

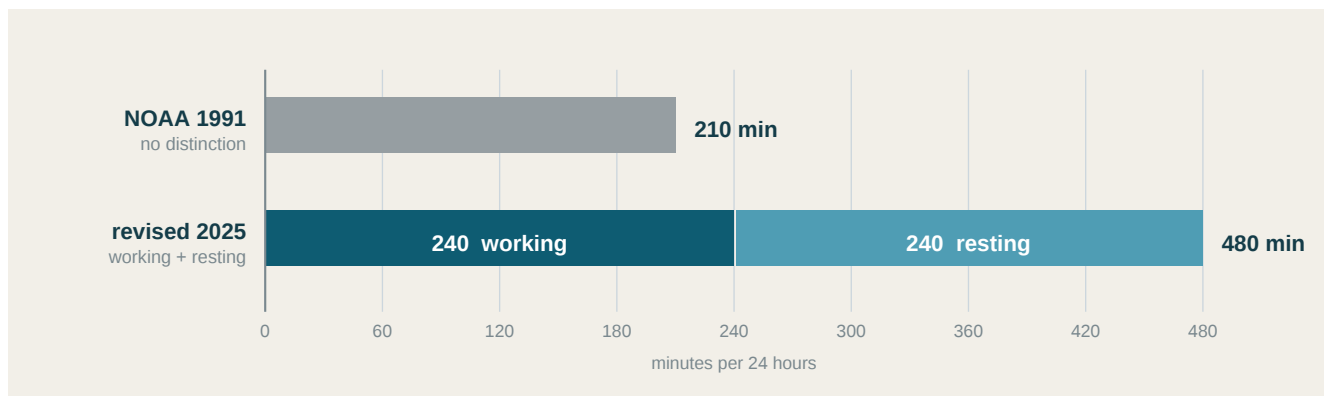
Oxygen at 1.3 atm: the revised CNS exposure limits

What the 2025 NOAA workshop changed — and what it explicitly did not. Compiled 9 September 2026.

The short version

A workshop convened by NOAA in March 2025 revised the CNS oxygen exposure limits for an inspired PO_2 of **1.3 atm**: instead of 180 minutes per dive and 210 minutes per day, now **up to four hours of working exposure plus up to four hours of resting exposure**. **Nothing changes for any other PO_2** . The guidance covers **CNS toxicity only**, not pulmonary. And the NOAA Diving Manual has **not been updated yet** — the paper states only the intention to do so.

Old and new



“Resting” is a defined quantity, not a feeling: a respiratory minute volume below $22.5 \text{ L}\cdot\text{min}^{-1}$, practically “not performing any activity beyond what a diver needs to do to decompress safely under optimal or near-optimal conditions”. The daily budget runs from the start of the first dive.

Three limitations most summaries leave out

First: 1.3 atm only. Statement 6 says it twice — nothing changes above, nothing is extended below: “No changes to the exposure duration guidelines for $\text{PO}_2 > 1.3 \text{ atm}$ are proposed given the lack of high-quality safety data.” The 1991 table therefore still applies unchanged at 1.4, 1.5 and 1.6 atm. Below 1.3 atm the revised guidance may be applied with less risk, but no longer duration is proposed.

Second: central nervous system only. Pulmonary toxicity is explicitly excluded and named as the limiting factor of long exposures. The reason for separating them: the old limits were set for both hazards together, although “the severity of consequence is far greater for CNS”. If pulmonary symptoms appear, no further diving until they have fully resolved.

Third: the manual has not changed. The paper states only: “NOAA plans to update subsequent editions of the NOAA manual consistent with the information contained herein.” Anyone looking up the NOAA table today still finds the 1991 version — and the PDFs circulating on forums show the old values.

The point nobody else makes: the resting data are open circuit

The revision is being reported as a rebreather story. That is too narrow. The strongest evidence behind the resting half comes from **open-circuit** exposures:

“One hundred and twenty-six open-circuit exposures have been conducted by NEDU around the 1.3 PO_2 limit. Seventy-two six-hour (360-minute) and 54 eight-hour (480-minute) resting exposures were performed. ... No oxygen toxicity seizures were recorded in any of the above dives, and none were terminated due to oxygen toxicity symptoms.”

Rebreather exposures come on top: 88 dives on MK 16 MOD 1 and MK 25 MOD 2 with 43–60 minutes of exercise followed by decompression, plus 116 dives with moderate exercise during the first 90–150 minutes of bottom time. The caveat for open circuit lies elsewhere, and the paper names it: the relevant data come from studies where PO_2 was precisely controlled, and variability arises “from changes in depth when using open-circuit gas”. On open circuit the inspired PO_2 moves with every change of depth. Anyone using the full four hours has to manage depth accordingly.

The weaker half: the working phase

The four resting hours rest on 126 exposures. The four working hours do not, in the same way. The paper concedes “concern about the limited robustness of both dry and wet dive data” and supports the limit with the general observation that 240 minutes at 1.3 atm “in various operational and testing scenarios has resulted in safe CNS profiles with reasonably robust supporting data”. No single study with exposure counts is cited for the working phase. Anyone applying the revision should know that its two halves are not equally well evidenced.

Why work and CO₂ are the real risk drivers

“Carbon dioxide retention promotes cerebral vasodilation and increased blood flow which increases brain tissue oxygen tension in the absence of any change in the inspired PO₂. It follows that hard work and elevated work of breathing are considered significant risk factors for CNS oxygen toxicity during diving.”

Add the immersion effect: for a given inspired PO₂ the risk appears higher in immersed divers than in dry chamber occupants. That is why chamber data do not transfer directly to diving — and why the working and resting phases are stated separately.

Risk mitigation as the paper states it

- Periodic five-minute breaks on a lower inspired PO₂, typically during decompression.
- Reduce the likelihood of CO₂ retention: minimise underwater work where practicable, **avoid gas densities greater than about 6 g·L⁻¹**, manage rebreather scrubbers properly, use low work-of-breathing apparatus.
- Reduce the consequences of a seizure: buddy system, a mouthpiece retaining device or full-face mask, tethering to decompression stages, use of habitats.

On gas density: the CMAS fact sheet “Max Depth” gives 9 g·L⁻¹. The ~6 g·L⁻¹ here is not a contradiction but a stricter figure for a different purpose — not the breathing limit, but avoiding CO₂ retention as a trigger. (Reading by tauchen.xyz; the two sources do not relate the numbers to each other.)

What it means for ordinary recreational diving

Little, and that should be said plainly. EAN32 at 30 m gives roughly 1.28 atm and would formally fall within scope — but no-decompression time runs out long before. The revision matters where long exposures actually occur: long technical dives, long decompressions, rebreathers, scientific diving. And the paper’s own closing sentence belongs in every account of it:

“Although this revised guideline is based on superior evidence to the one it replaces, it should nevertheless be understood that adherence to these limits does not guarantee that CNS oxygen toxicity will not occur.”

What remains open

The paper does not say when NOAA will update the manual. Exposures beyond eight hours are “anecdotally reported but poorly documented”. The working phase lacks a quantified evidence base. Whether and how the training agencies will follow has not been checked.

Source

Hoyt J, Murphy FG, Pollock NW, Kernagis D, Bird N, Menduno M, Bright J, Mitchell SJ. *Revised guideline for central nervous system oxygen toxicity exposure limits when using an inspired PO₂ of 1.3 atmospheres*. Diving and Hyperbaric Medicine. 2025;55(3):262–270. doi: 10.28920/dhm55.3.262-270. PMID 40986922. — Based on a workshop convened by NOAA on 29 March 2025 in Seattle, alongside the annual meeting of the American Academy of Underwater Sciences, with around 60 participants from technical and scientific diving. All quotations are from that paper.

Disclaimer

This sheet summarises a published paper and is provided without warranty. No liability is accepted for its use. It replaces neither training nor the standard of your own agency; what your agency prescribes takes precedence. Responsibility for gas planning and for every dive rests solely with the diver. **Analyse every mix yourself before the dive** — plan with the measured value, not with the number on the tag.

Sharing is expressly encouraged: print it, hand it out in class, pass it around the club — free of charge, commercially or privately. If you want to offer it online, please link to tauchen.xyz/noaa-einwirkzeiten rather than copying the file, so that everyone gets the current version.