

DS09
J. Linch

#750

August 16, 1989

8:17 A7:30

Chief, Regulatory Publications Branch
Division of FOI and Publications Services
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

(4)

54FR25762
6/18/89

Dear Sir,

In the following, I detail my comments on, Technical Position on Tectonic Models in the Assessment of Performance of High-Level Radioactive Waste Repositories. Because I received the above document late, my comments are necessarily restricted. I would appreciate another opportunity to comment at length.

I have a Ph.D. in structural geology and experience in the use of Tectonic Models in oil exploration and in the evaluation of high-level radioactive waste repositories. The following comments are my personal comments and do not represent those of any Federal agency, business, academic or other institution.

I agree wholeheartedly with the operational definition of Tectonic Models (page 5, paragraph 2) as devices to "...describe the geometric(al), mechanical and kinematic(al) relationship among observed structural features....". However, in my opinion, the document only uses examples of, and is primarily concerned with the utilization of geometric (conceptual) models. I believe that the regulatory requirements call for and the state-of-the-art demands that both kinematical and mechanical models be utilized to the greatest extent possible.

From a historical perspective, geologists have long failed to adequately differentiate among the three types of models. In my opinion, such practices remain in recent, 1989 vintage papers in prominent, refereed journals. Because of this confusion, I believe that it is important to provide unambiguous guidance on the limitations of and appropriate uses for each type of model.

I have used geometrical, kinematical and mechanical models to describe the same geologic feature. Thus, I believe that I have some insight into the differences among the models, their respective limitations, and their appropriate uses. The following are some comments that may be suitable in any further discussion on this topic in a revised draft.

Geometrical models - These models are the most limited. They are constructed using graphic techniques such as constructing parallel arcs with a compass (Busk Method). They often make use of the assumption that constant bed thickness must be maintained. They are often constructed to show sequential views giving snapshots in the kinematic history of a geologic feature. They

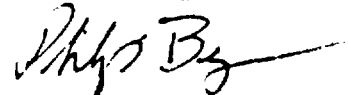
are constrained only by the initial assumptions and could be both kinematically and/or mechanically impossible i.e. violate assumptions about conservation of mass or energy. In my opinion, from a licensing point of view, they are inadequate for documenting alternative conceptual Tectonic Models.

Kinematical models - These models describe the motion of points in time. They have limited usage to document that observed structural features may have formed in a predicted manner without violating any initial assumptions about maintaining constant bed length or constant bed thickness. In my experience, such kinematical models require instantaneous changes in the velocity of particles but lack a physical basis for such particle velocity discontinuities. In my opinion, from a licensing point of view, these models are adequate to document that conceptual models may be internally consistent.

Mechanical models - These models are best suited to the licensing arena. They can incorporate physical processes as constraints and thus do not require simplifying geometric constraints. Unlike geometric or kinematic models, their complexity is unbounded. In my experience, unlike geometrical or kinematical models, mechanical models produce results that may be counter-intuitive and thus may serve to identify unanticipated processes or events. I have also found that apparently logical geometrical models give results that profoundly conflict with results from mechanical models. In some cases, the assumptions on which the geometrical models are based, are found to be overly constraining. These assumptions are not needed to mechanically model a particular geologic feature and thus violate the Principle of Occam's Razor that simplest is best.

Thank you for the opportunity to comment.

Sincerely,



Dr. Philip Berger
4754 Mussetter Dr.
Ijamsville, MD 21754