Cuttings reinjection is conceptually simple, as seen in Fig. 1. With many years of focusing, designing and operating Cuttings ReInjection (CRI) projects all over the world, in all types and depths of formations, the reason why CRI sometimes didn’t work for others was, frankly, simple and obvious. The company I founded, Apollo (now part of Baker Hughes), was successful at injecting drill cuttings everywhere it was given the opportunity to do so, and in over 90% of the CRI case histories, we had only one disposal conduit to work with and/or had to drill future wells within 50 ft of where we had injected drill cuttings slurries. Many of the CRI projects with which I was involved were the first ever attempted in that part of the world, even in countries that had either no previous offset well information to derive physical/rheological properties.

On projects that I took over or analyzed for operators, I was able to get the cuttings injected successfully or able to point out “what not to do” in the future. Subsequently, the operator achieved significant savings over other waste disposal solutions. Fortunately, the CRI success stories far outweigh the failures.

I have heard cases where the operator was advised by others that CRI was not suitable for the location or that the formation filled up. This statement shows a complete lack of understanding of subsurface strata. Formations do not fill up! From my experience being able to inject anywhere in the world in many different types and depths of formations, even in impermeable rock, I do not believe there is a drilling location that is unsuitable for CRI.

Cuttings reinjection is simply the lowest cost, easiest course of action for most drilling operations. I have documented costs of CRI operations in the expensive North Sea environment, as low as $5/bbl. CRI gets less expensive as the knowledge and experience of your CRI service provider grows.

Alternatives, such as bulk shipping or skip/ship, thermally/chemically treating and ultimate storing cuttings for eternity, are significantly more problematic and expensive. In some situations, where the operator believed that CRI was not the right choice, the operator chose to use a high-price, synthetic mud and dry the cuttings to meet environmental guidelines. Most if not all disposal techniques other than CRI store the cuttings/waste in the environment and are still a liability for the operator. Thus, the spending still hasn’t ended, it just has been postponed. CRI, of course, not only permanently disposes of cuttings, but also allows the mud and location to be run cleaner, because there is no underlying force to minimize waste streams.

So why did CRI, to my knowledge, work on every job that I was associated with, even in cases where experts advised against it? I believe success begins with a good foundation, and with CRI, a good foundation begins with understanding how the subsurface formation will react to cuttings injection, not just at first, but all the way through the project. It goes without saying that, as you inject drill cuttings into the formation, the formation will change. As the formation changes, how and what you continue to inject is crucial. For instance, if you are injecting into a sand, as you fill the sand pores with hydrated clay from the cuttings slurry, you now have a hydrated clay/sand formation.

In “less than simple” CRI projects, the new formation reacts differently than when CRI operations began. If the
service company does not change how/what they are injecting, then the formation either plugging, fills up (as some call it), or breaches to the surface. Incidentally, I have not heard of anyone plugging a formation at the beginning of a CRI project.

The injection formation is the place to start when planning a CRI project. As in building a drilling rig, every other part, while important, is useless without a good foundation. Analyzing the subsurface design is only one of the many difficulties CRI planners face. Other challenges include designing the disposal conduit and deciding what type of unit to install on the drilling rig or platform, how to get the necessary utilities, where to put the CRI unit, how to get the cuttings to the CRI unit, who to manage and run the CRI operation (you certainly don’t want your most talented personnel running a simple operation that would bore them to tears), what slurry properties to use, what the injection program should be, working with the operators management team, etc., Fig. 2.

Inadequately meeting just one of these challenges will result, and has resulted, in slowing or shutting down rigs, plugging formations and causing operators to become concerned about the feasibility of injecting cuttings in some areas. When a CRI project runs afoul, it is difficult for operators, who manage the entire drilling process, to fully understand what actually went wrong. Separating what didn’t work from what did work is critical in designing future CRI operations.

Consequently, there still are areas that operators do not inject and have instead used amazing, problematic, expensive solutions to get the cuttings off the rig and to a storage/treatment facility. New techniques and equipment have been established that would make these areas feasible for injection. To reduce cost and simplify operations, operators will likely look more to CRI as the lowest-cost fluids and waste management solution as time goes on.

THE AUTHOR

Jeff Reddich is former owner and founder of Apollo Services. Before its sale to Baker Hughes, Apollo was the world leader in CRI services and the largest independent company for cuttings skip/ship, vacuuming, drying and injection. Mr. Reddich is a registered mechanical engineer. He earned a BSc degree from the University of Louisiana at Lafayette. He has over 30 years of domestic and international drilling and waste management experience. As chief engineer of a prominent drilling contractor, his responsibilities were to design, build and operate drilling rigs, some of which required zero-discharge modifications and cuttings-handling/processing equipment. With over 15 patents, three SPE papers and several new patents pending, Mr. Reddich introduced CRI to many operators and regulators around the world.