August 23, 2004

Mr. Jim Reid
The Falconer Group
Facilitator, DUSEL Public Involvement Facilitator

Dear Jim:

Attached you will find the executive summary of the DUSEL-Cascades pre-proposal. We hope it will be helpful to the committee. This document will be posted on the DUSEL website and will be distributed to others in the community.

The project proponents who authored the summary are Kaleen Cottingham (project consultant), John Wilkerson, and me. Individuals who reviewed parts of the document on behalf of the University include Craig Hogan (Vice-Provost for Research), T. C. Richmond (for the Attorney General's Office), and Marilyn Cox (Director, Capital and Space Planning).

Any questions about this document or the larger pre-proposal can be directed to me at the address noted below or by email at icicle2@phys.washington.edu.

Best regards,

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Summary of the Pre-Proposal for DUSEL-Cascades

Background

The Deep Underground Science and Engineering Laboratory is a proposal to the National Science Foundation to create a deep-underground laboratory for basic research in physics, astrophysics, earth sciences, microbiology, and engineering. Building a laboratory at great depth allows physics and engineering experiments to be done in an exceptionally clean environment, away from the cosmic rays and other "noise" that interfere with measurements on the earth's surface. Earth scientists and microbiologists want depth in order to understand how the deep subsurface influences our surface environment, and to identify, understand, and make use of the exotic microbes that live deep within the rock.

DUSEL-Cascades Pre-proposal Components

The DUSEL-Cascades pre-proposal discusses the three project components:

- **The underground laboratory:** This would consist of a portal (tunnel entrances) at the base of Cashmere Mountain, two 3-mile parallel tunnels under the mountain, and a series of rooms for experiments at the tunnel ends.
- **The Science/Administration Center:** This, the main center of activity, would be sited in or near Leavenworth. Here, scientists, technicians, postdoctoral researchers, and students would monitor experiments, build detectors, and analyze data.
- **The Visitor Experience Center:** The Center's staff would host K-12 students and teachers interested in science, conduct public outreach programs on science, and sponsor research in science education, in partnership with community and educational groups. The Center would also be sited in or near Leavenworth.

Selection Process and DUSEL-Cascades

The current National Science Foundation (NSF) DUSEL site selection process, which runs through 2006, will examine 6-8 proposals, including those from:

- Cascades (Washington),
- the Henderson Mine (Colorado),
- the Homestake Mine (South Dakota),
- the Kimballton Mine (West Virginia),
- Mount San Jacinto (California), and
- the Soudan Mine (Minnesota).

The NSF is expected to consider the geologic suitability, construction costs, operations costs, permitting, and the scientific environment in deciding which site can best meet our nation's needs.

The DUSEL-Cascades proposal is headed by scientists at the University of Washington. This site was identified in a national search described in Appendix C of the pre-proposal, and selected after a review by two groups of geotechnical experts. Its virtues include horizontal (tunnel) access, excellent geology, excellent depth, good access, low operating costs, and most important,

a long history of successful tunneling in the Mt. Stuart batholith, where the site (Cashmere Mt.) is located.

The University of Washington's conclusion that Cashmere Mt. is the best site for DUSEL will be reviewed in the SEPA/NEPA environmental evaluation of DUSEL-Cascades, as well as in the NSF decision-making process. All viable alternatives will be evaluated as part of the SEPA/NEPA environmental impact statement.

DUSEL-Cascades: Potential Benefits to Area

1. Potential Impacts of Basic Science and Technology Discoveries at DUSEL

The nation's economic and physical well being increasingly depends on basic science discoveries that enable new technology, engineering, and medicine. The applications of DUSEL science include improved medical tools for diagnosing diseases, cleaner materials important to the computer industry, new pharmaceuticals, non-aggressive tools for verifying compliance with nonproliferation treaties, identification of microbes helpful in environmental remediation, new tools for assessing the sustainability of our water resources, and the possibility of identifying (and potentially even relieving) underground stresses that are the precursors of earthquakes.

DUSEL-Cascades discoveries can also enrich all of our lives by allowing us to better appreciate the wonder of our remarkable universe. Within the decade DUSEL scientists may be able to tell us the nature of the "dark matter," the major constituent of the universe that pervades all space, but somehow remains invisible to us. DUSEL biologists will be the first to inventory the indigenous communities of microbes that inhabit the deep subsurface – a rich biology that today is almost unknown to us.

2. The Potential Importance of DUSEL-Cascades Education Efforts

One of the nation's impending crises is a lack of technically literate citizens needed for the changing US economy: too few of our children aspire to be scientists, engineers, and technicians. A large fraction of the scientists who will work at DUSEL will be graduate and undergraduate students from universities throughout the US and abroad. DUSEL will be their introduction to research. The DUSEL Visitor Experience Center outreach program will focus on K-12 children, their teachers, and their parents, while also engaging the general public.

3. The Local Economic Impact of DUSEL-Cascades

The DUSEL operations plan calls for the hiring of over 100 support personnel, 15 permanent faculty scientists, and 25 young researchers at the postdoctoral, graduate student, or undergraduate student levels. Most of the support positions are white-collar or technical, including engineers, mechanics, machinists, electricians, librarians, chemists, computer support technicians, professional operators, personnel/benefits/financial managers, educators, design staff, and administrative assistants. Detailed personnel projections are given in the pre-proposal. Most scientific laboratories expect to provide significant training to new employees because of the specialized nature of the work.

On average an additional 100 personnel will work within the Science/Administration Center as visiting scientists (faculty and/or student). These researchers would typically visit from a few days to several months, and thus need hotels or longer-term housing.

Shannon and Wilson Inc. has estimated, based on construction projects similar to DUSEL, that two-thirds of the construction work force would come from the local area. Specialized crews, such as Tunnel Boring Machine (TBM) operators, would not be local.

While DUSEL has no fixed lifetime, NSF has discussed the laboratory in the context of 40 years of operations and an annual science budget of approximately $50 million. Approximately $24.4 million is required annually for laboratory operations, including salaries, services, and travel, almost all of which would be spent locally. An additional $1 million/year is estimated for building services that a local vendor would provide. The remaining $25 million would be invested in experiments, a portion of which would also be spent locally (visitor support, installation costs, experiments mounted by local researchers).

Basic research centers typically have high economic multipliers. An example of a service provider that might be new to Chelan County is a liquid helium supplier. Three industries have already expressed interest in doing research at DUSEL: a San Diego pharmaceutical company (interested in geomicrobiology), an IBM research group (interested in cosmic-ray-induced errors in microelectronics), and an underground engineering firm.

The Visitor Experience Center will be active year around. There may be opportunities to coordinate the outreach efforts of the Visitor Experience Center with those of the Audubon Center and National Fish Hatchery, to add a science component to Leavenworth tourism.

4. Enriching Local Life

The new people who come to the area because of DUSEL-Cascades – a core of permanent faculty, plus many visitors, some of whom will frequently return – will have an impact beyond economics, research, and education. They will become part of the community. The DUSEL-Cascades visitors will be remarkably diverse, coming from around the world, and representing a wide range of disciplines.

DUSEL-Cascades will establish close relationships between Leavenworth/Chelan County and the University of Washington. If DUSEL-Cascades is selected, many of the university's best professionals will be working with community leaders and with state officials on planning issues of mutual importance. Project proponents see other outgrowths of these partnerships. One possibility is the potential use of the Visitor Experience Center as a base for University Extension, thereby given local citizens opportunities to continue their education. There will also be opportunities for coordination with Wenatchee Valley College.

5. Research of Special Regional Relevance

While the principal science activities will be physics, earth science, and geomicrobiology, the laboratory will host other activities of interest to the local community and regional institutions (including the UW, Washington State University, and the Forest Service). We plan to use the surface campus as a base for field studies in ecology, including forest fire recovery and stream restoration. Laboratory infrastructure—support staff, computing, chemistry and microbiology labs—would make the campus an attractive base for graduate and undergraduate students and other researchers wanting to do field work.

One of DUSEL's major earth-science research goals, gaining a deep understanding of the behavior of subsurface water, deserves special note. If DUSEL is sited at Cashmere Mountain, the nation's first long-term study of the coupled surface and deep subsurface processes that govern the stability and purity of water sources would likely be conducted locally, for that mountain environment. The results could help guide local water policies for generations to come.

Potential Adverse Impacts: Construction

1. Potential Coring Impacts

Prior to a final decision by the NSF, coring of the deep rock must be done to check rock competence, water quality and conductivity, and the temperature gradient. Potential adverse impacts include the physical impact of the drilling rig (the staging area is about 40 feet by 40 feet) and noise associated with a daily helicopter bringing materials and water (the lubricant) to the mountain site or sites. The work would likely be done in the fall, to minimize potential interference with nesting birds. When the coring is completed, the small hole (the cores are typically two inches in diameter) will be capped and all equipment and materials removed. There should be no lasting evidence of this activity.

2. Potential Portal-Area Staging Impacts

The bulk of the heavy construction is tunnel construction, which will be done by a tunnel boring machine (TBM). Laboratory rooms, which account for about 25% of construction, will be done by the conventional drill-and-blast method. Laboratory finishing includes concrete floors for the tunnels and rooms and application of a sealant to tunnel walls. The plan, prepared by Shannon and Wilson, Inc., envisions the completion of heavy construction in 2.6 years.

Staging areas for a project of this size are typically about five acres. Staging activities include trucking (discussed below), materials storage, cement mixing, and various other activities typical of construction projects. Near the portal (but outside the riparian region) there are adequate flat areas for staging.

The pre-proposal describes efforts to reduce the size of the DUSEL staging area, such as off-site construction offices and storage. We have proposed moving many activities underground, into a large portal room at DUSEL-Cascades, to minimize construction sounds. (We are working on a design for the portal that will allow trucks to immediately enter the tunnel, turn on an arc, load underground, and leave the tunnel.) However, even after all such steps are taken, surface impact will be substantial during construction.

Because of surface impact concerns, the TBM will be assembled in sections, with each section pulled underground before the next is assembled. Disassembly will be done similarly.

TBM's, invented for urban construction, are much quieter than drill-and-blast and produce very little powder/dust. They are electrically powered. Once the TBM has penetrated past the portal area, there should be little noise or light generated. Drill-and-blast excavation will be used for one near-surface excavation, the portal room. This construction will generate substantial noise. For this reason the portal room should be constructed at a time when activities like tourism and bird nesting are at a minimum.

Staging area activities will be conducted in accordance with the conditions contained in a variety of required permits. After completion of construction, the staging area will be restored. As holder of the use permit, the University of Washington will be the responsible party.

3. Potential Trucking Impacts

The primary impact of construction on the broader valley community will be the trucking of the rock produced by the excavation. An average of 44 truck-loads (truck plus pup) of gravel will be produced per day over the 2.6 years of excavation. Trucking mitigation efforts will include:

- Carefully covering loads;
- Driving at low speeds through areas with houses;
- Scheduling the traffic so that quiet periods are preserved (including grouping trucks in fours and fives);
- Using traffic controls (temporary signals or flaggers) to help residents enter the road in areas like Icicle Island;
- Periodic cleaning of the road and any private property that is affected;
- Use of wheel washes;
- Restoring and improving the road before and after construction; and
- Retrofitted trucks using low-sulfur fuels to minimize emissions/particulates.

Even after all such steps are taken, trucking will remain a significant adverse impact on residents. Trucking may have to be discontinued on summer weekends, when the Icicle Creek Road is heavily used. Further studies by proponents, the County, and the Forest Service must be done, both to assess impacts and to identify mitigation measures (such as free transportation services) that could help keep Icicle Valley tourism strong during the construction period.

The 44 trucks/day can be compared to current traffic loads on Icicle Creek Road. On average, 1100 vehicles/day use the road. About 25% of the traffic (275 vehicles/day) proceeds beyond the Snow Lakes trailhead (onto the Forest Service portion of the road).

Trucking impact can be reduced if the hauling distance can be shortened. The Forest Service may be able to use a significant amount of the gravel for road and parking area restoration projects in the immediate vicinity. We have also suggested using the gravel to restore the County gravel pit, located near Sleeping Lady, to its original grade, converting the area to a park. Together, these projects could consume 70% of the gravel, substantially reducing the number of trucking miles. These possibilities require further study and the cooperation of various parties.

4. Potential Impacts associated with Roads, Cabling, and Power

A 12kV distribution line and high-speed cable must be brought up Icicle Creek Road to provide the laboratory with power and communications. DUSEL-Cascades power usage, estimated at 3.2 MW, can be met with current Chelan County PUD facilities. The lines will be buried for reliability and aesthetics. Others may be able to take advantage of the burial to remove overhead lines from areas like Icicle Island.

This work will be done in conjunction with roadbed improvements and resurfacing of the Forest Service portion of Icicle Creek Road. DUSEL does not require widening or straightening of the road: its present width meets standard trucking requirements. In talks with the Forest Service, no other reason has been identified that would require widening or straightening. The main adverse

impact will be traffic delays, as road construction will reduce traffic to one lane. Thus, work should be scheduled for a low-use season. Road repair is currently a Forest Service priority, regardless of DUSEL.

Potential Adverse Impacts: Post-construction

1. Potential Impacts at the Portal Area

The portal (tunnel) opening would be similar to the tunnel on Highway 2 near Money Creek, though smaller (about 70% as large). The pre-proposal geotechnical study identified a number of possible portal locations.

Residents listed parking, traffic, light pollution, and ventilation noise as potential portal concerns. Noise is one reason the pre-proposal adopted an all-electric laboratory design. This reduces the tunnel ventilation speed to 1.4 mph, allowing very quiet operations. An underground "portal room" was added to bring all parking, deliveries, utilities, and security underground. Surface lighting was designed to operate only when a visitor arrives or departs. The low "mushroom" fixtures will direct light downward.

To address concerns about parking and traffic, the project has included provisions for transportation to/from the laboratory by an electric shuttle, which will run on a circuit between Leavenworth and the laboratory. Private cars will be strongly discouraged. We have offered to work with Leavenworth officials to expand the shuttle system so that it could also serve Icicle Valley visitors during the busy summer months (or year around).

Some deliveries will occur at the lab when detectors are being assembled. Most detectors will be constructed in modules in the Leavenworth Science/Administration Center, then transported to the lab. Detector construction is delicate, painstakingly slow work, not an intense construction activity. After completion, most detectors will be isolated in cleanrooms, with data transmitted electronically to the Science/Administration Center in Leavenworth. In most cases, very little on-site maintenance will be needed.

Some improvement of the Forest Service road to the portal will be needed, as the road will be used year around. About 800 yards of road will be used. Older trees crowd one section of this road. Unfortunately a few of these may need to be removed.

The Forest Service will retain ownership and control of the site. The University of Washington will apply for a use permit that, if granted, will specify all allowable activities, as well as restoration requirements when use ends. Restoration will include capping the tunnel and closing the openings, likely using the original granite. The University is open to arrangements where the public can share use of the site.

2. Potential Impacts associated with Water Usage

Daily water use in the underground laboratory is estimated at 2000 gallons per day. This is equivalent to use of about three typical households. We have not yet determined what water sources are available for the project. If surface or groundwater is not available, it would be practical to handle water needs by trucking water from an available source to a storage vessel on site. We are aware of the complexity of water and water law.

It is likely, though not certain, that the tunnel will produce water. Tests will be made during coring to better determine the quantity and quality of the water. It is quite likely that the bulk of the water will originate from the near-surface region: this water would be cool and similar to the general mountain runoff in quality. If most of the water is from deep parts of the tunnel, it will be warm and typical of area deep-well water in quality. If water is produced in the tunnel in excess of needs (or if use of tunnel water is not allowed), we would be required by the Department of Ecology to treat the water so that it meets all quality and temperature standards, before it is returned to the environment.

3. Potential Operations Impact of the Science/Administration and Visitor Centers
The Visitor Experience Center will serve as a major education/outreach center for K-12 students, college undergraduates, and the general public. We estimate that it could attract up to 250,000 visitors each year. Thus, its adverse impacts on Leavenworth include increased parking and traffic. The University would work closely with Leavenworth in finding a suitable location, providing adequate parking, and integrating the Center with other tourism activities and education and outreach efforts.

The Science/Administration Center will house about 200 scientists and support staff, with about half of the personnel being visiting researchers and students. The adverse impacts include the associated traffic and competition for local housing. Both Centers will have water and utility requirements typical of office facilities of similar size.

The University of Washington intends to lease or acquire the needed land and build the two Centers. The intent of the University is to build Centers that are architecturally outstanding. The University's Capital Projects group uses sustainable design principles to minimize power and water use and otherwise reduce environmental impacts.

We recognize that affordable housing is a growing concern in Leavenworth. The pre-proposal discusses the public-private partnerships that the UW has employed to address this issue elsewhere, and which could be explored with Leavenworth.

Additional Citizen Concerns

- **Potential for DUSEL-Cascade Tunnels to Drain Lakes:** As noted before, several major tunnels have been built in the batholith near regional lakes, including examples like the Snow Lakes tunnel where the excavation was done directly under the lake, and in close proximity. No unintended adverse effects have been noted over the last 75 years. The hydrology of the DUSEL-Cascades site will be thoroughly studied in the coring program, before construction. Deep tunnels generally are connected hydraulically to a limited region because the intense pressure closes possible conduits for water.
- **Future Construction of a Megadetector***:* A very large detector – or megadetector -has been discussed in connection with some other sites. As discussed in section 7.5 of the pre-proposal, Cashmere Mt. is not suitable for this detector.
- **DUSEL Expansion:** The pre-proposal construction plan provides sufficient room to meet the needs of US scientists now and for the foreseeable future. It is highly unlikely that any

expansion would be undertaken in the first 20 years of operations (i.e., before 2033). If some expansion were proposed in the far future, it would be very modest, two or three additional rooms. Any expansion would require a new public permitting and environmental review process.

- **Hazardous Materials, Threat of Spills:** The materials used underground are similar to those used in university and industry science laboratories in urban areas like Seattle. To our knowledge no spill of hazardous materials has occurred in the 40-year history of US underground science. US regulations for materials handling are particularly strict, including preventative measures like double containment vessels and detailed protocols for storage, handling, and disposal of materials. DUSEL-Cascades safety and environmental procedures will be monitored by the University of Washington (the use permit holder), state and federal regulatory agencies, standing committees appointed by the NSF, and laboratory management.
- **Loss of Oversight Control:** The University will be the sole DUSEL landlord, owning or leasing the land on which the Science/Administration and Visitor Experience Centers are located, and holding the Forest Service use permit for the area occupied by the underground facility. The University will thus retain all oversight powers necessary to safeguard the State's property and citizens, and to guarantee that the laboratory operator abides by all provisions of the Forest Service use permit.

Mitigation

The University of Washington understands that projects like DUSEL-Cascades may bring broad benefits to Leavenworth, Chelan County, and Washington State, but with costs and impacts that may affect certain groups disproportionately. Mitigation uses fair compensation to address those impacts that engineering cannot solve. The University's newly established DUSEL-Cascades Project Office will discuss appropriate mitigation with regulatory agencies and local government, with conservation, recreation, and tourism groups, and with individuals who are most directly impacted. The University and the NSF have long records of fairness in working with the public.

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