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Communication and Ethical, Legal, and Societal Issues

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Communication and Ethical, Legal, and Societal Issues

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"Soft Law" Approaches to Nanotechnology Oversight

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Project Goals: We seek to identify, study, evaluate and recommend innovative soft law governance approaches that may apply to nanotechnology and could be scaled up to a transnational level. Specifically, we seek to: 1. Identify and classify the wide variety of public, private and collaborative soft law governance initiatives that have been implemented or proposed for nanotechnology, as well as similar models for other emerging technologies and may be adaptable to nanotechnology. 2. Evaluate the outcomes, design choices, strengths and weaknesses of the mechanisms studied. Based on the results of our analysis and an expert workshop, we will select four of the most promising oversight models for further, in-depth analysis. 3. Using a series of evaluative questions, a survey of relevant stakeholders and a second expert workshop, conduct an in-depth analysis of the four most promising soft law governance models for nanotechnology.

Regulatory agencies are in the early stages of developing regulatory frameworks for nanotechnology, but it will be many years before comprehensive federal regulatory oversight is in place for nanotechnology. In the mean time, a number of innovative, voluntary or partnership-based programs, which we refer to as "soft law" initiatives because of their non-binding nature, have emerged to try to fill the oversight gap for nanotechnology. In this presentation, we analyze and compare six existing soft law initiatives for nanotechnology: (1) the Dupont-EDF NanoRisk Framework; (2) the Responsible NanoCode; (3) The NanoSafety Consortium for Carbon (NCC); (4) the EU Code of Conduct for Responsible Nanosciences and Nanotechnologies; (5) the Nanomaterial Product Stewardship Program; and (6) CENARIOS nanotechnology certification program. We assess the relative strengths and weaknesses of these various soft law programs, identify different positions on the role of these programs vis-à-vis traditional regulatory programs, and propose a typology for these soft law programs based on the participation and parameters of the programs.

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Biological and Environmental Research Information System: A Multifaceted Approach to DOE Systems Research Communication

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Project Goals: Provide programmatic information via printed and online materials to help build the critical multidisciplinary community needed to advance systems research for DOE energy and environmental missions. The Biological and Environmental Research Information System group works with program managers and the scientific community to help develop and communicate key scientific and technical concepts for research community and public discourse. Ideas are welcome to extend and improve communications and program integration and thus represent BER's research more comprehensively.

Concerted communication is key to progress in cutting-edge science and public accountability. Our goals focus on three objectives: (1) facilitate science planning, research, and communication; (2) inform a broader audience about DOE research projects, progress, and significance to science and society; and (3) respond to outreach and information exchange needs of related DOE projects.

For the past 22 years, our group, the Biological and Environmental Research Information System, has focused on presenting all facets of genomics research for the Department of Energy's (DOE) Office of Science. The materials we produce have helped ensure that scientists can participate in and reap the bounty of the genome revolution, that new generations of students can be trained in genomics and systems biology, and that the public can make informed decisions regarding genetics issues.

In 2009, our scope was extended to include all programs within the Office of Biological and Environmental Research (BER), which conducts frontier research in climate, subsurface biogeochemistry, and genome science within the Office of Science. These programs explore scientific complexity at temporal and spatial scales requiring contributions from teams of interdisciplinary scientists, thereby necessitating an unprecedented integrative approach both to the science and to research communication strategies. Because each scientific discipline has different perspectives and languages,

effective communication to help foster information flow across disciplines and translation of scientific discovery into appropriate DOE mission areas is critical to BER's success. We work with DOE staff and the research community to produce and disseminate information in various formats: technical reports, roadmaps, websites, brochures, databases, technical compilations, presentations, exhibits for scientific meetings, text, graphics, and posters. We staff the BER and Genomic Science exhibit at more than 10 scientific meetings each year. We also work with DOE grantees and members of the extended DOE BER community, especially with the outreach efforts of the Bioenergy Research Centers, the Joint Genome Institute, the Environmental Molecular Sciences Laboratory, and the Atmospheric Radiation Measurement Climate Research Facility to help increase their reach and impact.

For BER's Biological Systems Science Division (BSSD), our recent Genomic Science program accomplishments include

Research plans and reports produced with the scientific community:

- *Systems Biology Knowledgebase Implementation Plan* (September 2010), plus a series of individual workshop reports (January –June 2010)

BER BSSD booklets and brochures include:

- *Advanced Technologies for Biology: Overview of Structural Biology Infrastructure* (March 2011)
- *Overview of Projects Underpinning Knowledgebase Development* (revision, February 2011)
- *Biological Systems Research on the Role of Microbial Communities in Carbon Cycling: Summary of Projects of Awarded in Summer 2010* (October 2010)
- *Bioenergy Research Centers: An Overview of the Science* (revision, August 2010)
- *Plant Feedstock Genomics for Bioenergy: Joint Awards* (July 2010)
- *BSSD Overview* (May 2010)
- *Bioenergy Research Centers: Education and Outreach* (March 2010)
- *Genomic Science Program Overview* (February 2010)

Other recently produced BER BSSD materials include the *Genomics for Energy and Environmental Science* placemat (January 2011), abstracts book for the *DOE Genomic Science Awardee Workshop VIII and Knowledgebase Workshop* (February 2010), and an exhibit created for the DOE Office of Science Genomic Science Program (October 2009). BER BSSD works in progress include this abstracts book.

We also continuously update and enhance numerous websites including the Genomic Science website (*genomicscience.energy.gov*) and public image gallery (*genomics.energy.gov/gallery/*). A major redesign of the Genomic Science website was completed in November 2010. The updated site streamlines content and design, while improving navigation and increasing functionality and accessibility. New sections gives greater access to information about DOE user facilities and the Genomic Science Knowledgebase.

BER-wide projects completed include the creation and dissemination of:

- Searchable public BER Research Highlights database (*public.ornl.gov/hgmis/bernews/*)
- *DOE BER Overview* (revisions: March 2011, August 2010)
- *BER Grand Challenges: A Long-Term Vision* (December 2010)
- DOE BER poster (August 2010)
- DOE BER exhibit (July 2010)

For BER's Climate and Environmental Sciences Division (CESD), our recent accomplishments include

Research plans and reports produced with the scientific community:

- *Climate Research Roadmap* (September 2010)
- *Complex Systems Science for Subsurface Fate and Transport* (March 2010)

BER CESD placemat and brochures include:

- *Energy-Climate Nexus* placemat (January 2011)
- *Terrestrial Ecosystem Science Overview (May 2010)*
- *CESD Overview* (March 2010)
- *DOE Environmental Molecular Sciences Laboratory (EMSL) Overview* (March 2010)
- *DOE Atmospheric Radiation Measurement (ARM) Climate Research Facility Overview* (February 2010)
- *Climate and Earth System Modeling Overview* (in progress)

Office of Biological and Environmental Research (BER) http://science.doe.gov/ober/ober_top.html

BER documents http://www.berscience.org/

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submitted post-press

Societal Implications of Nanoscale and Bioenergy Science and Technology Undertaken at U.S. Department of Energy Research Centers

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Project Goals: The SFA seeks to determine the degree to which its findings can be applied to similar choices for

other technologies, uses, and management approaches. In meeting these goals, the SFA will establish a unique ELSI resource for SC, and for the broader suite of communities interested in societal implications associated with emerging S&T.

This poster presents an overview of the Ethical, Legal, and Social Issues (ELSI) Scientific Focus Area (SFA) at Oak Ridge National Laboratory. This SFA's two long-term goals are to:

- Create a new base of knowledge that identifies the kinds of societal issues that arise at key junctures over time, as S&T moves from research and development (R&D) into use, and
- Analyze the potential implications of alternative choices upstream (for R&D) and downstream (for use).

The SFA seeks to determine the degree to which its findings can be applied to similar choices for other technologies, uses, and management approaches. In meeting these goals, the SFA will establish a unique ELSI resource for SC, and for the broader suite of communities interested in societal implications associated with emerging S&T.

In this SFA, "ELSI issues" refers to the set of choices, impacts, and implications that determine the manner in which S&T and their products are developed and integrated into society to achieve SC goals. "Societal considerations" are those issues brought to bear when making choices. "Junctures" are key decision points along the continuum of R&D through initial use. SFA research will identify how parties involved in making choices at these junctures tend to weigh multiple, potentially competing and conflicting considerations, in a manner that links to specific technologies, applications, and institutional processes. Thus, SFA research is structured to identify and analyze the:

- implications of ***S&T process and product-related*** societal considerations associated with specific choices that arise in moving from research to the eventual use of DOE S&T;
- implications of specific ***institutional and organizational management*** choices associated with moving from research to the eventual use of DOE S&T, and societal issues associated with those choices;
- extent to which our findings are ***generalizable*** across technologies, contexts, applications, and R&D lifecycle phases.

ORNL's ELSI SFA is designed to be gap-filling. ELSI-related studies tend not to have been organized to answer cross-cutting questions, although DOE would benefit from a stronger foundation upon which to anticipate issues that arise over specific technologies. Moreover, ELSI and related studies generally have not focused on SC-funded S&T, SC's mission, or on the extent to which their findings are applicable to DOE. These gaps increase SC's challenges in making sets of choices that can affect its ability to achieve its mission. This SFA seeks to fill these gaps by combining an explicit focus on SC S&T with targeted research aims and questions.

Focusing on SC's Nanoscale Science Research Center (NSRC) and Bioenergy Research Center (BRC) located at ORNL, the SFA anchors its investigations to specified technologies, potential applications, and institutional practices. Alternative methods are used to identify key choices at junctures along the pathway from laboratory to use, parties who make those choices, the considerations that influence their decisions, and the implications of alternative choices upstream for R&D and downstream for early and mature use, disposal, and decommissioning. All analyses address a principal, core objective: to ***identify and analyze issues of societal concern***, as they may be reflected in key junctures along the R&D-through-initial use trajectory.

To impose structure and bounds on our inquiries, we ask how three sets of attributes influence key issues (e.g., energy-environment-society tradeoffs) that are likely to be at the heart of tough choices concerning nanoscale and bioenergy S&T in different contexts and at different points along R&D-to-use lifecycle phases. These three sets of attributes are: (a) technology products and processes; (b) their potential applications; and (c) institutional and organizational management of research centers—here focusing on intellectual property and information management. More specifically, we ask:

- Holding constant a single category of technology, how do societal issues and tradeoffs vary when that technology is used in different applications?
- Holding constant a single application—here defined in terms of a specific societal goal, how do societal issues and tradeoffs vary when that goal is pursued with different technological options?
- Holding constant guidelines for intellectual property and information management, how do research centers' implementation practices influence the nature of their S&T R&D and how does information flow from inside to outside of the research centers?

By disaggregating and delving into different layers of attributes that influence societal considerations associated with key decision points, this Science Plan will develop new understandings about the societal implications of emerging technologies.

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submitted post-press

Nanoscale Science Ethical, Legal, and Social Issues (ELSI) Analyses: Issues, Nano-Attributes, and Potential Applications

Co-PIs: Amy K. Wolfe[1]* (wolfeak@ornl.gov), **David J. Bjornstad**,[1]* Co-authors: W. Christopher Lenhardt,[1] Barry Shumpert,[1] Mitch Doktycz,[1] and Stephanie Wang[2]

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Project Goals: One avenue for inquiry within the Ethical, Legal, and Social Issues (ELSI) Scientific Focus Area (SFA) at Oak Ridge National Laboratory seeks to identify the kinds of societal issues that arise at key junctures over time, as S&T moves from research and development (R&D) into use. More specifically, the SFA focuses on the set of choices, impacts, and implications that determine the manner in which S&T and their products are developed and integrated into society to achieve DOE Office of Science (SC) goals.

This poster describes initial analyses that begin to disaggregate factors influencing decision points and their associated societal issues along the pathway from R&D to use within the realm of DOE Nanoscale Science Research Centers (NSRCs). As one starting point, we look to existing ELSI scholarship to help us categorize key *choices*, the *issues* parties typically involved in making these choices raise (or do not raise), and how involved parties *weigh or trade-off* among the multiple salient issues in determining how to proceed.

A critical aspect of this ELSI SFA is it's strong linkage to DOE-SC S&T. History repeatedly has shown that societal responses to the same technology vary, even in seemingly similar contexts. The overall ELSI SFA is structured to help sort out the extent to which S&T-related attributes versus application-related attributes (e.g., energy versus environmental applications) influence choices, issues, and tradeoffs. Therefore, we also are examining nano-related ELSI literature with regard to its linkage with particular categories of:

1. nanoscale science and technology—the extent to which the kind of nanomaterial or process matters; and
2. sphere of application—the extent to which different uses of nanomaterials or processes matter, where we focus on energy versus environmental applications.

Our examination of approximately 85 nano-related ELSI publications indicates that the predominant issues on which ELSI scholars have focused are the role of ELSI, perceptions, governance, and equity. We found that the vast majority of publications do not specify kinds of nanomaterials or processes, so that it is unclear whether these publications intended to be general across all nanomaterials and processes. Likewise, most articles refer in general to the potential applications of nanomaterials and processes rather than to specific spheres of application. Despite these gaps, the literature does help to identify a variety of considerations that may be important to understanding choices, issues, and tradeoffs along the pathway from R&D to use. This poster presents our interim findings from this literature-based analysis and implications for our goal of disaggregating the evolving societal considerations associated with DOE's emerging S&T.