

RulemakingComments Resource

From: Kosson, David S <David.Kosson@Vanderbilt.Edu>
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To: RulemakingComments Resource
Cc: Clarke, James H; 'Stewart, Richard'; Kosson, David S; 'Charles Powers';
kathryn.higley@oregonstate.edu; craigbenson@gmail.com; 'l bliss@crep.org'
Subject: [External_Sender] Comments on 2015 proposed LLW rule 80 FR 16802
Attachments: Final_CRESP comments on 2015 proposed LLW rule 80 FR 16802.pdf

Attached please find comments on the 2015 proposed LLW rule 80 FR 16802, which I am hereby submitting on behalf of the CRESP review team.

Sincerely,

David S. Kosson, Ph.D.

CRESP Principal Investigator

Cornelius Vanderbilt Professor of Engineering
Professor of Civil and Environmental Engineering
Professor of Chemical Engineering
Professor of Earth and Environmental Sciences

Vanderbilt University

Office: (615) 322-1064
Mobile: (615) 337-5889



The Consortium for Risk Evaluation with Stakeholder Participation III

Consortium Universities: **Vanderbilt University**, Howard University, Oregon State University, New York University, Robert Wood Johnson Medical School, Rutgers University, University of Arizona, University of Wisconsin - Madison

CRESP Comments on 2015 Proposed NRC LLW Rule, 80 FR 16082, by

David Kosson on behalf of the CRESP Review Team

david.kosson@vanderbilt.edu

(615) 337-5889

July 24 2015

These comments on the NRC proposed Low-Level Waste Disposal Rule, 80 FR 61082 (March 26, 2015) are offered by David Kosson on behalf of a CRESP Review Team consisting of Craig H. Benson, James H. Clarke, Kathryn A. Higley, Charles W. Powers, Richard B. Stewart and him. Each of these commenters has extensive experience in nuclear waste management and environmental regulatory issues. They are senior researchers and members of the Management Board of the Consortium for Risk Evaluation with Stakeholder Participation (CRESP), and share CRESP's commitment to performance-based regulatory approaches, that are informed by risk, and are protective, science-based, flexible, and cost-effective.¹

Experience and Qualifications of Commenters

David S. Kosson is Cornelius Vanderbilt Professor of Engineering at Vanderbilt University, where he has appointments as Professor of Civil and Environmental Engineering, Chemical Engineering and Earth and Environmental Sciences. He is principal investigator of the multi-university Consortium for Risk Evaluation with Stakeholder Evaluation (CRESP). Dr. Kosson has led the development of the US EPA Leaching Environmental Assessment Framework (LEAF) and leads the Cementitious Barriers Partnership which is a multi-institution initiative focused on developing advanced tools for predicting the long-term performance of cementitious materials in nuclear applications. Dr. Kosson also has been a member of the leadership

¹ CRESP works to advance cost-effective, risk-informed cleanup of the nation's nuclear weapons production facility waste sites and management of potential future nuclear sites and wastes. CRESP carries out multi-disciplinary research, education and review in waste processing and special nuclear materials; remediation, near surface disposal and long-term stewardship; nuclear waste management policy and strategy; and, stakeholder engagement and communication. Principal Investigator David Kosson and Co-Principal Investigator Charles Powers lead the multi-university consortium that has served the DOE and its stakeholders since 1995, currently through a cooperative agreement (2006-2017) awarded to Vanderbilt University. The CRESP Management Board is comprised of technical, engineering, scientific, medical and policy experts from eight university consortium member institutions: Vanderbilt University, Howard University, New York University School of Law, Oregon State University, Rutgers, The State University of New Jersey, University of Arizona, University of Wisconsin - Madison and Georgia Institute of Technology.



Department of Civil and Environmental Engineering
VU Station B Number 351831
Nashville, TN 37235
Phone: 615-322-2697 Fax: 615-322-3365
www.cresp.org

committee for the Risk and Performance Assessment Community of Practice (formerly the Performance Assessment Community of Practice) and served as an advisor on several major projects for the DOE Office of Environmental Management.

Craig H. Benson is Dean of the School of Engineering and Applied Science and the Hamilton Professor of Civil & Environmental Engineering at the University of Virginia. Previously, he was Wisconsin Distinguished Professor and Chair of the Departments of Civil and Environmental Engineering and Geological Engineering at the University of Wisconsin- Madison. Dr. Benson has been conducting experimental and analytical research in geoenvironmental engineering for nearly three decades regarding containment of solid, hazardous, radioactive, and mining wastes. Benson directs the CRESP Landfill Partnership in collaboration with Professor Clarke. His research includes laboratory studies, large-scale field experiments, and computer modeling. Dr. Benson has received numerous awards for his work on containment systems modeling including the Ralph Peck Award in 2012 from the American Society of Civil Engineers and the Award of Merit from ASTM International. Dr. Benson is a member of the National Academy of Engineering, Past President of the ASCE Geo- Institute and former Vice Chair of the Executive Committee of ASTM Committee D18 on Soil and Rock. He is a participant and has been a member of the leadership committee of the Risk and Performance Assessment Community of Practice.

James H. Clarke is Professor of the Practice of Civil and Environmental Engineering and Professor of Earth and Environmental Sciences at Vanderbilt University. Dr. Clarke was a member of the former Nuclear Regulatory Commission (NRC) Advisory Committee on Nuclear Waste and Materials and is a consultant to the NRC Advisory Committee on Reactor Safeguards. He is a Board Certified Environmental Scientist (BCES) and a member of the American Academy of Environmental Engineers and Scientists, a Fellow of the American Academy of Forensic Scientists, and a member of the Association of Environmental Engineering and Science Professors. He is also a participant in the Risk and Performance Assessment Community of Practice and, with Professor Craig Benson, in CRESP's Landfill Partnership.

Kathryn A. Higley is Professor and Head of the School of Nuclear Science and Engineering at Oregon State University. She is a member of the National Council on Radiation Protection and Measurements, Vice-Chair of the International Commission on Radiological Protection's Committee 5 (Protection of the Environment), a Fellow of the Health Physics Society, and a Certified Health Physicist. She works extensively in the development and application of tools to assess environmental dose and impact from radionuclide releases.

Charles W. Powers is Professor of Environmental Management at Vanderbilt University, co-Principal Investigator and founding chief executive officer of the Consortium for Risk Evaluation with Stakeholder Participation and was active in the initial efforts to build the Risk and Performance Assessment Community of Practice. He has published extensively on how to achieve integrated, technically-based risk- informed environmental policy. In addition to having served on the faculties of Yale, Harvard and Princeton Universities and the Robert

Wood Johnson Medical School, he was chief environmental officer and Vice President for Public Policy at Cummins Engine Company. In addition to CRESA he helped create and was first chief executive officer of the Health Effects Institute, Clean Sites, Inc., and The Institute for Evaluating Health Risks and for a decade chaired the New York Academy of Sciences' New York/New Jersey Harbor Consortium.

Richard B. Stewart is University Professor and John Edward Sexton Professor of Law at New York University (NYU) and Director of NYU's Center on Environmental and Land Use Law. He has published extensively on environmental law and policy and administrative law and regulation, including (with Jane Stewart) *Fuel Cycle to Nowhere: US. Law and Policy on Nuclear Waste* (2011), the first comprehensive history and account of U.S. nuclear waste regulation and policy. During 1989-1991 Stewart served as Assistant Attorney General for Environment and Natural Resources at the US Department of Justice, where he was extensively engaged in the implementation of CERCLA and environmental issues at DOE defense facilities. He was formerly Chair and currently serves as Advisory Trustee of the Environmental Defense Fund.

Comments on the Proposed Rule

Risk-informed, performance-based low-level waste regulation

We strongly support and commend NRC's commitment, reflected in a number of recent decisions and statements, to a risk-informed performance-based approach to low-level waste (LLW) regulation. In its deft use of scientific methods and structure, this approach ensures protection while providing needed flexibility to tailor regulatory requirements to the characteristics of particular wastes and disposal sites in the context of managing risk. Consequently, the approach is pragmatic and cost-effective. CRESA has long espoused this approach and has worked with waste managers, regulators, and communities to implement it in a variety of settings. In January, 2013, CRESA filed comments on the preliminary proposed version of the LLW rule urging this approach.

Many key provisions in the proposed rule commendably reflect and implement the risk-informed performance-based approach. These include the provisions for a 1000-year compliance period rather than the 10,000-year period in the 2011 preliminary proposed rule, a risk-based approach to inadvertent intruder protection, site-specific waste acceptance criteria using risk-based performance assessments, and insistence on the use of updated dosimetry. In CRESA's 2013 comments on the preliminary proposed rule, we recommended just such provisions and are pleased to see that NRC has proposed their adoption.

Other provisions in the proposed rule, however, impose rigid and uniform requirements inconsistent with this same risk-informed performance-based approach. These include requirements for a three-tier regulatory structure that includes a 10,000-year period for all LLW that includes not only the 1000-year compliance period but an additional second tier "Protective Assurance" period extending to 10,000 years for all LLW, not just long-lived wastes, and a third

tier “Performance Period” for long lived LLW with concentrations exceeding those in Table A of 10 CFR 61.13(e), beginning 10,000 years after facility closure and extending for an indefinite period. Given the uncertainties presented and limits of knowledge regarding circumstances over millennial time periods, these proposed provisions are unrealistic and may well be lacking in technically-specifiable rigor while concealing the fact that they could result in unacceptably variable application. Hence, they should be deleted.... in favor of a single Tier 2 measure for the period after 1000 years that would use a qualitative analysis of the risks posed by specific quantities of wastes at specific sites and apply an ALARA approach for assessing protectiveness. This approach should be complemented with an appropriate and pragmatic performance monitoring requirement during operation and a limited post-closure period that ensures that permit assumptions are being met and provides early warning if key assumptions are not being achieved. Where appropriate and feasible, exposure goals may be used as a guideline for qualitative evaluation of risk and protectiveness.

As explained in the Federal Register discussion of the proposed rule, the rule must respond to the circumstance that long-lived LLW were not considered in the development of the LLW classification tables. This circumstance does not, however, justify imposing burdensome regulatory requirements for ordinary low level wastes extending beyond 1000 years. Further, the risks posed by depleted uranium (DU) and the potential risks posed by other such “unique wastes” that require additional analysis may, depending on circumstances, require special protective measures. But these risks should be addressed through a flexible, site-specific performance-based approach rather than specifying unrealistically long periods for demonstrating conformance with regulatory standards including quantitative exposure limits for a very diverse universe of LLW. The special issues posed by long-lived wastes should be resolved on a site-specific, waste-specific basis through a collaborative approach involving input from the Risk and Performance Assessment Community of Practice.

CRESP’s comments on specific provisions of the proposed rule are as follows:

Proposed rule provisions that appropriately reflect and implement a risk-informed, performance-based regulatory approach and that accordingly should be adopted

Site-specific waste acceptance criteria. The proposed provisions for 10 CFR § 61.58 provide for development and implementation of waste acceptance criteria that will ensure compliance with the performance objectives of Subpart C, based either on waste classifications set forth in §61.55 or the technical analyses of the particular land disposal facility required by §61.13, including the information required by §61.12. Providing the option of using waste acceptance criteria based on analysis of the specific location, conditions, and design of a specific site appropriately provides site-specific flexibility while ensuring risk-informed performance-based protectiveness.

Site specific performance assessments. The provisions in the proposed rule, §§61.7 and 61.13 regarding performance objectives, technical analyses, and performance assessments, both for

sites using site-specific waste acceptance criteria and sites using the §61.55 waste tables, also rely on principles of risk-informed, performance-based protectiveness and will provide the basis for assessing and demonstrating compliance with the regulatory requirements. These assessments will serve as a sound basis for establishing waste acceptance criteria and site selection and design features that ensure compliance with the performance objectives in Subpart C, while taking site-specific variables into account.

Reducing the Tier 1 Regulatory Compliance period from 10,000 years to 1000 years. CRESP commends NRC for withdrawing the provision in §61.2 of the preliminary proposed rule for a uniform 10,000-year Tier 1 compliance period. As explained in CRESP's 2013 comments on the preliminary proposed rule, and as also acknowledged at various points in the proposed rule Discussion,² reliable demonstration of compliance with exposure limits for such a long period of time into the future is infeasible and unrealistic in the context of current scientific understanding. Demonstrating compliance with a regulatory limit at 1000 years is at the limits of practicality associated with the current body of knowledge. Current experience and knowledge associated with engineered near-surface disposal facilities is limited to a few decades and only a limited number of studies have been conducted to determine whether these facilities are functioning in accordance with predictions. Consequently, a shorter Tier 1 period, in the range of around 500 to 1,000 years, is appropriate and consistent with the characteristics of typical LLW and the logic of a tiered approach. A 1000-year compliance assessment period has been used for low-level wastes at various sites by agencies such as DOE and Agreement States. For example, the State of Texas uses a 1000-year period for assessing the performance of a waste disposal facility, with a second tier analysis where needed in the case of long-lived highly mobile radionuclides.³ A 1000-year period is provided in DOE's Radioactive Waste Management Manual, DOE Manual 435.1-1.

Inadvertent intruder provisions providing for site specific assessment of exposure potential. We strongly support the provisions in the proposed rule that provide for a site-specific, waste-specific assessment of potential risks to inadvertent intruders in place of the provisions in the preliminary proposed rule that assumed a 100% probability of intruder exposure in all circumstances.

Risks to inadvertent intruders are highly specific to particular sites, the character and design of the particular waste disposal facilities at a site including defense in depth measures, the specific wastes disposed of at a site, and the location of higher-hazard wastes within the site. The likelihood that an intruder will enter a site and engage in activities that may result in inadvertent exposure depends on the accessibility of the site and the likelihood that it may be used in the future for agriculture, construction, drilling, or similar activities. The likelihood

² See 80 FR 16089, 16090, 16091, 16092, 16108.

³ The proposed compliance periods reviewed by ACRS were 20,000 years and 10,000 years (See ACRS Letters to the Commission dated September 22, 2011 and July 22, 2013, respectively). In both cases, the ACRS recommended a 1000 year compliance period.

that the intruder will be exposed to significant levels of radiation depends on the nature of the wastes disposed of, waste disposal depth, the presence and type of engineered barriers, and the location of higher-hazard wastes within the site. Further, depending on the nature of the intruder activity, any exposure that occurs may be lower or higher, short-lived or chronic. A site-specific and risk-informed, performance-based approach is needed to address all of these different variables, assess the resulting risk to inadvertent intruders, and provide the most practical means to manage any potentially significant risks in order to secure appropriate protectiveness. Among other matters, this allows the most appropriate intruder scenarios to be developed and applied on a site- and waste-specific basis.

The proposed rule provisions regarding inadvertent intruder assessments appropriately follow this approach and represent a very positive development. Assessments must assume an inadvertent intruder occupies the site and engages in normal activities or other reasonably foreseeable pursuits that are realistic and consistent with expected activities in and around the disposal site at the time of site closure and that might unknowingly expose the person to radiation from the waste, examine the capabilities of intruder barriers to inhibit an intruder's contact with the waste or to limit the inadvertent intruders exposure to radiation; and estimate an inadvertent intruder's potential annual dose, considering associated uncertainties. In the proposed rule Discussion, the NRC states: "In addition the NRC is not assuming the probability is 100% that contact with the LLRW by an intruder will occur. ... engineered barriers and disposal practices, such as greater disposal depth, are to be included in the intruder assessment." 80 FR at.1609.

Defense in Depth. Defense in depth has always been a major tenet with nuclear power generation and we support explicit inclusion of defense-in-depth in the proposed rule for LLW disposal. The inclusion of a performance-based provision in the proposed rule can help ensure that appropriate protections are provided for the risks posed by long-lived wastes and for the potential risks to inadvertent intruders. We believe that the defense-in-depth analysis should follow a qualitative approach to assessing resilience, taking into account the nature and quantity of waste, the natural and engineered features of the site, the performance analysis, and the safety case.

Safety Case. Safety case and safety case evaluations, as developed and promoted by the International Atomic Energy Agency (IAEA) have been valuable concepts and tools and we support their use in the assessment of the management and disposal of LLW. We also strongly support provisions in the proposed rule requiring applicants and licensees to demonstrate a safety case that is updated on an ongoing basis to reflect new information and knowledge. The safety case provisions are another performance-based provision that can help ensure that appropriate protections are provided for the risks posed by long-lived wastes, and dealing with possible risks to inadvertent intruders.

Updated dosimetry. This is another notable provision in the proposed rule is S61.7(g), which requires licensees to demonstrate compliance with the Subpart C performance objectives,

using dose methodology specified in the standards for radiation protection set forth in 10 Part 20, that are based on more current dosimetry than that used in the development of the §61.55 waste tables. The proposed rule also allows applicants and licensees to use updated factors that have been issued by consensus scientific organizations (e.g., International Commission on Radiological Protection) and incorporated into federal radiation guidance by the U.S. Environmental Protection Agency (US EPA). Additionally, applicants and licensees may use the most current scientific models and methodologies (e.g., those accepted by the International Commission on Radiological Protection) to calculate the dose for site-specific circumstances. This provision represents an important step towards ensuring that LLW disposal is based on current science and is consistent with the objective of risk-informed, performance-based protectiveness.

Proposed rule provisions that are inconsistent with a risk-informed, performance-based regulatory approach and should accordingly be modified or deleted

Several other provisions of the proposed rule are unduly prescriptive, are not appropriately risk-informed, and preclude appropriate performance-based consideration of site- and waste-specific circumstances, as required ensuring implementation of risk-informed, performance-based protectiveness principles. These provisions should be modified or removed. They are as follows:

The Tier 2 and Tier 3 provisions in §61.2. These provisions, which provide for a second tier uniform 10,000-year protective assurance period for all LLW and third tier performance periods of indefinite duration beyond 10,000 years for long-lived wastes with concentrations exceeding the Table A concentration limits, are unrealistic, unsound, and should be deleted in favor of a single Tier 2 measure for the period after 1000 years that would use a qualitative analysis of the risks posed by specific quantities of wastes at specific sites and apply an ALARA standard to determine the need for further protective measures in cases where they are indicated.

As explained in our 2013 comments to the preliminary proposed rule, demonstrating compliance with exposure limits over many millennia exceeds our current capacities and knowledge. Any such demonstration, as required by the proposed Tier 2 provisions, would be an arbitrary and hypothetical exercise. For the same basic reason, we believe that the proposal for a post 10,000 year Tier 3 analysis and demonstration of risk minimization for long-lived wastes is unsound and should be removed. There may well be circumstances, particularly in the case of disposal of appreciable quantities of long-lived wastes, where consideration of risks and protective measures in the period after 1000 years is required. But these circumstances should be determined on a site-specific, waste specific basis. The time horizon for analysis should be determined on a case-by-case basis, as should any needed protective measures.

Another unjustified feature of the Tier 2 provisions is their imposition of across-the-board requirements, extending to 10,000 years, that are applicable to all LLW, most of which will have levels of radioactivity that have decayed to insignificance after 1000 years. Post-1000 year

analyses should be limited only to those wastes/sites for which convincing justification can be provided.

Finally, the proposed rule provisions unjustifiably introduce two novel standards, a Tier 2 standard based on a dose level that is “reasonably achievable based on technological and economic considerations,” and the Tier 3 standard that exposures will be “minimized to the extent reasonably achievable.” The substance of these respective standards is not clear. How these standards differ is also not clear. The ALARA standard is long-established and well understood through many years of application. There is no justification for introducing new and untried standards, which will introduce needless confusion and uncertainty, in place of ALARA.

In all these respects, the proposed Tier 2 and Tier 3 provisions depart from the regulatory policy that NRC has followed since issuing Part 61 in 1982, and are contrary to NRC's risk-informed, performance-based approach to protectiveness. We also believe that the Discussion accompanying the proposed rule does not provide sufficient justification for these departures from current policy and practice. These requirements are at odds with the explicit recognition elsewhere in the proposed rule Discussion of the grave uncertainties and difficulties in assessing exposures and performance over such long future time.⁴ While we understand and commend NRC's concern with the potential risks posed by Unique Waste Streams that were not considered when Part 61 was adopted, these risks can be appropriately addressed without imposing highly prescriptive, burdensome and unrealistic requirements that are not risk-informed or justified in the case of typical low-level wastes and sites. The special issues presented by Unique Waste Streams can be in our view appropriately be addressed through a single Tier 2 provision for a qualitative assessment of post 1000 year risks and other provisions in the proposed rule, including the site-specific waste acceptance criteria using risk-based performance assessments, defense in depth measures for disposal sites, and requirements for demonstration of a safety case that is periodically updated. These safeguards can and will ensure that the risks posed by long-lived wastes will be analyzed and protected against on a site-specific, waste-suit specific basis.

The provisions in in §61.42 for demonstrating compliance with respect to inadvertent intruder protection standards. These provisions require a showing of compliance with a regulatory limit of 500 mrem for a 1000-year Tier 1 period and for a 10,000 year Tier 2 period. They also represent an unnecessary and unjustified departure from regulatory policy that NRC has followed since issuing Part 61 in 1982, and are contrary to NRC's risk-informed and performance-based approach to protectiveness. We submit that instead, an ALARA standard should be adopted for inadvertent intruders for both Tier 1 and Tier 2 as the appropriate reference point for protective measures to be assessed and enhanced if necessary in particular site-specific circumstances. 500 mrem should appropriately be used as a guideline to be included in the evaluation, but not as a quantitative limit that requires compliance demonstration. In adopting Part 61.55, NRC had originally proposed a 500-mrem

⁴ See 80 FR 16089, 16090, 16091, 16092, 16108.

inadvertent intruder regulatory exposure limit, but deleted it on US EPA's advice that operationalizing such a limit as a regulatory requirement was not feasible. NRC thereupon dropped this proposal, explaining in the Part 61 FEIS, p. 5-4:

"The EPA commented that it was not appropriate to state the 500 mrem (whole body) dose limit as a regulatory limit in the Part 61 rule, since the licensee would not be able to monitor or demonstrate compliance with a specific dose limit that applies to an event that might occur hundreds of years from now.⁵

The Federal Register NPR discussion of the proposed rule fails to acknowledge or provide justification for reversing this longstanding decision. The reasons for EPA's objections to an inadvertent intruder regulatory limit remain valid today. ACRS in its comments on the preliminary proposed LLW rules also indicated opposition to an inadvertent intruder exposure limit, stating that the main objective of performance assessments is the avoidance of catastrophic consequences, rather than strict adherence to dose limits.⁶

Reinvigoration of a Risk and Performance Assessment Community of Practice

As discussed above, we find that, while many parts of the proposed rule exemplify the risk-informed, performance-based approach to regulation and waste management that the Commission has endorsed, the provisions requiring a 10,000-year compliance period in all circumstances and those relating to inadvertent intruders contain elements we find unnecessarily rigid and even unrealistic. We submit that these elements should be revised in favor of a more flexible approach geared to require performance more directly tied to circumstances of particular sites and wastes and the risks that they may pose.

In order to implement this approach, both in respect of this rule and the other elements of low-level waste regulation and disposition, we recommend that the NRC continue its commitment to mobilizing the professional judgment of regulators, the regulated community, and academic and other experts to define the sound science and risk-based assessments, determinations, and waste management decisions, and how they can best be applied in varying circumstances. The capacity to make such judgments would be greatly strengthened, and regulatory decisions significantly improved, if the professionals in different organizations, including NRC, DOE, and Agreement States along with non-government experts, collaborate closely and on a regular basis to share experience, best practice, and new developments in the relevant disciplines, including risk analysis and containment technologies. We believe that such a collaborative approach to low level waste regulation is necessary to ensure that regulations are practical and effective and minimize the potential inconsistency in low level waste management policies and practices. In particular, the Risk and Performance Assessment Community of Practice initiative, in which some of these commenters are active participants, has been revitalized and is regularly holding targeted web-based meetings, in which CRESA representatives have been presenters, on topics

⁵ <http://pbadupws.nrc.gov/docs/ML0525/ML052590184.pdf>, p. 136.

⁶ ML11256A191, 3 (Sept 22, 2011), *ACRS Report on proposed Part 61 revision*, p. 4.

of importance to LLW management. We urge NRC (and its DOE counterparts as well) to continue to provide leadership to this effort. We are ready to work in any way possible to support such important collaboration, and believe it can achieve consensus risk-informed approaches that best meet the requirements of the different regulatory regimes that shape this complex area of waste management.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "David S. Kosson". The signature is fluid and cursive, with a long horizontal stroke at the end.

David S. Kosson, Ph.D.

CRESP Principal Investigator

Cornelius Vanderbilt Professor of Engineering

Professor of Civil and Environmental Engineering

Professor of Chemical Engineering

Professor of Earth and Environmental Sciences

Vanderbilt University

Office: (615) 322-1064

Mobile: (615) 337-5889

e-mail: david.kosson@vanderbilt.edu