**Check One:** [ ] **Project** [x] **Review** [ ] **Collaboration**

[ ] **Workshop** [ ] **Other**

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| **Descriptive Title** | Mechanistic understanding of the role of adsorbed water on the bulking/swelling of fine particles |
| **Working Title[[1]](#footnote-1)** | (Don’t) Blame it on the rain |
| **Technical Area[[2]](#footnote-2)** | Dry Systems |
| **Date** | 6/17/25 |
| **Short Description** | The interaction of liquids on solid surfaces can produce changes in the physical characteristics of the powder bed. A common source of this is moisture sorption via ambient humidity in powder handling. Problems observed in powder handling are often reflexively blamed on this adsorbed moisture and/or accompanying moisture in the product. This “tramp” moisture is observed to (ostensibly) cause bulking/swelling/sticking in a dynamic environment for particle testing and/or handling.Common solutions include installing climate control to regulate the relative humidity, nitrogen purging or addition of desiccants to formulations. While effective not all of these solutions are viable to meet margins in mass production while the actual role of water in these effects remains elusive. Conversely other industries such as food science include additives to purposely facilitate bulking as a desired product attribute.This review is intended to comprehensively describe the phenomenon of bulking in dry powders and their impact, deliberate or otherwise, to the powder bed.. |
| **Objectives** | Review the mechanisms for bulking such as water or other additives and scope for impact to attributes of the powder bed such as bulk density, air-flow permeability and cohesion. |
| **Scope** | Adsorption of moisture on a solid surface. Bulking is meant to be distinguished from caking.  |

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1. Title used in meeting agendas and file archives [↑](#footnote-ref-1)
2. One or more from the following list: W = wet systems; D = dry systems; F = particle formation; SR = size reduction; M = modeling; SE = systems engineering [↑](#footnote-ref-2)