Setting Deep Stops via Ambient Pressure Reduction (APR)

By Gregory S. Porter

In my quest to learn more about decompression illness and how to avoid it I came across an excellent article by Richard L. Pyle on the importance of Deep Safety Stops. I've included a link to the file below. Richard found that if he made a deep 'safety stop' of 2-3 minutes at about 125' when ascending from beyond 200' that he would surface with far more energy than when he left the stop at 125' out. He goes into detail as to why this may occur, but in brief he felt the safety stop allowed off-gassing of the N2 before it bubbled at shallower depths where it would then be more difficult to off-gas (since it was a bubble). This bubbling at shallower depths happened because the N2 dissolved in tissues at 6+ atmospheres was more likely to come out of solution in tissue and/or blood when taken straight to 'shallow' depths - even with a conservative ascent rate. The deep safety stop allowed the N2 to off-gas while still dissolved, before bubbling occurred.

Richard suggested a linear distance calculation for setting deep safety stops during ascension, which he details in the referenced article. What seemed logical to me was to set deep stops based on a consistent ambient pressure reduction (APR) chosen by the diver. The APR method was developed because a linear ascent from depth results in a non-linear, incrementally greater reduction in ambient pressure for each equal distance ascended. With the APR model a diver would be able to make a safety stop at every depth where he realized, for example, a 30% reduction in ambient pressure. If he felt more conservative then a 25% APR (or whatever) profile could be followed.

An Excel spreadsheet was developed to define stop depths based on a diver-supplied APR%. The output is very simple. A text version example is included below that defines a 50% APR profile. In this profile, a diver ascending from a dive to 120' (left column) will realize a 50% reduction in ambient pressure at 69' (right column). Here's where he'd make his first safety stop, then find 69' or the next deepest depth in the left column (in this case 70') which indicates his next 50% APR safety stop to be at 36' (right column). This cycle would continue until reaching his normal shallow safety stop on a non-decompression dive or his first calculated (or computer generated) deco stop. A laminated copy of the Excel file's two column output can easily be carried on non-decompression dives and as a reference if needed during a bail out on a deco dive.

Phi Le (phi@skynet.be) has included this APR method for setting deep stops as well as Richard Pyle's linear distance method into his Palm based decompression program *Decoweenie*, available at Jim Cobb's Trimix website at http://www.cisatlantic.com/trimix/trimix.html. The program queries the diver for his desired APR % and length of safety stop and then includes the calculated deep stops and their times along with the rest of the output decompression profile.

Please note that this text is not intended to discuss the merits of the deep stop theory in general, rather it assumes the value of deep stops is accepted by the reader and therefore proposes a method to determine where those stops should be taken. Also note that this is not purported to be a method to determine a full decompression profile. It is intended to set deep stop(s) prior to

the deepest decompression stop defined by a diver's chosen decompression profile or to define intermediate stops on a 'deep' non-decompression dive prior to a normal shallow safety stop.

For additional information on deep stops and decompression theory see:
http://home.adelphia.net/~robworld/Bubble_Decompression_Strategies.htm
http://www.gap-software.com/decotheory.html
Richard Pyle's article is at:
http://www.bishop.hawaii.org/bishop/treks/palautz97/deepstops.html &
http://www.cisatlantic.com/trimix/pile/deepstops.html

Best Regards,
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ver 1

50 % APR

Original Depth (ft)	APR Depth (ft)
15	-1
20	2
25	6
30	9
33	11
35	12
40	16
45	19
50	22
55	26
60	29
65	32
66	33
70	36
75	39
80	42
85	46
90	49
95	52
99	55
100	56
105	59
110	62
115	66
120	69