Reperforating – Why and Effects

Reperforating a well is often one of the most advantageous and inexpensive operations that can be done – virtually at any point in a well's life.

1. The openings in the wall of the casing and the perforation tunnels are the only pathway into the formation – if these are inadequate or have been damaged by fill, debris, dirty fluids, muds, etc., the fastest and most effective way to re-establish communication to the formation is to reperforate.
2. The area open to flow at 12 spf, with 0.75" holes, is just 2% - this is inadequate for a high flow rate well.
3. Laminated formations require more perforations or a breakdown immediately following perforating.
4. Wells that have been shut in for any significant period, even as short as a few months, can often benefit from reperforating.
5. Fracture treatments often breakdown easier and will less pressure when reperforated. Case histories from the Anschutz Ranch field shown that poor perfs or damaged perfs could not be broken down by a frac until the well was reperforated.
6. Reperforating the well will rarely harm the well. The main suggestions are to use a large hollow carrier gun to get maximum connection with minimum damage. Fracturing, especially in hard rocks such as the Nugget (10,000 psi +), is easier following perforating with large hollow carrier guns. Fracturing attempts following through tubing perforating have a much higher incidence of wellbore screenouts.

Some observations on reperforating:

Bottom Line - probably 4 to 5 is acceptable. The actual number is a complex issue with no exact answer. See SPE 18843 and SPE 20634 for tests on casing strength remaining at high shot density. The variables and the conditions are:

1. Hollow carrier or capsule carrier (expendable or semi-expendable) - Hollow carrier guns sustain the charge firing and absorb the explosive forces from lateral effects of the shaped charge. Small guns often swell (large guns typically do not swell), but the casing is mostly undamaged, expect for small splits around the perforation entrance holes. Capsule guns such as strip guns, bi-wire, link jets and other expendable or semi-expendable guns force the casing to absorb the explosive force from firing the charge. In uncemented casing, the casing may split from 4 shots per foot of 20 gram charge capsules on the first gun firing. Cemented casing strings withstand the explosive forces better, but splits will occur after 2 or 3 shots of this type of a gun.
2. Cementing of the casing is critical to casing survival - uncemented casing can split on the first capsule gun firing. Uncemented casing must be shot with hollow carrier guns and may survive 2 to 4 shots before splitting if the hollow carrier guns are loaded with charges of 23 grams of explosive or less. . The worst combination to casing integrity is a large capsule BH charge; I've seen this gun configuration rip the casing open in fully cemented targets.
3. Cement Presence and Integrity - If the cement is absent, expect damage after the first or second perf run, especially with capsule guns. In well cemented targets with hollow carrier runs, we have perforated up to 7 times (North West Hutton Wells for scale by-pass) before the casing because so bad we could not get the guns through the zone.

4. Charge phasing - I've perforated well cemented surface targets three times with 60 degree phased 4-spf hollow carrier guns and created no damage at all. I've also perforated bare casing a 6 spf with 23 gram capsule gun at zero degree phasing and split the pipe. The carrier type, charge size, spacing and overlap of vertical placed shots are the keys. Zero degree phasing is the worst phasing for creating splits (very close and vertically aligned holes).
5. Charge Density - cemented casing can easily stand 16 to 20 spf of 60 degree phased DP charges if shot at once or 24 to 27 spf in two or more applications IF THE CHARGES ARE ALIGNED AND PHASING SATISFIED. See the SPE papers for details.
6. Casing Strength - in higher alloy pipes from J-55 to L-80 and maybe to P-110, the resistance to perforating damage increases (less damage), but harder pipes than P-110 are more susceptible to explosive induced cracking.
7. Dry vs. liquid filled wellbore - liquid over the gun by 50 ft will create much less gun and casing damage than firing dry.

Other factors will affect the casing strength, but most are minor - temperature, charge material (RDX, HMX, PYX, HNS, etc.), charge standoff, high vs. low order firing, charge malfunction, etc.