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**Question 91: What methods other than jack hammering, water jetting and low charge explosives have you used to remove coke during turnarounds? What are the advantages and the risks for these methods?**

**Mike Teders** (Valero)

Jack hammering is the most popular method for coke removal as it is effective and is the lowest risk to equipment. As stated early, jack hammering can be used effectively around refractory as long as the refractory has stainless steel needles. The chipping hammer will through sparks when the chipping hammer cuts through coke and starts to hit refractory. Chipping hammer operators will have to be trained to chip coke around refractory; otherwise the coke impregnated refractory may be mistakenly removed. Water jetting has been used in the main column but not in the reactor. To my knowledge we have not used any unconventional methods to remove coke.

**Tom Lorsbach** (UOP)

UOP is not aware of methods other than mechanical chipping and water jetting being used for FCC reactor coke removal. Low charge explosives are sometimes used to remove fused or coked catalyst from fixed bed reactors, but we are not aware of this tech technique being used in FCC reactors. We would not recommend using explosives in an FCC reactor. Mechanical chipping is preferred in the reactor vessel because water jetting risks damaging internal linings or having water become pocketed behind abrasion resistant linings. The disadvantage of chipping is that it is time consuming. A severely coked reactor can take up to two weeks to clean sufficiently to permit inspection and maintenance to begin. A major risk associated with mechanical chipping is potential for damage to shell cladding or cold wall linings.

Water jetting has been used to successfully remove coke from unlined reactor vapor lines. An advantage of water jetting is that it is potentially faster than manual coke chipping.

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