHA for the project, which this proposed variance would incorporate by reference). The checklists would have to include all steps and equipment functions that the risk assessment indicates are essential to prevent injury or illness during compressed-air work.

McNally would have to ensure that the safety and health provisions of this project-specific HOM adequately protect the workers of all contractors and subcontractors involved in hyperbaric operations for the project to which the HOM applies.

F. Communication

McNally would have to:

1. Prior to beginning a shift, implement a system that informs workers exposed to hyperbaric conditions of any hazardous occurrences or conditions that might affect their safety, including hyperbaric incidents, gas releases, equipment failures, earth or rock slides, cave-ins, flooding, fires, or explosions.

2. Provide a power-assisted means of communication among affected workers and support personnel in hyperbaric conditions where unassisted voice communication is inadequate.

(a) Use an independent power supply for powered communication systems, and these systems would have to operate such that use or disruption of any one phone or signal location will not disrupt the operation of the system from any other location.

(b) Test communication systems at the start of each shift and as necessary thereafter to ensure proper operation.

G. Worker Qualifications and Training

McNally would have to:

1. Ensure that each affected worker receives effective training on how to safely enter, work in, exit from, and undertake emergency evacuation or rescue from, hyperbaric conditions, and document this training.

2. Provide effective instruction on hyperbaric conditions, before beginning hyperbaric operations, to each worker who performs work, or controls the exposure of others, and document this instruction. The instruction would need to include:

(a) The physics and physiology of hyperbaric work;

(b) Recognition of pressure-related injuries;

(c) Information on the causes and recognition of the signs and symptoms associated with decompression illness, and other hyperbaric intervention-related health effects (e.g., barotrauma, nitrogen narcosis, and oxygen toxicity);

(d) How to avoid discomfort during compression and decompression;

(e) Information the workers can use to contact the appropriate healthcare professionals should the workers have concerns that they may be experiencing adverse health effects from hyperbaric exposure; and

(f) Procedures and requirements applicable to the employee in the project-specific HOM.

3. Repeat the instruction specified in paragraph (G)(2)(b) of this proposed condition periodically and as necessary (e.g., after making changes to its hyperbaric operations).

4. When conducting training for its hyperbaric workers, make this training available to OSHA personnel and notify the OTPCA at OSHA's National Office and OSHA's nearest affected Area Office before the training takes place.

H. Inspections, Tests, and Accident Prevention

1. McNally would have to initiate and maintain a program of frequent and regular inspections of the TBM's hyperbaric equipment and support systems (such as

temperature control, illumination, ventilation, and fire-prevention and fire-suppression systems), and hyperbaric work areas, as required under 29 CFR 1926.20(b)(2), including:

(a) Developing a set of checklists to be used by a competent person in conducting weekly inspections of hyperbaric equipment and work areas; and

(b) Ensuring that a competent person conducts daily visual checks and weekly inspections of the TBM.

2. Remove from service any equipment that constitutes a safety hazard until it corrects the hazardous condition and has the correction approved by a qualified person.

3. McNally would have to maintain records of all tests and inspections of the TBM, as well as associated corrective actions and repairs, at the job site for the duration of the job.

I. Compression and Decompression

McNally would have to consult with its attending physician concerning the need for special compression or decompression exposures appropriate for CAWs not acclimated to hyperbaric exposure.

J. Recordkeeping

In addition to completing OSHA Form 301 Injury and Illness Incident Report and OSHA Form 300 Log of Work-Related Injuries and Illnesses, McNally would have to maintain records of:

1. The date, times (e.g., time compression started, time spent compressing, time performing intervention, time spent decompressing), and pressure for each hyperbaric intervention.

2. The names of all supervisors and DMTs involved for each intervention.

3. The name of each individual worker exposed to hyperbaric pressure and the decompression protocols and results for each worker.

4. The total number of interventions and the amount of hyperbaric work time at each pressure.

5. The results of the post-intervention physical assessment of each CAW for signs and symptoms of decompression illness, barotrauma, nitrogen narcosis, oxygen toxicity or other health effects associated with work in compressed air for each hyperbaric intervention.

K. Notifications

1. To assist OSHA in administering the conditions specified herein, McNally would have to:

(a) Notify the OTPCA and the Cleveland, Ohio Area Office of any recordable injury, illness, or fatality (by submitting the completed OSHA Form 301 Injuries and Illness Incident Report)[18] resulting from exposure of an employee to hyperbaric conditions, including those that do not require recompression treatment (e.g., nitrogen narcosis, oxygen toxicity, barotrauma), but still meet the recordable injury or illness criteria of 29 CFR 1904. The notification would have to be made within 8 hours of the incident or 8 hours after becoming aware of a recordable injury, illness, or fatality; a copy of the incident investigation (OSHA Form 301 Injuries and Illness Incident Report) must be submitted to OSHA within 24 hours of the incident or 24 hours after becoming aware of a recordable injury, illness, or fatality. In addition to the information required by OSHA Form 301 Injuries and Illness Incident Report, the incident-investigation report would have to include a root-cause determination, and the preventive and corrective actions identified and implemented.

---

[18]See footnote 12.

(b) Provide certification to the Cleveland Ohio Area Office within 15 working days of the incident that McNally informed affected workers of the incident and the results of the incident investigation (including the root-cause determination and preventive and corrective actions identified and implemented).

(c) Notify the OTPCA and the Cleveland Ohio Area Office within 15 working days and in writing, of any change in the compressed-air operations that affects McNally's ability to comply with the proposed conditions specified herein.

(d) Upon completion of the SST Project, evaluate the effectiveness of the decompression tables used throughout the project, and provide a written report of this evaluation to the OTPCA and the Cleveland Ohio Area Office.

Note: The evaluation report would have to contain summaries of: (1) The number, dates, durations, and pressures of the hyperbaric interventions completed; (2) decompression protocols implemented (including composition of gas mixtures (air and/or oxygen), and the results achieved; (3) the total number of interventions and the number of hyperbaric incidents (decompression illnesses and/or health effects associated with hyperbaric interventions as recorded on OSHA Form 301 Injuries and Illness Incident Report and OSHA Form 300 Log of Work-Related Injuries and Illnesses, and relevant medical diagnoses, and treating physicians' opinions); and (4) root causes of any hyperbaric incidents, and preventive and corrective actions identified and implemented.

(e) To assist OSHA in administering the proposed conditions specified herein, inform the OTPCA and the Cleveland Ohio Area Office as soon as possible, but no later than seven (7) days, after it has knowledge that it will:

(i) Cease doing business;

(ii) Change the location and address of the main office for managing the tunneling operations specified herein; or

(iii) Transfer the operations specified herein to a successor company.

(f) Notify all affected employees of this proposed permanent variance by the same means required to inform them of its application for a Variance.

2. OSHA would have to approve the transfer of the proposed permanent variance to a successor company through a new application for a modified variance.

VII. Authority and Signature

James S. Frederick, Deputy Assistant Secretary of Labor for Occupational Safety and Health, 200 Constitution Avenue, NW, Washington, DC 20210, authorized the preparation of this notice. Accordingly, the agency is issuing this notice pursuant to 29 U.S.C. 655(d), Secretary of Labor's Order No. 8-2020 (85 FR 58393, Sept. 18, 2020), and 29 CFR 1905.11.

Signed at Washington, DC, on September 16, 2022.

James S. Frederick,
Deputy Assistant Secretary of Labor for Occupational Safety and Health.

[FR Doc. 2022-20782 Filed: 9/23/2022 8:45 am; Publication Date: 9/26/2022]