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## Exotic diving gases

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### **!** Warning:

Scuba diving is a safe hobby, but without proper training, equipment and attitude it may endanger yours and your dive buddy's life. The author takes NO responsibility about the information of this page.

## Contents:

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### 1. What's this page for?

I've gathered some information about *exotic diving gases* to this page, which are very rarely used in diving.

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### 2. What are heliox, heliair or trimix?

Heliox is a mixture of helium and oxygen (HELIum-OXYgen). Heliox is used on deeper dives than it's possible to dive with regular air.

Heliair is a mixture of helium and air (HELIum-AIR). Heliair is used on mid-deep dives ranging from 40 to 60 meters. Main purpose of heliair is to reduce the nitrogen narcosis. Trimix is a mixture of helium, oxygen and nitrogen (Tri = three), and the percentages of gases may vary. Trimix is used on deeper dives than it's possible to dive with regular air. Take a look at [Trimix and heliox diving page](#).

See also: <http://www.cisatlantic.com/trimix/trimix.html>

Triox is an other name for hyperoxic trimix. See: <http://www.sfdj.com/spring/triox.html>

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### 3. ..and what are *neox, hydreliox, hydrox, neoquad, argox, xenonox, kryptonox* etc. strange named gases?

Neox is a mixture of neon and oxygen. Hydreliox is a mixture of hydrogen, oxygen and helium (hydrox = hydrogen + oxygen). Neoquad is a mixture of four gases: helium, neon, nitrogen and oxygen. Argox is a mixture of argon and oxygen. These gases are very *exotic* and rare diving gases.

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### 4. Hydrogen (H<sub>2</sub>), hydreliox and hydrox:

Hydrogen has been used succesfully in extremely deep dives (500 meters and more) with helium and oxygen. The mixture of these three gases is called *hydreliox*, and it doesn't really have any benefits to diving with open circuit equipment (since it's not very good idea to dive to above mentiobed depths with OC...). Hydrogen has also been used together with oxygen (*hydrox*), but this mixture is very explosive, if the percentage of oxygen is more than 4-5%. For this reason it's not possible to breathe this mix above 30 meters to avoid hypoxia.

Read more about hydrogen and diving:

<http://www.mindspring.com/~divegeek/mixhistory.htm>

<http://www.divingheritage.com/modernairsupplykern.htm>

<http://www.divingheritage.com/moderncomex.htm>

<http://www.saa.org.uk/ratsnest/othermixedgases.html>

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### 5. Neon (Ne), neox and neoquad:

Neon is less absorbed by body tissues than helium or nitrogen due to it's greater density, but it's also very expensive gas compared even to expensive helium. Instead of pure neon, there has also been use for *crude neon* mix, which is a mixture of 75% neon and 25% helium (crude neon is a by-product in air distillation). Neon as an inert gas seems not to have any narcotic effects in a dives less than 360 m depth, and it does not cause the distortion of

voice like helium or hydrogen does. The density of neon limits it still mainly to depths less than 180 m, because neon is so slowly released from body tissues causing long decompression times. This is the reason why neon is mostly used in a short *bounce-dives*. Neon is mostly used together with oxygen (NEon+OXYgen = "neox"), or with trimix (trimix = helium + oxygen + nitrogen) to make *neoquad* mix. DCS cases, where diver has breathed neon as an inert gas, are very hard to treat because of complex recompression schedules.

An example of using neox: <http://atlanticwreckdivers.com/awd/Mitchell/frankfrt-MB.html>  
Mixed gas history: <http://www.cisatlantic.com/trimix/aquacorps/mix/MixTimeline.htm>

## 6. Argon (Ar) and argox:

Argon is very narcotic gas (much more narcotic than nitrogen) and also very dense gas leading to breathing difficulties on very deep dives, but it does not cause the distortion of voice like helium or hydrogen does. In theory argon could be used as an decompression gas on shallow depths together with oxygen (argon + oxygen = *argox*) to reduce the inert gas absorbance into tissues on ~ 9-15 m decompression stops. Argox is still very rarely used and tested gas, and argon is mostly used pure as a dry suit inflation gas because of it's good thermal characteristics.

## 7. Noble gases xenon (Xe), krypton (Kr) and radon (Rn):

Xenon (Xe) is non-toxic gas and therefore it could be used as an inert gas in breathing mixture together with oxygen (xenonox), but xenon is also very narcotic gas (it's an anesthetic gas too...) and that's why there's no real use for diving. Xenon is actually 25 times as narcotic as nitrogen. For a dry suit gas xenon could be nice, because it has very good thermal characteristics, but is has not been tested for that purpose enough. Xenon is also very, very expensive gas!

Krypton (Kr) (oxygen + krypton = kryptonox) causes dizziness, and it's not suitable for diving. Radon (Rn) is radioactive gas, and obviously not suitable for diving.

## 8. The isotopes of noble gases and other compounds:

Deuterium ( $H^2_2$ ) is a heavier isotope of *normal* hydrogen (*protium*,  $H^1_2$ ), but too expensive to use in diving. Methane ( $CH_4$ ) is relatively inert and light, but fairly narcotic and explosive as is hydrogen too. Other compounds may have some advantages with ie. in avoidance of voice distortion: for example  $CF_4$  (tetrafluoromethane), which is heavy gas but fairly bad on tissue solubility.  $N_2O$  has also been tested for dry suit inflation, but it is dangerous because it's high narcosity if it's inhaled. There's been some tests also with sulfurhexafluoride (five times as dense as air).

## 9. Narcotic factors of gases:

Narcotic factors of gases:

(Chemical sign, name, factors (divide by / multiply by) )

He, helium, 4.26 / 0.23

Ne, neon, 3.58 / 0.28

H<sub>2</sub>, hydrogen, 1.83 / 0.55

N<sub>2</sub>, nitrogen, 1 / 1

Ar, argon, 0.43 / 2.33

Kr, krypton, 0.14 / 7.14

Xe, xenon, 0.039 / 25.64

(Source: "The Physiology and Medicine of Diving" by Peter Bennett and David Elliott, 4th edition, 1993, W.B.Saunders Company Ltd, London.)

The table above is based on narcotic effect of air (=1). So, for example, xenon (as diluent gas in same percentage as nitrogen in air) in breathing mix is 25.64 times as narcotic as nitrogen. Or helium is 4.26 times less narcotic than nitrogen, etc.

It is also good to know, than oxygen is narcotic in high partial pressures. Some sources claim it to be as narcotic than nitrogen (Bill Hamilton,

<http://www.tekniskdykking.org/tekniskdykking/artikler/aqua/RWHNitrox.htm>.

## 10. Summary table:

gas	chem. sign / ingredients	use	price.: (10ltr*200bar) <small>(Finnish price converted to US dollars)</small>	other
air	78,1%N <sub>2</sub> , 20,8% O <sub>2</sub> , 0,9%Ar, 0,2% other	common diving gas	~\$ 5	compressed air is the most common gas for diving
nitrox	oxygen (O <sub>2</sub> ) and nitrogen (N <sub>2</sub> ) mixture	<i>hyperoxic nitrox</i> : see below: EANx. <i>hypoxic nitrox</i> : longer bottom times on 50-60 m dives. This gas was used mainly decades ago on commercial dives. Oxygen percentage is less than 21%.	hypoxic nitrox: ~ \$8-15	hypoxic nitrox gives you stronger nitrogen narcosis and longer decompression, but it reduces the CNS% load
EANx / enriched air	oxygen (O <sub>2</sub> ) and nitrogen (N <sub>2</sub> ) mixture	oxygen percentage more than 21%	~ \$6-15	commonly used
oxygen	O <sub>2</sub>	decompression gas	~ \$8-15	maximum diving depth 6 m
trimix	oxygen (O <sub>2</sub> ), nitrogen (N <sub>2</sub> ) and helium (He) mixture	deep diving gas	~ \$8-100 depending of helium percentage	used on deep dives for reducing the partial pressure of oxygen and nitrogen narcosis
heliox	oxygen (O <sub>2</sub> ) and helium (He) mixture	deep diving gas	~ \$50-100	used on deep dives for reducing the partial pressure of oxygen and nitrogen narcosis
argon	Ar	dry suit gas	~ \$10-30	dry suit gas, mostly used with trimix

				(which is not suitable for dry suit gas due to it's high thermal conductivity)
argox	oxygen (O <sub>2</sub> ) and argon (Ar) mixture	decompression gas	~ \$10-30	used on ~9-15 m decompression stops, see above "argox"
hydrox	oxygen (O <sub>2</sub> ) and hydrogen (H <sub>2</sub> ) mixture	deep diving gas	? \$	explosive, mixture not breathable above 30 meters
hydreliox	oxygen (O <sub>2</sub> ), heliumin (He) and hydrogen (H <sub>2</sub> ) mixture	deep diving gas	? \$	explosive, mixture not breathable on shallow waters
neox	oxygen (O <sub>2</sub> ) and neon (Ne) mixture	deep diving gas	~ \$2000	rarely used, very expensive
nequad	trimix and neon mixture	deep diving gas	~ \$2000	rarely used, very expensive
xenon	pure xenon (Xe)	N/A, (dry suit gas?)	~ \$4500	very good thermal insulator, but too expensive
xenonox	xenon (Xe) and oxygen mixture	useless for diving	~ \$4500	extremely narcotic
kryptonox	krypton (Kr) and oxygen mixture	useless for diving	~ \$8000	extremely narcotic

## 11. Where can I get training?

There is not really training courses for *exotic diving gases*, which are described in this page. Diving with hydrogen or neon is very rare, mostly commercial or related to some sort of experiences (and though dangerous...). Training courses for other gases than ordinary air:

Training agencies for nitrox and trimix diving:

### **GUE (<http://www.gue.com>):**

For example: Tech Diver 1-3 courses.

### **IANTD (<http://www.iantd.com>):**

Basic Nitrox Diver, Advanced Nitrox Diver, Technical Diver, Normoxic Trimix Diver and Trimix Diver courses.

### **DSAT (<http://www.padi.com>):**

Tec Deep Diver course.

### **PADI (<http://www.padi.com>):**

Enriched Air Nitrox Diver Specialty course.

### **CMAS (<http://www.cmas.org>):**

## **NAUI**

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