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Computational fluid dynamics (CFD) has become an important tool for evaluating hydrodynamic forces and for hydraulic design. CFD has led to innovative solutions that improve safety, reduce construction costs, and increase project functionality. CFD also has the potential to become a project's Achilles heel if abused. This paper presents a rare look at the limitations, risks, and failures of CFD and presents methods for owners, project managers, and CFD modelers to avoid certain pitfalls, including:

1) Using CFD to prove preconceptions rather than evaluate the hydrodynamics:

Engineering judgement must be taken into account compared to the findings of CFD models, but when CFD results do not support preconceived notions it is critical to resolve whether the CFD or the engineer's judgement is correct.

2) Using CFD in lieu of physical models where not appropriate:

The low cost of CFD relative to physical models is driving engineers to use CFD where it is not appropriate. The justification for this misuse is that the project cannot afford a physical model and that the CFD model, while not appropriate, is better than nothing. This justification is incorrect: Having no model is better than an incorrect CFD model. False confidence in CFD results can lead to the construction of poorly performing or unsafe projects.

3) Improper code application:

All CFD codes are not created equal. CFD codes are validated and calibrated for specific applications. While an application may lend itself to CFD in general, it is important to understand the limitations of specific CFD codes and apply them appropriately.

4) Model uncertainty is not quantified:

While indispensable in many applications, no CFD model is perfect, nor are the inputs certain. Understanding the cumulative uncertainty is fundamental to proper application of model results.

In light of the pitfalls above, Alden has developed specific methods to minimize the risk in using CFD. These methods and several case studies specifically related to dam safety will be discussed in detail to help owners in the preparation of CFD bid specifications, project managers in managing CFD engineers, and CFD engineers in understanding the limitations of their models.