Improving Chemical Effectiveness Through Continuous Injection

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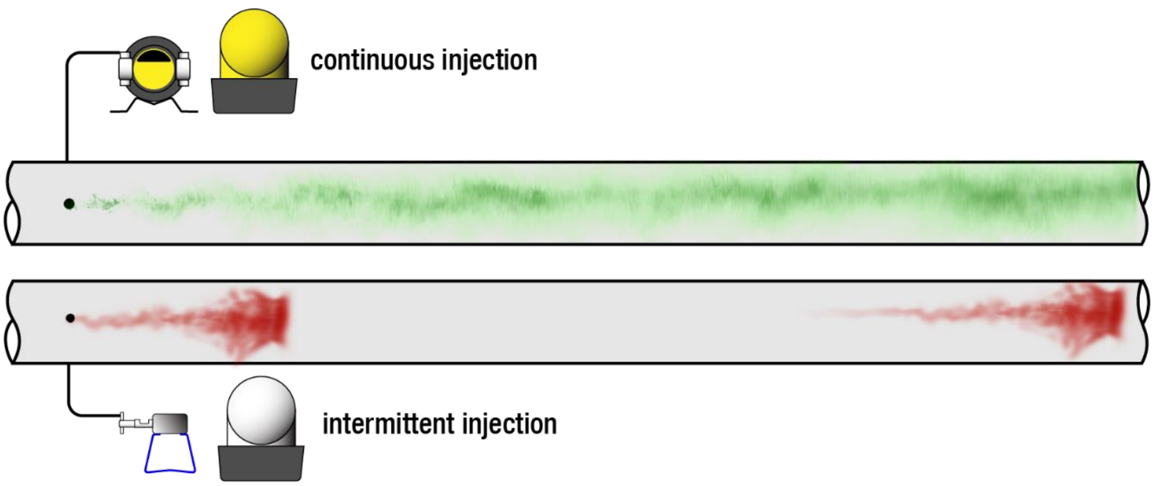
The cost of chemical treatment is a significant operating expense in upstream and midstream oil and gas operations. This paper addresses how continuous chemical injection improves the dispersion and effectiveness of chemical treatment when injecting into a flowing pipe stream. The graphic below depicts the difference in continuous injection compared to the more traditional intermittent injection.



Ineffective chemical treatment may result in unnecessary equipment repairs or lost revenue from unscheduled shut-downs. For example, poorly treated production fluid can cause pipeline corrosion starting in the wellbore and continuing through downstream gathering systems and facilities. In general, a very small volume of treatment chemical is required to treat a very large volume of process fluid, where the effective *dispersion* of this chemical is paramount in achieving complete chemical consumption in all areas of the process stream.

Chemical Injection Mitigates:	
Friction	Asphaltenes
Corrosion	Hydrates
Foaming	Wax
Freezing	Scale
	Microbes

In most cases, the necessary chemical treatment rates are determined by an ideal ratio or concentration, where *lower* than ideal injection rates will not provide complete treatment, and *higher* than ideal rates result in unused (wasted) chemical which, in some cases, can cause other issues such as fluid compatibility or unwanted emulsions.

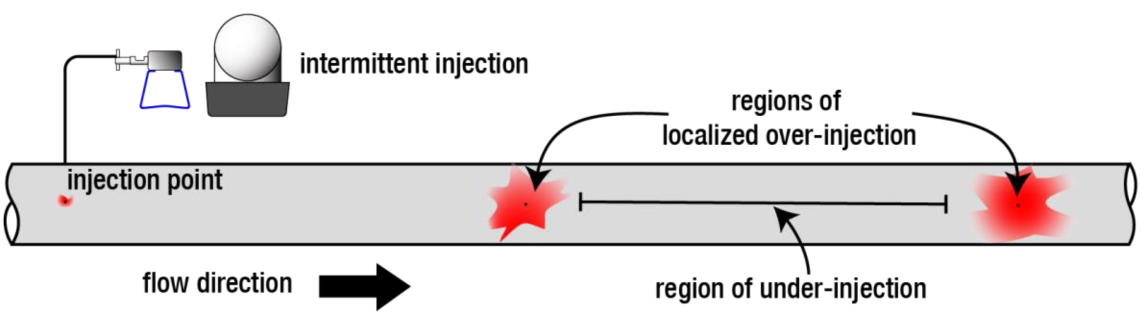
Both under-injecting *and* over-injecting can be expensive

Chemical injection pumps meter fluid by injecting in discrete doses equal to that of one pump plunger stroke. When injecting in to a moving pipe stream, this can result in discrete 'blobs' of injected chemical that travel down the length of the pipe, which are left to be passively dispersed (mixed) throughout the moving flow stream in order to provide complete coverage.

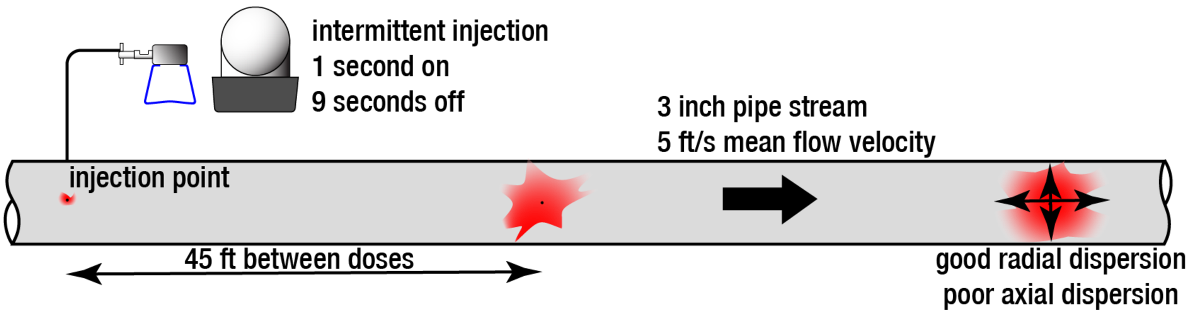
Even though an operator may be injecting the ideal volume of chemical (when measured over the course of a day, week or month), they may not *necessarily* be ensuring an effective treatment program. Within the moving flow stream, the intermittent injection behavior results in localized areas of over-injected chemical (blobs) spaced between longer lengths of untreated fluid.

Ideal treatment requires:

1) Accurate rates
2) Effective *dispersion*



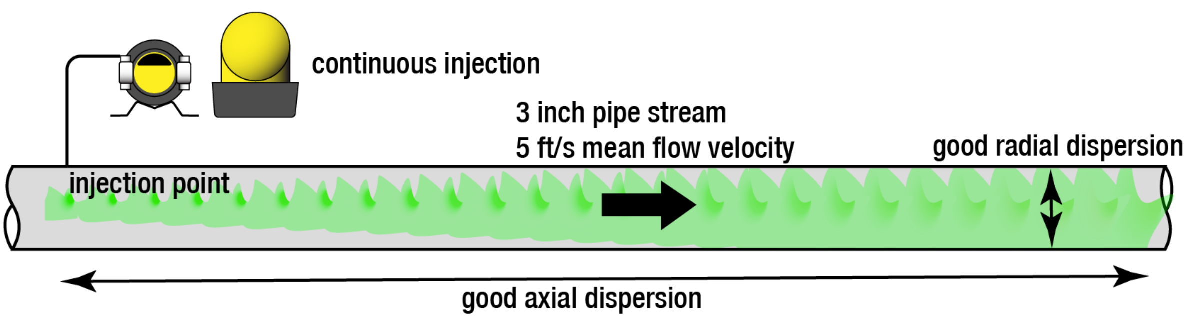
Most chemical pumps today are controlled by a timer to achieve a given number chemical doses per minute. For example, a pump that outputs a maximum of 100 Q/d would run 10% of the time to output a desired value of 10 Q/d. The on/off timer would run the pump on for, say 1 second, and off for the next 9 seconds of a 10 second cycle.



In the example above, when injecting in to a moving flow stream, this 9 second dwell time results in 45 ft of distance between the injection doses. In order to achieve complete dispersion, each chemical dose will need to be naturally dispersed by 45 feet in the axial direction to fully treat the flow stream. The distance between squirts varies significantly and its effect is amplified when injecting low volumes of chemical into fast moving pipe streams. In many cases a squirt of chemical only treats the pipe stream every 100 feet or more!

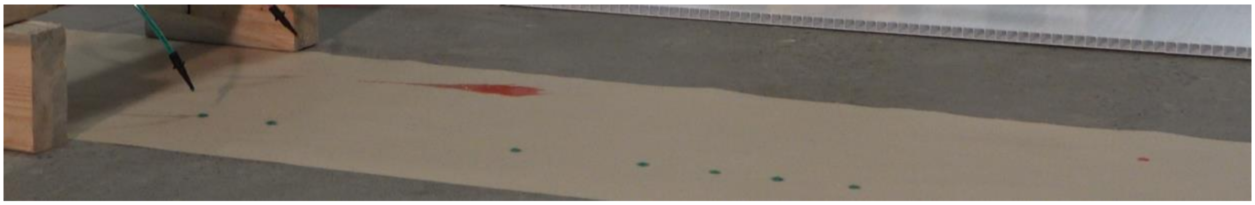
While dispersion rates are highly dependent on flow characteristics specific to each case, Sirius has shown that the *most effective* and least obtrusive way to diminish this effect is to *eliminate the dwell time (or the axial distance travelled) between discrete injection doses*.

The Fusion™ pump from Sirius Instrumentation and Controls features a relatively low injection volume per stroke (requiring more strokes per minute to inject a given rate) as well as variable speed control to allow the pump to operate continuously, *without any timed injection delays* during operation.

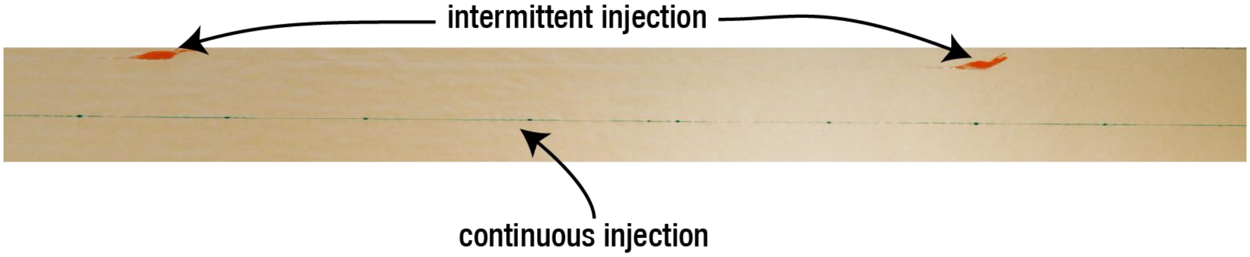


This uniform and continuous flow maximizes the chemical contact time with the flow stream, and. ensures the chemical has the best opportunity to disperse both radially and axially in the flow stream. Most chemical treatments become more effective as contact time increases. By ensuring axial dispersion occurs as quickly as possible, it permits the chemical to have more contact time with the medium and allows it to react as designed.

This difference can be illustrated by setting up two pumps and injecting colored dye on to a travelling sheet of paper. The image below shows a timer controlled (intermittent) pump injecting red dye vs a continuous pump injecting green die. Both pumps are injecting an identical rate of 10 quarts per day on to the paper.



Lowering the nozzles to touch the paper prevents the formation of droplets and better illustrates what the chemical distribution would look like when injecting in to a liquid flow stream.



Improved dispersion through continuous injection best assures that the closest to ideal injection rate can be used to fully treat the flow stream. In real world applications, operators have reported significant performance gains after retrofitting from an intermittent to a continuous pump:

- An East Texas operator reduced consumption of foaming agents by 67%, while stabilizing well production and reducing well workovers and downtime.
- A West Texas operator reduced pipeline corrosion rates by 80%, while also reporting a reduction in chemical consumption.
- A West Texas operator reported a 50% reduction in H_2S scavenger consumption required to meet sales gas requirements at a downstream H_2S analyzer.

For more information, visit www.siriuscontrols.com and review our application studies, or watch our video at https://youtu.be/0OIuKNrKEoI