Paste and Thickened Tailings – A Guide (Second Edition)

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The first edition of the "Paste and Thickened Tailings - A Guide" published by the Australian Centre for Geomechanics in 2002 played an important role in helping academics and practitioners establish common terminology and understanding in this rapidly advancing field. Launched earlier this year the second edition further builds on this by including new chapters on slurry chemistry and reagents, and a substantially expanded case studies chapter.

"Paste and Thickened Tailings - A Guide (Second Edition)" comprises of twelve chapters, each written by internationally recognised experts, covering all aspects of paste and thickened tailings from preparation through to surface and underground disposal and mine closure. The editors note that the guide is not a design manual and is rather intended to provide guidance and advice for professionals considering implementing a paste and thickened tailings system.

The chapter on sustainability notes that it is important to examine full life-cycle costs before selecting a tailings disposal system. Apart from reduced operating and closure costs, paste and thickened tailings systems may also offer non-monetary benefits in terms of improved public perception regarding environmental and social issues. Increasingly, for many operations production is limited by water availability.

A good appreciation of rheological concepts is important in understanding the key processes related to paste and thickened tailings systems: tailings dewatering, transport and disposal. The rheology chapter provides a detailed overview of these concepts and includes the suggestion that tailings disposal systems are designed to meet the rheology required for the selected disposal method.

The chapter on material characterisation notes that some tailings properties change during the preparation, transport and disposal processes; most significant of these is the change in the tailings mixture rheology. Guidelines for relevant measurements for characterising the tailings for each of these processes are presented. The author warns that beach slope angles determined from laboratory flume tests should be treated with caution as there is no accepted method yet for predicting deposition slopes from laboratory tests. The chapter concludes with a useful check list of material properties that should be measured for the thickened tailings projects.

It may be the least accessible chapter in the guide, but the slurry chemistry chapter deals with issues that are critical to implementing successful systems for tailings containing clay minerals. The authors describe how the colloidal properties of the clay suspensions influence the tailings rheology and behaviour during sedimentation dewatering. It is likely that future significant advances in paste and thickened tailings will be dependant on a proper understanding of slurry chemistry.

The chapter on reagents provides an interesting history of the development of flocculants and coagulants – I am pleased to finally know the difference between the terms "flocculant" and "flocculent"! Reagents are a significant cost for many paste and thickened tailings systems. The

authors' overview assists designers and operators to optimise reagent selection and dosage by providing a good understanding of flocculation and coagulation mechanisms and the factors that affect reagent performance.

The chapter on thickening and filtration provides an excellent overview of the thickener types and the methodologies used for sizing thickeners. They note that sizing paste thickeners is largely based on experience with similar installations. The various types of filters used to produce paste are described with the relative advantages and disadvantages of each type. Useful indicative costs are provided for thickeners and filters.

The transport chapter discusses the flow behaviour of paste and thickened tailings in pipelines. The relative advantages and limitations of centrifugal and positive displacement pumps are reviewed and the author notes that life-cycle costs must be evaluated when selecting the pump type. Transport of paste by truck and conveyor is discussed although these modes are not widely used for surface tailings disposal. The chapter concludes with a review of aspects to consider when undertaking an economic evaluation or comparison of transport systems.

A balanced assessment of the advantages and disadvantages of surface disposal of paste or thickened tailings compared with conventional tailings is presented in the above ground disposal chapter. The author notes that although the concept of high density tailings disposal technology was first implemented over 30 years ago, the adoption of the technology for surface has been slow. This is ascribed to the lack of reliable methods for producing and transporting tailings. With the recent advances in these areas it is expected that implementation rate of paste and thickened tailings systems will accelerate. The chapter details considerations for design, operation and management.

The mine backfill chapter discusses the interdependence of backfill composition, underground benefits and legal compliance. This is illustrated by considering the benefits of underground paste disposal for base metal, coal, gold and platinum mines. The author reviews underground rock mechanics requirements, environmental requirements and considerations for ensuring successful paste transport. Examples of two underground paste disposal projects are presented to illustrate the application of underground paste backfill technology.

The closure chapter notes that although all mining operations have a finite life, the mining operation remnants (including the tailings storage facility) have an almost infinite life. The mining company, in consultation with local communities and authorities, must develop a suitable final closure design that meets the requirements of all stakeholders. The chapter deals with safety, stability, aesthetics, acid mine drainage, financial issues, reclamation and rehabilitation.

The guide concludes with twelve excellent case studies for surface disposal of paste and thickened tailings. The studies cover a broad range of systems illustrating the applicability of the technology for different applications. This chapter will be extremely valuable for anyone contemplating at paste and thickened tailings system. However, the value of the case studies could be enhanced by more consistent reporting of key parameters (e.g. rheology and beach slope) and identification of key lessons learnt from the system (i.e. what did not work, how the system was improved).

In summary the guide makes an extremely valuable contribution to the advancement of paste and thickened tailings technology. It is a key reference for all professionals in the field.

For further information or to obtain your copy of the Australian Centre for Geomechanics' *Paste and Thickened Tailings - A Guide (Second Edition)*, please contact Josephine Ruddle via acg@acg.uwa.edu.au