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THE RADFLOW™ THICKENER FEEDWELL: REDEFINING THICKENER SIZING AND FLOCCULANT USAGE

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ABSTRACT

The development of the novel Radflow™ thickener feedwell and its successful application is investigated. Typical thickener feedwell deficiencies were demonstrated and systematically overcome to ultimately culminate in the design of an advanced feedwell. Scale model methodologies, in addition to Computational Fluid Dynamics (CFD), are presented to show the Radflow's superior energy dissipation characteristics in comparison to other standard industrial feedwells.

Three Radflow feedwell case studies are then presented; two retrofits and a new thickener installation by Roytec Global (Pty) Ltd. These case studies demonstrate that the *standard thickener design heuristics* (rules of thumb) of limiting rise rates and flux rates are *excessively conservative* when operating a thickener with a more *efficient feedwell* design. Alternatively, it is shown that if the Radflow is used in a thickener that has been conservatively sized or operated, then it is unnecessary or sometimes even counterproductive to follow the standard practice of enhancing the settling characteristics. Excess flocculant adds to additional operational expenses, but can also limit the achievable underflow density. Additional dilution of the feed can also attribute to design and operational complexities, along with added energy consumption.

Hence, an argument is presented that the thickener design scale-up *safety factors* (limiting rise and flux rates) are *relaxed* to more reasonable values, which approach the free-settling rates achieved in laboratory tests, if a well-designed feedwell is used. This is because the specific volumetric sizing flux ($m^3/m^2.h$) can approach the limit of the free settling rate when a thickener's flow dynamics are tightly controlled. This is particularly important in dealing with slow settling (and notoriously difficult to thicken) materials such as clays and fine precipitates. However, since thickener diameters are often dictated by external parties or other factors, a consolation argument is made (for conventionally sized thickeners) that the flocculant dosing rate should be minimized during thickener commissioning, to a level where the operational liquid rise rate is marginally lower than the floccule free-settling rate achieved in laboratory tests. This argument can be extrapolated to an extreme case in which some conservatively sized or operated "high-rate" thickeners may not require any flocculant at all and hence revert back to a so-called "conventional" thickener. While this may not be a practical or feasible for most thickeners, there are applications in which the use of polymer flocculants is undesirable and hence the Radflow feedwell presents an elegant enabling solution by limiting the thickener size for these cases.

Keywords: Feedwell, flocculant dosing, thickener sizing, thickener rise rate, thickener flux, Radflow™ feedwell