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**Testimony on
“American Jobs and Energy Security:
Domestic Oil Shale the Status of Research, Regulation and Roadblocks”**

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Introduction. Chairman Lambourn, Congressman Tipton, and members of the subcommittee, thank you for the opportunity to testify before the subcommittee. My name is Michael Hagood and I represent the Idaho National Laboratory. I have over thirty years of experience working in the fields of energy and environment, including participating in associated research, development and demonstration programs. I have BS and MS degrees in the field of geology and am a licensed geologist and hydrogeologist. I have been with Idaho National Laboratory since 2003 and am responsible for developing science and technology and regional programs for the Energy and Environment Directorate. My testimony today will touch upon western oil shale development and its potential impact on U.S. energy security and economy, however, the emphasis of my testimony will be on relevant research.

Idaho National Laboratory Background. Idaho National Laboratory (INL) is a science-based, applied engineering U.S. Department of Energy (DOE) laboratory dedicated to supporting missions in energy research, science, and national defense. INL has a long history in energy resource evaluation, energy systems analysis and integration, and system-of-systems engineering, coupled with a technical focus on advanced modeling and simulation, computational engineering and analyses, instrumentation and controls, and materials development and testing. INL addresses research in nuclear, fossil and renewable energy, advanced transportation and energy storage, as well as critical energy infrastructure protection. In particular, INL is known for conducting demonstrations to help reduce risks associated with deployment of technology and being an honest, independent broker of technical information.

Idaho National Laboratory also has a goal to assist in addressing regional U.S. energy and environment challenges. From this perspective, INL has taken a particular interest in energy resource development in the Western Energy Corridor, including the rich oil shale resources located in Colorado, Utah and Wyoming. INL has been engaging in oil shale research, supporting the U.S. Department of Energy and industry for several years, as well as investing in unconventional fossil energy research internally. INL partners with regional universities relative

to energy and environment research, including with Colorado School of Mines, University of Utah, Utah State University Bingham Research Center, and University of Wyoming. INL has also developed technical relationships with Canadian research institutions in Alberta and Saskatchewan, which have challenges and capabilities relevant to oil shale development.

Western Oil Shale and Energy Security. The world class nature of western oil shale resources is measured in magnitude, longevity and strategic import to U.S. energy security. It is the largest hydrocarbon resource on earth and on a per acre basis is the most concentrated oil bearing resource on earth. The United States is expected to continue to rely heavily on oil through at least 2035 according to the U.S. Energy Information Administration and one would expect U.S. dependence to extend much beyond this. In the meantime, the U.S. will need to pursue securing access to reliable supplies of energy and at the same time lessen its dependence on politically and economically unstable sources of oil imports. Given this situation, western oil shale can play a substantial role in contributing to U.S. energy security.

Western Oil Shale and the Economy. Development of a substantial industry around western oil shale can lead to significant regional job creation as well as help reduce the flow of dollars being sent overseas to purchase oil. As western oil shale becomes officially recognized as a secure, known and long-term source of oil reserves, the creation of an oil shale industry would result in significant national and international investment. As an example, I would point to what has transpired in Alberta associated with oil sands development.

Western Oil Shale and Research. As world oil demand and prices continue to rise there will be increasing efforts to develop more of the unconventional fossil energy resources, such as oil shale. In parallel, technological innovation and associated investment will emerge to more effectively develop these resources. Research has been, and will continue to be, a critical component in successful development of these unconventional fossil energy resources. An example is the recent impact of horizontal drilling, fracking and use of proppants in accessing and recovering natural gas from shale. Another example is the innovative subsurface steam injection and recovery process implemented to help unlock Alberta oil sands at depth. Increasingly, research is also playing a role in better understanding the interdependencies between energy and the environment, the impacts of energy development on the environment and ultimately the development of innovation that helps mitigate environmental impact.

Congress recognized the importance of unconventional fossil energy research when they passed the Energy Policy Act of 2005 (Act). In particular, Sec 369 of that Act focused directly on promoting the development of liquid fuels from the Nation's vast unconventional hydrocarbon resources, including oil shale, and directed the study and mitigation of technical impediments to unconventional fuels development.

Oil shale research being conducted today addresses a variety of topics, many of which are profiled in U.S. DOE's "Oil Shale Research in the United States". Research is being conducted to better understand the nature of the oil shale resource itself as well as its setting. A number of these projects are also focused on realizing a better understanding of specific and cumulative impacts on the environment. A significant need in the future is to further address oil shale development impacts on green house gas emissions, water use and quality, and air quality concerns. For example, INL is conducting modeling and bench-scale tests in an effort to better understand potential impacts of in situ heating of oil shale on groundwater quality.

Oil shale recovery and retort processes are also a major research focus, and there are several approaches being advanced. These processes exist at various levels of maturity and many are still in the research and development phase. A summary profile of these approaches can be found in U.S. DOE's report "Secure Fuels from Domestic Resources: The Continuing Evolution of America's Oil Shale and Tar Sands Industries". A particular trend in such research is addressing in situ oil shale retorts at depth. Another emerging research interest relates to reducing the energy requirements associated with oil shale development and the potential integration of renewable and nuclear energy, which have the potential to help extend the lifetime of the oil shale resource and reduce green house gases.

Research on western oil shale is being conducted by a number of regional universities, state and federal agencies, national laboratories and private industry. University and research laboratories working in this area include Colorado School of Mines, University of Utah's Institute for Clean and Secure Energy, Utah State University Bingham Research Center, Los Alamos National Laboratory and Idaho National Laboratory, along with sponsorship through the National Energy Technology Laboratory. Regional federal offices and state agencies such as U.S. Geological Survey and Utah Geological Survey are also contributing to assessing oil shale resources and their environmental setting. Private industry, primarily comprising larger companies, is investing significantly in research built around recovery and processing techniques. Relative to industry between 2007 and 2010 DOE identified twenty-nine private companies engaged in research and development.

Of special note, the Department of the Interior's Bureau of Land Management (DOI/BLM) has been advancing opportunities for oil shale (and tar sands) technology research and demonstration on Federal lands in the West through the Oil Shale Research Development and Demonstration (RD&D) Leasing Program. A first set of leases have been allocated to Shell, Chevron, American Shale Oil and Enefit American Oil (formerly OSEC). Nominations for a second set of RD&D leases are currently under review, with BLM recently announcing their reviews of three candidates for leases in Colorado and Utah.

Relevant research on oil shale is also occurring internationally. Companies which are assessing the application of their technologies to western oil shale are also conducting technology demonstrations elsewhere in the world. Technology transfer associated with already demonstrated, conventional oil shale retort operations have also emerged with the intent that these may be applied to western oil shale, including technologies derived from Estonia, Brazil, and even China. In this spirit, the U.S. has recently signed a cooperative research agreement with the republic of Estonia.

International technology transfer was recognized by Congress, as per Section 369 (h) of the Energy Policy Act of 2005, in which the Congress directed the Secretary of Energy to establish the Unconventional Fuels Task Force to “make recommendations with respect to initiating a partnership with the Province of Alberta, Canada for the purpose of sharing information relating to tar sands. Although focused on tar sands (oil sands), the associated innovation and “lessons learned” in Alberta is useful in addressing oil shale development approaches and impacts.

Oil shale research can result in direct job creation in private industry, regional research institutions and government agencies. The greater long-term positive impact on the economy, however, will be realized through the ultimate deployment of innovation that in turn helps realize substantial oil production in an environmentally responsible manner. Once a substantial oil shale industry is established in the region, accompanied by a healthy market place, one would also expect greater investment in, and contribution from, aligned research efforts that would bring additional economic benefits. For example, with a set of more mature R&D relationships in the region, innovation would result in creation of spinoff companies and services, which would lead to creation of jobs. A rich environment comprising industry, education, research and sound policy will lead to large international investment, similar to what is being experienced with the oil shale industry in the United States.

Recommendations. In view of its size, value and longevity, western oil shale deserves greater attention. It is of international scale. The United States should continue to pursue smart and environmentally responsible development of these resources. Realizing a sizeable oil shale industry can contribute significantly to U.S. energy security, but its establishment and impact could take several years. Along these lines, it is recommended that in the near term, steps be taken to implement recommendations made by Unconventional Fuels Task Force. A strategy was proposed by the Unconventional Fuels Ad Hoc Working Group in 2008 to address these recommendations, and developed an approach for further advancing development within the Western Energy Corridor, with an initial emphasis placed on oil shale.

Relative to oil shale research, it is recommended to establish a regionally based, long-term integrated and focused applied research program that helps accelerate identification and implementation of solutions that would be impactful in the smart and environmentally

responsible development of oil shale resources. It is also recommended that such a program leverage the rich research capabilities within the region and internationally.

When aligned with a healthy oil shale industry, research on western oil shale can lead to even greater economic development within the region, sustainable over this century. As witnessed in similar circumstances elsewhere, research can also lead to strengthening existing U.S. competitiveness, nationally and internationally. Beyond this, there is also the opportunity to identify and establish value added industrial enterprises built upon the oil shale energy platform.

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