

**Nichols Presentation to the Commission to Review the Effectiveness of the  
DOE Laboratories  
Monthly Meeting  
March 24, 2015**

**Background.** Let me provide context for my remarks by telling you a little about myself, and my role in the National Nuclear Security Administration (NNSA).

In 2001 I retired from the U.S. Air Force, after a career that not only gave me my Doctorate in Engineering Physics, but also the privilege of working at Los Alamos National Laboratory for three years, recreating a performance baseline for the W76 nuclear warhead.

Upon leaving the Air Force, I spent four years as a staff member of the Defense Nuclear Facilities Safety Board (Board), providing oversight of Department of Energy's Defense Nuclear Facilities. That was my first exposure to the Departmental Directives System.

At the Board, I focused on understanding the content and interrelationships between the Department's directives that governed nuclear safety. There were 130 to 150 such directives at the time, in a variety of formats.

Since 2005, I have worked for the National Nuclear Security Administration (NNSA). I was a charter member of the Office of the Chief of Defense Nuclear Safety, becoming the Chief of that office in 2008. After subsequent reorganizations, I became the Associate Administrator for Safety and Health in 2011. I held that position until this year, when we merged my organization with the NNSA

Infrastructure and Operations Organization, and I became the principal deputy of the merged organization. In various capacities, my offices were responsible for the creation and revision of several directives, and for representing NNSA's interests in the directives process.

With that background, I'd like to explain some of the key factors that I believe give rise to the current situation, in which our contractor partners experience overly conservative decision-making and oversight. In my remarks, I will touch on the nature of the DOE enterprise, how that nature drives the creation of our directives, the conflict between theory and practice, and some of what we do to restore balance to the system.

**The nature of the Enterprise.** It is an understatement to say that the Department is an incredibly diverse entity. Activities governed by the Department range from quiescent, non-hazardous work to the assembly and dismantlement of nuclear weapons. Risks associated with our operations span the spectrum both in severity and in type. Some activities carry little risk of any kind, some carry large physical risks to public and worker safety, some have great economic risk, some involve matters of great importance to influential stake holders, and some carry all of the above.

As a further complication, our organization is geographically dispersed, which can create a sense of isolation and differences in approach even between activities that are somewhat similar.

**Our Directives.** The Department uses its Directives to establish policy, assign roles and responsibilities, and govern our enterprise. The diversity of the Department poses somewhat of a dilemma regarding the level of prescription and detail that directives should contain. Where risks are low, a high level of prescription is not warranted. Higher-risk operations require a higher level of prescription. So, it might seem appropriate to categorize our operations based on the level of risk, and then write and implement with a corresponding level of prescription.

To a great extent, this is what is done. Each of our directives includes an applicability section that describes what types of activities are covered. For example, we have different sets of requirements for work with radioactive and non-radioactive materials, or for on-site and off-site shipments. We classify our nuclear facilities into four categories, based on the potential hazards to the workers and public, and we make distinctions between them in the requirements that they must meet.

However, within any category of facility or activity there can still be a very wide range of circumstances that might exist, and also a wide range of risk. Given the nature of our business, we have many one-of-a-kind facilities. To get each Departmental requirement properly tailored to each unique hazard would result in a massive and very complex set of directives, with so many exceptions and special circumstances that it would be impossible to maintain. On the other hand, designing the requirements to consistently address the worst-case conditions would result in gross over-regulation at most facilities.

So, we build flexibility and engineering judgment into our requirements sets. For requirements that apply across a range of hazards, we include some requirements that must be met, but we also provide a large number of suggestions (guidance or 'should' statements) that allow for individual facilities to tailor the application of the directive to meet their unique needs without being overly conservative.

We also leave many requirements somewhat ambiguous to allow for flexibility in application. For example, we may say that the choice of a particular input parameter to a calculation must be technically justified, but we don't describe what constitutes appropriate technical justification. This paradigm is often, if somewhat erroneously, referred as telling 'what' to do, but not 'how' to do. It is also referred to as allowing for a 'graded approach,' in which the rigor and effort of the approach to meeting a requirement is expected to vary based on the level of risk involved.

Our directives system includes formal mechanisms to provide relief for those unique situations where the benefit of meeting a requirement is not warranted for some reason. The relief is available through approval of exemptions and equivalencies. Our relief approach is also graded, with approval of some matters available at the contractor level, others at the Field Office Manager level, and still others at a Secretarial Officer level. The criteria for approving relief are broad, noting for example that an exemption should pose no undue risk, but not defining how to determine the level of risk or how to determine whether it is 'undue.' The ambiguity is deliberate, to allow the decision authorities to exercise judgment in the application of the requirements to unusual and widely varying situations.

The result of this approach is what I refer to as a need for intelligent compliance, which is both a strength of the system and where the system begins to diverge from how it is supposed to work.

**Theory vs. Reality.** To illustrate this divergence, consider the situation in which an analyst needs to evaluate the safety of an operation at a nuclear facility, and put controls in place to ensure safe operations. We have a high level requirement that hazards in our nuclear facilities must be adequately analyzed and controlled. We have a standard that describes the steps that should be taken to analyze, document, and control the hazards of a nuclear facility. The standard is written at a level so that almost all of our facilities of a given type could meet all of the applicable requirements without a need for exemptions. However, most of our facilities contain unique hazards. If the analyst implemented only the requirements of the standard, it is likely that the resulting analysis would not meet the high-level requirement to adequately evaluate and control the unique hazards in the facility. Meeting the detailed requirements is a necessary but not sufficient condition for meeting the higher-level requirement they implement. Judgment (intelligent compliance) must be used to select some of the non-mandatory components of the standard, as needed, to address the aspects of the operations that not all facilities share.

This is where problems begin to arise.

The nature and need for expert judgment means that the conclusion on whether adequate safety has been achieved becomes somewhat subjective. The analyst may

be confronted with a range of values that could be chosen for a particular input value for a safety calculation, and in many cases has no standard that definitively says which value must be chosen to ensure adequacy. If the analyst uses sound judgment and chooses a value that is less conservative than one that might have been chosen, he or she is subject to criticism that the analysis is not sufficiently conservative.

In practice, this is a frequent occurrence. Oversight personnel scrutinize analyses for errors or non-conservative assumptions that would invalidate the analysis, and in so doing have appropriately identified significant errors and bad practices, improving safety for our operations. Oversight personnel are rewarded for improving safety, and so tend to seek the more conservative analyses.

On the other hand, there is generally no reward for 'pushing back' against a more conservative approach, and there is significant risk in doing so. Should oversight personnel push for adoption of a more conservative approach than the analyst chooses to pursue, there are likely to be serial meetings, correspondence and discussions held in which the analyst is required to defend the conservatism of the analysis in excruciating detail. The impact to schedule and the resource demands can be significant, and the competence of the analyst may well be called into question.

Moreover, should there be an accident and a contributing factor is determined to be insufficiently conservative analysis, the demand for accountability creates another

risk for the analyst that is minimized if the analyst adopts a more conservative approach.

In many cases, the cost of the increased conservatism (and the benefits of a more reasonably conservative analysis) would not be shared by the analyst, but would be borne by some other part of the organization.

So, other than the reward that comes from following one's personal integrity, there is little incentive to resist the pressure for a more conservative approach. Repeated capitulation to such pressure skews the entire the system towards ever-increasing over-conservatism, and does so at a grass-roots level, usually outside the formal decision making process of the approval authorities, and without their awareness except in unusually significant cases.

Though I have described this in terms of safety requirements and use the example of an analyst, this pattern is like a fractal that repeats itself throughout the enterprise. We could replace the analyst with anyone who has a responsibility for safety or other areas involving other types of risk. The pattern is present in the behavior of the people who draft and revise the requirements. It is endemic in our approach to oversight. Oversight personnel and organizations are inherently rewarded based on the problems that they find and the solutions that their attention drives. It is what they are chartered to do, and provides a useful function. Conversely, their very existence can be challenged should they miss something that later became germane in an incident. As with the analyst, the system rewards (or is at best neutral) an overly conservative approach and exposes oversight personnel to increased

professional risk should they choose to be 'reasonable' in their approach to controlling the risks for which they are responsible. Consequently, if they err they tend to err on the side of demanding increased conservatism.

At this point, one might ask why this phenomenon would be more prevalent in the Department than in other organizations, such as the Nuclear Regulatory Commission. I suspect that it is not absent elsewhere. But, the diversity of our operations and the consequent flexibility we have built into our requirements, combined with the high hazards of some of our operations, create an environment where the tendency to over-conservatism is inevitable. A system where there is less judgment involved in determining whether requirements are met should be less subject to the creep in conservatism that we consistently see in the Department.

**Restoring the Balance.** So, how do we counter this tendency, particularly if it is inevitable? Measures must be in place to actively counterbalance it by addressing the core weaknesses, and personnel must be in positions where they have sufficient power to resist and are motivated to do so, serving as a check on the system. As I am most familiar with the safety side of the Department, I will give examples of how we seek to establish appropriate balancing influences.

A key weakness in a judgment based, geographically dispersed system is the ability to have a community standard and awareness of what has been judged to be adequate elsewhere; having a sense that one is not standing alone when making a judgment strengthens one's ability to make an appropriate stand and lowers the perception of personal risk.

In NNSA, we have implemented a number of mechanisms to standardize implementation of nuclear safety requirements. We established a Biennial Review program for NNSA Federal organizations having nuclear safety responsibilities. We identified roughly 18 functional areas that were important to nuclear safety, and developed a standard set of review criteria. We then created a team that included a few core members to ensure consistency, but that largely pulled membership from the organizations that we were to review. For example, to review Los Alamos we took subject matter experts from other Field Offices to form the bulk of the review team. The common set of review criteria, together with the cross fertilization of subject matter experts educates the reviewers and reviewed alike, and improves the standardization of approach.

Another standardization method we instituted was the Safety Basis Professional Program. We identified roughly a dozen technical areas where we believed standardized, classroom training could improve consistency of approach for reviewing safety analyses, and had all of our safety basis personnel attend all the courses.

The Safety Basis Professional Program is an NNSA enhancement to the Department's Technical Qualification Program, which is required for all technical personnel who have nuclear safety oversight responsibilities. The standard training builds a consistent understanding and application of technical requirements. The network of relationships that comes from the classroom environment also helps reduce the perception of isolation when making decisions.

NNSA also established a periodic Technical Bulletin – a newsletter in which we address common areas of misunderstanding on safety matters, answer questions, publish thought pieces designed to stimulate conversation, and disseminate best practices and lessons learned.

We developed a standardized staffing model, known as the Capabilities Based Field Office, to normalize the numbers of personnel appropriate for providing oversight in particular functional areas.

There are other efforts I could mention, such as a variety of workshops and broad meetings where we discuss common concerns. Among these are the Energy Facilities Contractors Group (EFCOG) meetings, Facility Representative and Safety System Oversight workshops, and Nuclear Explosive Safety workshops, many of which involve both Federal and Contractor participation, as well as oversight personnel, and help to set common expectations.

Another weakness in a judgment-based system is the sense that there is no authority capable of resolving disputes over how safe is safe enough, or to adjudicate differences in opinion over what requirements mean. In 2005, the Department established Central Technical Authorities (CTAs), whose responsibilities included providing authoritative guidance and expectations on nuclear safety questions to their organizations. Over the years since, the NNSA CTA has taken positions on matters that had become contentious with oversight organizations, in order to bring non-productive discussions to a close.

The CTA is sufficiently high in the organization to be able to resist external pressures, and to feel the impact that overly conservative approaches bring to the organization. In NNSA, the CTA position has moved depending on the technical backgrounds of senior leadership. It was the Principal Deputy Administrator, became the Administrator, was delegated to me as Associate Administrator for Safety and Health, and is now held by the Associate Administrator for Safety, Infrastructure and Operations, for whom I now work.

Another measure we instituted is to require CTA concurrence on revisions to directives that impact nuclear safety. Over the years since, we have frequently used that concurrence authority to resist changes that we believed would have increased conservatism without commensurate benefit, and to ensure that NNSA comments – including those from our contractors – were adequately addressed. Since the CTAs were established, no Directive affecting nuclear safety has been published over the objection of a CTA.

The last measure I will mention is a process we have instituted to allow personnel to voice differences of opinion over technical matters involving safety. All of our sites have implemented Differing Professional Opinion (DPO) processes, and NNSA has a headquarters-level DPO process run by my organization. The process guarantees the right to each NNSA federal and contractor employee to voice disagreement with management decisions that they believe are counter to safety. The existence of the system is designed to help ensure fulsome discussion of issues at the lowest possible level, by providing a mechanism to allow elevation should local conversations not

resolve the issue. We follow an open, independent and transparent process to review issues raised as DPOs, and resolution of the DPOs that have been elevated to the headquarters level have often, in part or in whole, supported the position of the submitter.

**Conclusion.** I would suggest that at least in the area of nuclear safety, for decisions that are often judgment based, these measures to establish a community standard and ensure there is an authority to resolve disputes have helped. Nevertheless, instances of overly transactional oversight, overly conservative approaches continue to be reported, and I do not believe we have yet created a properly balanced system. I believe it is better than it was, but we need additional improvement.

I also believe that the most effective path for continued improvement is to continue the one we are currently on. I do not believe that changes to the requirements themselves are the answer. We have had repeated discussions at the worker level across our complex regarding excessively burdensome requirements and oversight. Although requirements can always be improved, the problem almost always cited at the worker level is the implementation, not the requirement itself (particularly because exemptions are always available to address inappropriate requirements).

I believe we need to continue to find ways to provide balanced perspective on implementation of requirements, to reinforce a common set of expectations, and to

provide personnel an assurance that they will be supported if they adopt a position that is reasonably conservative.

**Closing Comment.** Let me close with a comment about risk. Risk is the combination of a source of harm with the likelihood that the harm might happen. We commonly think that the correct risk decision is one that leads to no harm. Conversely, a decision to accept a risk that leads to harm is judged to have been the wrong decision.

Of course, we know that in reality this common mindset is flawed. When risk is accepted there is *always* a chance that the accident will happen even if the risk acceptor did everything right. In NNSA we have over 400 nuclear facilities. If I make a decision to accept a risk that could only happen at a facility once in a thousand years, but the risk exists at all of my facilities, I shouldn't be surprised if it happens somewhere in the complex every two or three years.

When we encourage our personnel to be more risk tolerant towards professional risks, we need to be mindful that a few may end up responsible for an undesirable result because they were doing precisely what we asked them to do. If, in the name of accountability, we penalize them or allow others to do so, we send an almost insurmountable message to their colleagues. We tell them that we will not support them if they take the personal risk we are asking them to take, and the statistically inevitable happens. When such events happen, we need to recognize that we as an organization accept risks through our policies and practices. The individual who

acts responsibly in accordance with those policies and practices is not to be blamed when the risk we accepted materializes on his or her watch.