What is the intellectual merit of the proposed activity?

The PIs propose a long drift through limestone/dolomite from an existing chemical limestone mine down to an ancient thrust fault. The drift then does a switchback and continues to follow the limestone unit to the deep laboratory site.

The existing mine provides some confidence that large openings can be constructed in the limestone unit at depths of 1 km or less but I am not aware of any mine in a limestone unit down to the depths (pressures and temperatures) proposed for the deep laboratory. I also have some concerns regarding the ability to mine through the fault zone. It is an ancient fault but the PIs do not know the condition of the rock or the nature of the stress field. The proposal mentions large-scale faults/fractures in the area but does not elaborate as to their locations, size, or frequency. This is also a 'green' field site and thus expensive.

The proposed location in western Virginia while admittedly close in distance to much of the U.S. population, is still in a rural area and not as accessible as would be ideal for a unique national facility. Also, the location may be too close to BNL and Fermilab to do the very long baseline physics experiments.

The PIs point out that this site is in sedimentary rocks. This does have some advantages in terms of the repeated section of rocks with the same chemistry but different PT conditions but as the drift will be exclusively through limestone/dolomite this is much less of any advantage than if they could access a spectrum of sedimentary rocks. The microbiology may be limited as the host rocks have neither Iron nor Sulfur for microbes to use as an energy source. I also don't understand the utility of storing carbon dioxide in a carbonate unit, which would dissolve if the stored carbon dioxide gas comes in contact with water.

The research team is well qualified to build the proposed facility. The PI is the Provost at
Virginia Tech. This is good in that he can commit resources that an individual faculty member cannot but I also wonder how much time he can devote to this project. It is also unclear if he has a significant research interest in the proposed facility. He seems to be a manager rather than a chief scientist. The institutional support for the S2 phase of the proposal is excellent.

Environmental/permitting issues related to this proposal seem minor.

What are the broader impacts of the proposed activity?

Community support for this project is excellent. Dr. Pfiffner and Ms. Sharp have excellent experience in outreach/education programs. The local community has agreed to donate land for a visitor's center and Ms. Sharp has the experience (and time) to develop an outstanding facility. Dr. Pfiffner's experience in the South African gold mines is also very relevant but I wonder how much time a research professor could (and should) devote to outreach and education.

This proposal plans to attract men and women from rural America into Science and Engineering. I take a broad view on diversity so I feel that this goal is worthy and relevant.

I am also impressed with the long list of researchers who plan to use the proposed facility.

Summary Statement

Overall, I rank this proposal very good. Both the research and outreach/education teams are excellent. If this proposal was for just the shallow laboratory, I would rank it as excellent. My primary scientific/technical concerns are 1) whether or not the geology is well enough constrained to mine through the fault zone and construct large, stable caverns in limestone at depths of 2.3 km; 2) is this facility too close to BNL/Fermilab to conduct the very long baseline experiments?; and 3) costs of a very long drift. S2 funding would allow the PIs to address some of my concerns.