



Pathways to New Missions

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*Thanks to Doug Minnema,
Neysa Slater-Chandler, and Jim Liverman*

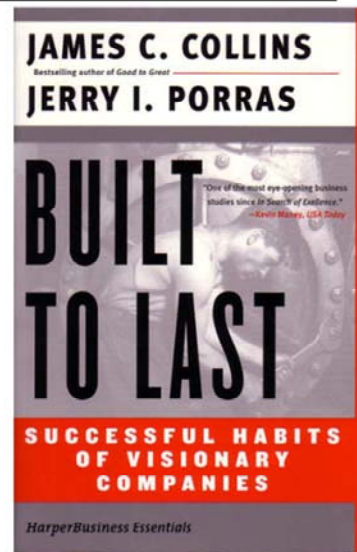
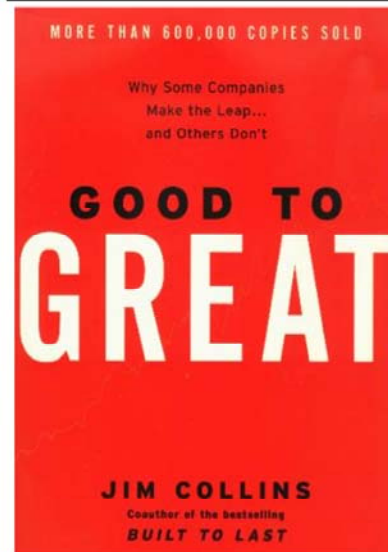
Thanks for the kind words of introduction. Thanks to Pat Worthington, Frank Russo, and Tony Umek for the invitation to speak, and thanks to our hosts at Savannah River.

This is the 3rd time I'm speaking at this Workshop, I like the theme of this year's Workshop -- Pathways to New Missions -- so much, that I've simply used it as the title of my Presentation.

Let me thank the Board's staff -- Doug, Neysa, and Jim -- for their contribution to this talk.

Finally, these are my opinions as the Chairman of the DNFSB.

New Missions



2

Three years ago, when I spoke to this group at Brookhaven National Laboratory, the theme was based on the Jim Collins' book *Good to Great*. At that time I said the key to Greatness was committed leadership and empowered workers. Over time, I've begun to fully appreciate the critical role of leadership in building the organizational and safety cultures **that enable** mission success. So, I'm pleased to be here to today to speak to you all, the Champions (and leaders) of ISM.

Before Jim Collins wrote *Good to Great*, he and Jerry Porras profiled long-lasting, visionary companies in *Built to Last*. This book could have been titled *Pathways to New Missions* because it talks about companies that succeeded and prospered because of leaders were able to identify new missions and they understood how to lead their companies into uncharted waters. Those that could not, did not survive! Companies like 3M, IBM, HP, Sony, Motorola, and Walt-Disney stood the test of time not only by being the best at what they did, but also by creating new missions that were aligned with their core organizational values and capabilities. Latest book is *How the Mighty Fall*.

Other, newer companies like Apple, Pixar, and Google, to name a few, appear to understand that concept also. Sadly, we need only to look at recent newspaper headlines to find many examples of companies that could not master the uncharted territory.

And let's be clear, DOE has always been seeking new missions. It is driven by R&D. Every major construction project is one-of-a-kind facility! This is one of the reasons that the Board has encouraged the introduction of safety early into the design of a facility or a new mission.

Pop Quiz: How did they do this?



3

First, let us begin with a pop quiz.

"In fourteen hundred ninety-two
"Columbus sailed the ocean blue.

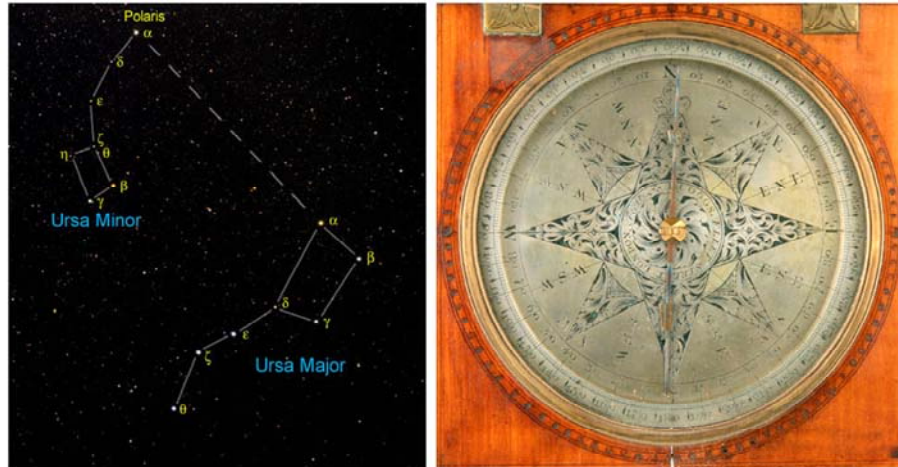
"He had three ships and left from Spain;
"He sailed through sunshine, wind and rain."

Columbus and his men sailed across an open sea, out of site of land, for 71 days. He thought he knew where he wanted to go to, and he thought he knew how to get there. Columbus did not know anybody who had ever made the trip before, so he was venturing into uncharted waters. There were no landmarks to guide the way, since there was no land to see.

So my question to you today is, "how did they navigate these uncharted waters?"

[Photo is of reproductions of Columbus' three ships, sailing off the coast of Florida on the 500th anniversary of the first trip.]

Answer



4

Let's follow the poem a little longer:

“He sailed by night; he sailed by day;
“He used the stars to find his way.

“A compass also helped him know
“How to find the way to go.”

My point is that Columbus did not venture into those uncharted waters without the best navigational aids available at the time. Columbus had embarked on a mission with his men and ships, but he did not have a safe path to follow. He created a safe passage one day at a time.

That is what we are here to talk about this week, how do we take the tools that we have created for safely conducting our current missions and apply them to new missions that have never been done before.

You know, it is easy to point to a 518-year old example and say, “see, he did it, why can't we?” But, hasn't the world changed a lot in those intervening five centuries? Haven't our tools and navigational aids improved a lot since then?

∴ I like to take a little time to explore those thoughts this morning.

Remember!



There is no GPS that will lead you safely into the unknown future. You must decide your own destination and use navigational aids for ensuring the safety of each step along the way.

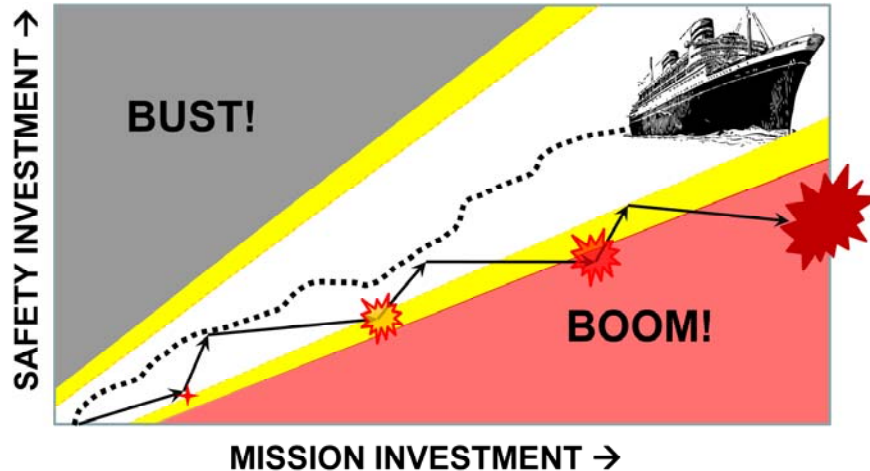
5

It is an often-used cliché, but it bears repeating – the future is uncharted. There are many new challenges to be overcome and many new things to be discovered. But there are also many new and different hazards to be avoided or controlled.

An example that comes to mind is nanotechnology. I was at Sandia National Laboratories when the initiative began. It was exciting, but in the early days no one was thinking about the health consequences of working with nano-particles that can be easily ingested and settle in the lungs. In fact, nano-particles are a perfect example. Their properties can be completely different than larger particles of the same material. Assuming we understood the hazards because we understood how larger particles behaved could cause significant safety problems.

There is always some “unknown-unknowns,” but we need a fighting chance. And every time we discover one of those unknown-unknowns, we must learn from it so it does not surprise us again.

Maintain a Balanced Course



A modified "Reason Model" -- from Reason, 1997 and Starbuck, 1988.

6

We can look at safety in the same way that Collins and Porras looked at corporate success, and the same way Columbus looked at exploration. Most explorers felt their way along shorelines and often were dashed against the rocks. Some sought uncharted waters; most failed to reach the opposing shore, but there were a few explorers that continually braved the uncharted waters and succeeded beyond all expectations. Why?

I use this model often because it says so much about organizational behavior. As it turns out, it is also a very good analogy to the concept of traversing the uncharted waters.

From the *Exxon Valdez's* grounding to NASA's shuttle and Mars-mission failures, we know what happens when teams try to simultaneously meet conflicting goals, such as the "better, faster, cheaper" paradigm or the design-build philosophy.

From Davis-Besse, Bhopal, Texas City, DC Metro, and Upper Big Branch Mine, we know what happens when we marginalize safety and maintenance to reduce costs, or when we measure our safety by injury and illness rates alone.

And from the *Deepwater Horizon* we know what happens when we try to reach new depths without adequately managing the risks involved.

We must always ensure a balance between our investments in safety and mission, especially when seeking new missions, and we should always err on the side of safety. We do not always know the perfect course to our destination, but we do know that each new step brings with it new hazards and larger strains on our safety systems. **We cannot continue to move forward on the mission without supplementing the safety resources also.**

Navigational Aids



- **Integrated Safety Management**
- Leadership and Culture
- Metrics and Leading Indicators
- Awareness, Assurance, Oversight
- Regulatory Enforcement
- Safety in Design
- Nuclear Safety R&D
- Directives and Standards



7

These are important navigational tools available to protect you and guide you as you embark on your quest for new missions.

They are the same tools that we have often discussed, but we will discuss them today in a different mindset, *that of explorer rather than tourist*.

Not in order of importance.

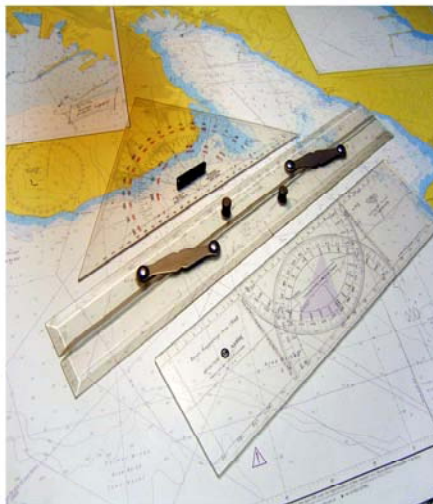
Integrated Safety Management



Once you have a new mission, ISM helps by

- Evaluating potential hazards of each step to be taken
- Identifying controls to reduce or eliminate those hazards
- Helping you learn from the last step before taking the next step

**Charting a safe course
is not enough –
You must follow it!**



8

The decisions as to what future missions we will explore are the responsibility of DOE's senior managers. But once those decisions have been made, we begin the process of charting a course through the unknowns separating us from that destination.

Integrated Safety Management is one of the primary tools in the day-to-day efforts of exploring the unknown. ISM guides us through a process of systematically evaluating what we know and don't know about the step we are about to take; it helps us identify the possible hazards involved with that step; it leads us to methods to eliminate, control, or mitigate those hazards should we encounter them as we take the step; and it shows us how to take what we experienced during that step and learn from it before we take the next step.

Once you chart a course, you must resist the temptation (because you're in new mission space, to become distracted and engage in corollary activities without a careful hazards analysis. There are unknown-unknowns lurking. Staying on the course we've charted is certainly the key to successful exploration, but if we find that we cannot do that, then we need to be sure and use the same processes to evaluate any changes in our direction. **As any good hiker knows, stepping off the trail is the first step in getting lost. Oh, I have a few stories about getting lost while hiking.** And navigational aids saved the day. In one case, I followed a river bed to safety; in another, I used the position of the sun to set my direction; in a third, I came to a body of water and tasted it to see if it was salt water.

Leadership and Culture



- Safety is a team effort
- Building a great team takes a great leader

Are we building the leaders of tomorrow? Do we know how?



9

It only takes one photo to remind us of Captain Sullenberger and the crew of US Airways Flight 1549. They not only taught us a great deal about leadership and teamwork, they also reminded us that with proper training and practice, one can recover from even the worst, most unexpected situations in the best way.

A group's culture is a product of its leadership, it is not a separate entity. Managers must understand that they are closely watched by their staff, and **their personal behaviors and decisions set the examples for the organization**. Whether you are managing a group of 5 or 5000, if you want your group's culture to change then you must change first!

We must understand that the organization's culture is the true basis for the success of any mission or safety program. **Culture is "how we do things here."** All of the best procedures, all of the most detailed evaluations, all of the latest instruments and techniques will serve no purpose if they are not consistent with how work gets done in the organization.

Captain Sullenberger understood this; he set the example for his team and for us.

Leadership and Culture



Leadership is not a “crash course”

- Leadership development programs
- Hiring & promoting practices based on safety ethics as well as work ethics
- Succession planning
- Properly aligned rewards programs

Culture needs active management

- Managers need to lead by example
- Employees need to be actively engaged
- *Organizational changes need evaluation for cultural and safety implications*
- Technical competence must persist
- To manage culture, we need metrics



10

Missions and organizations change frequently within DOE, creating stresses that can fundamentally alter the cultural basis upon which safety depends. **But the impact of these changes on culture and safety are not recognized, and subsequent declines in safety performance are not anticipated.** Change will continue to occur, that is inevitable. But leadership and culture are the keys to both accomplishing a mission and ensuring its safety; we must instill in our future leaders the skills necessary to actively manage organizational culture. **So, our new leaders will forge new missions. Only then can we negotiate the Pathways to New Missions.**

FR program is a good example of valuing safety.

And one thing we must never forget – our missions require a high degree of technical competence within both the Contractor and the Federal organizations. Technical inquisitiveness and competence are vitally important attributes for both mission and safety. New missions require new approaches, new approaches require new tools, new tools require new perspectives, new perspectives require new understandings. As we learn to manage and adjust organizational cultures to make us safer, we must be sure that we do not interfere with those basic technical attributes that make us successful.

Note that I said that this applies to both the Contractors and the Federal staff. **For DOE to accomplish its inherently governmental functions,** technical inquisitiveness and competence must be highly prized core values that DOE and its organizations continuously pursue.

Metrics and Leading Indicators



- Metrics are a vital part of managing any effort
- For safety, managing by lagging metrics alone is risky and ineffective
- Leading indicators are metrics that tell us what may come to pass
- But there is no ideal leading indicator, so do not wait for one before starting
- Leading indicators only mature with use

The value of any metric, leading or lagging, is determined by the quality of the decisions it facilitates



11

All of you have been putting a great deal of effort into developing performance-based assurance systems; this means you are all thinking “how can I measure that?” **There is no doubt that metrics are an important part of managing a large and complex operation, and in that sense the effort is appropriate.**

But we cannot manage by metrics alone, especially if those metrics are based on past accomplishments. These lagging metrics are very limited in their ability to predict future performance. I’m reminded of the little disclaimer at the bottom of the financial advisors’ advertisements – “past performance is no guarantee of future success.” In some cases there are events we hope to avoid completely; in those cases past performance is only a measure of success or failure and nothing at all can be inferred about future performance.

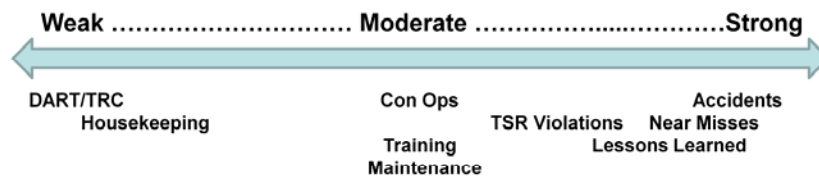
It is time that we begin to manage with leading indicators. We have been talking about this for a while; other industries are already doing it well. We all understand the concept; we all recognize its value; but we have gotten hung up in the hunt for perfection. Well, let’s face it – there is no perfect leading indicator that works for everybody. There is no mathematical function that equates tomatoes to oranges, either. Regardless of what some people think, logic based on a shared horticulture tells us that tomatoes and oranges are both fruit. In the same way, logic based on a shared organizational culture will allow us to interpret the meaning of interlinked metrics and trends.

Leading Indicators



The Board encourages the use of leading indicators that

- Consider relative trends between safety and production
- Receive full senior management attention and support
- **Lead to “actionable” conclusions**
- **The value of a leading indicator is based on the strength of its association with the detriment to be avoided**

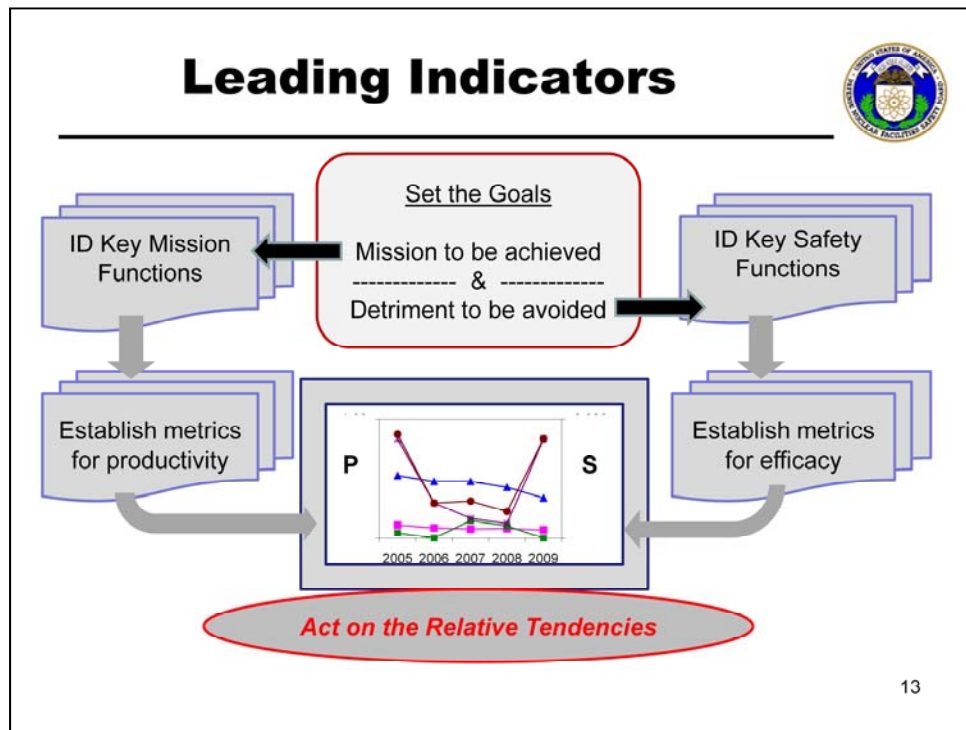


12

For us, leading indicators are uncharted territory, but we must start somewhere. It is important that we first understand what we want to accomplish with a leading indicator program. If we all had similar operations, then we might be able to create one universal set of leading indicators. But we know that is not the case. Even in the commercial nuclear industry, where all plants do essentially the same thing (generate electricity), there has been a great deal of difficulty creating that universal set of indicators. Each organization operates differently.

There may not be a perfect or universal set of leading indicators, but we can identify a universal set of attributes that a good leading indicator program should have. **In essence, any good leading indicator program must be monitoring the collective decisions made by the organization and ensuring that those decisions maintain an adequate balance between safety priorities and mission priorities.**

There is a broad spectrum of metrics that one can use as leading indicators, but their strength depends on the intended purpose. For example, DART and TRC rates are frequently touted as indications that an organization is safe. However, those metrics provide no indication of the quality of the facility or process safety programs. In fact, focusing on DART and TRC may actually divert resources and attention from facility safety programs. For low-probability, high-consequence operations, metrics such as the rates of TSR violations, near misses, and procedural violations are much more informative and supportive of the facility's safety efforts.



The Board has proposed a goal-based approach to identifying and using leading indicators that we believe will get us off and running. We encourage all of you to consider our approach, or build one of your own, but most importantly, **get started on something**. With practice will come experience; with experience will come maturity; and with maturity will come full benefit.

This graphic illustrates our concept of a process for determining leading indicators.

It begins with the end in mind by asking the question “what is to be accomplished and what is to be avoided?”

Having decided that pair of goals, then one identifies the functions necessary to accomplish those goals and then determines the metrics that measure the quality and effectiveness of those functions.

By following the relative trends of the paired goals, one can begin to understand the direction we are headed in James Reason’s “mission-safety investment” space. As a result, trends become more recognizable and needed course corrections become readily apparent.

Awareness, Assurance, Oversight



- Recent major accidents have implicated inadequate oversight
- Awareness, assurance, and oversight are vital management tools

We must not relax awareness, assurance, and oversight to improve efficiency and productivity

14

[Top row: Minneapolis I-35W bridge collapse, 2007, 13 dead; Upper Big Branch Mine explosion, 2010, 29 dead; DC Metro crash, 2009, 9 dead. Bottom row: Metrolink #111 train crash, 2008, (26 dead), Imperial Sugar Company dust explosion, 2008, 14 dead; Deepwater Horizon explosion and oil spill, 2010, 11 dead.]

We all have seen the pictures. We all know the names – British Petroleum, California Metrolink, Upper Big Branch, Tesaro, DC Metro, Crandall Canyon, Imperial Sugar, Interstate-35 West, and so on. But these are only some of the major organizational accidents that have recently occurred in the United States alone. We do not have to go far to find clear examples of the importance of both corporate- and government-level awareness and assurance programs, as well as the need for robust and proactive oversight by regulatory bodies.

Like performance metrics and leading indicators, assurance and awareness programs are important tools providing valuable information to line managers about their safety programs. **And oversight is an important inherently governmental function that must not be compromised.** Too many lives have been lost, too many missions have failed for us to neglect those lessons.

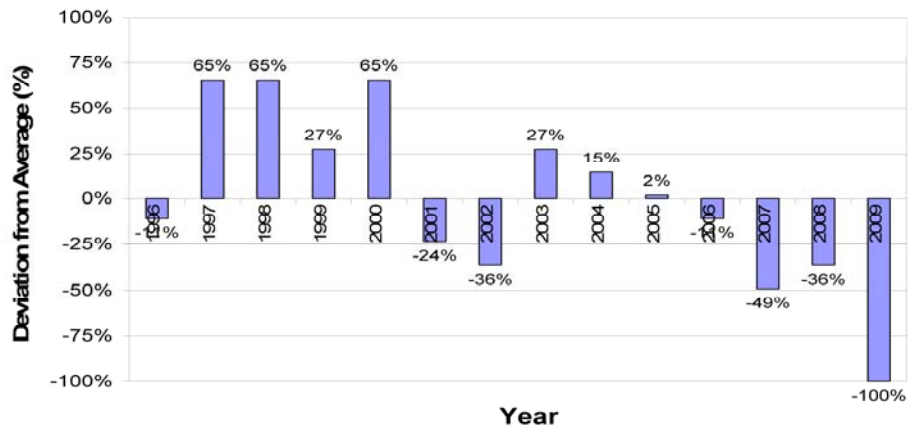
As both line manager and regulator, DOE is responsible for all three types of activities, assurance, awareness, and oversight. DOE must avoid the temptation to rework and integrate these activities in order to gain operational efficiencies. DOE must be careful about shifting responsibilities between contractors and Federal staff. The cost of one significant accident, whether measured in loss of life, loss of money, loss of mission, or loss of public confidence, will far outweigh any gains made in efficiencies.

We must learn from these painful lessons and not set ourselves up to repeat them.

Regulatory Enforcement



DOE PAAA Nuclear Safety Notices of Violation



- There has been a big drop in PAAA enforcement actions since 2006
- The Board is evaluating this change in enforcement patterns

15

Regulatory enforcement is another inherently governmental function of DOE, first mandated by Congress in 1988. Enforcement plays a very important role in upholding the regulatory basis of DOE's modern nuclear safety paradigm.

The Board has noted a big change in DOE's nuclear safety enforcement in recent years. **From 1999 to 2006, DOE issued about 8-12 nuclear safety enforcement actions per year. After 2006, the numbers have been dropping steadily per year from 5 to 0.** Overall, what this chart tells us is that the **number of nuclear safety violations issued per year by DOE has dropped by over 67% since 2006.** Last year, there were no nuclear safety enforcement actions taken at all. While we would like to believe that this trend represents a substantive improvement in the nuclear safety posture, this is not consistent with the Board's perception of the state of nuclear safety within DOE.

To get the "Deviation from Average," calculate an annual average for the number of enforcement actions the PAAA office has issued since they began; then calculate the difference between the average and the amount for each individual year. That displays the data in terms of positive and negative values, which allows one to accentuate the drop over the last few years on the graph.

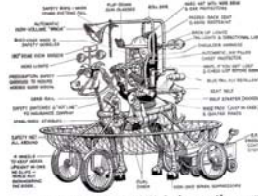
Regulatory enforcement is as important today for ensuring effective implementation of DOE's nuclear safety requirements as when it was mandated 22 years ago. Regardless of why it has occurred, **this recent drop sends a strong message to the Contractors that DOE is either reducing the importance of nuclear safety or is satisfied with the current level of implementation.** Neither of these perspectives is consistent with an organizational goal of continual improvement. If implementation has improved to minimum acceptable levels, then it is time to raise the bar and begin to push performance to the next level. If implementation is not at minimum acceptable levels, then DOE's failure to take action is establishing a new, lower de facto standard.

Safety in Design



- The Board is encouraged by DOE's efforts to consider safety early in the design process
- As new missions arise, consider applying this concept more broadly in project planning
- The resulting continuity of analysis between design and operation of nuclear facilities has proven valuable
- Facility safety and worker safety are both important but must be managed separately

Adding safety as an afterthought is inefficient and ineffective



16

One of the areas where the Board has seen good progress over the past few years has been in DOE's efforts to better integrate safety early in the design of new facilities.

This is critical for new missions and the one-of-a-kind facilities that DOE designs and builds.

This is also an important concept to remember when we think about charting pathways to new missions. **Even if we are not designing a new physical structure, we are designing new methodologies, new technologies, new products; including safety considerations early in those designs will certainly help improve both the safety and the cost-effectiveness of the activity or product.**

Nuclear Safety R&D



The Board is concerned about DOE's lack of commitment to resolving cross-cutting nuclear facility safety concerns

- Many safety controls are conservative due to uncertainties that could benefit from further study
- Reducing uncertainties and improving understandings would improve efficiency while enhancing safety
- New missions and technologies will also introduce new hazards that will need to be studied



17

New missions and hazards cannot be fully analyzed without a strong underpinning of research and development.

There is no doubt that DOE's culture fully appreciates the need for mission-related research; that is why DOE exists. And if there is an aspect of a particular mission that requires safety considerations, that is well appreciated also.

But there is a lack of appreciation for the need for safety-related research applied to DOE's day-to-day operations. DOE's nuclear safety controls usually depend on cross-cutting areas such as aerosol generation, dispersion, and measurement; fire propagation, detection, and suppression; and others. Very conservative assumptions and models are applied in many of these areas because either the basic phenomenology is not well understood or there are large uncertainties in key parameters. **New research in these areas will help improve safety and will also help improve operational efficiencies.** It's a win-win situation for DOE.

Most importantly, we cannot hope to chart a course into the unknown future without ensuring that we have the tools necessary to do it safely. And that will require a robust nuclear safety R&D program designed to identify and quickly respond to emer_in_ threats and unanticipated issues.

Board is planning a public meeting.

Directives and Standards



Oversight & Governance Changes

- 1991 SEN-35-91 issued, initiating modern nuclear safety within DOE
- 1994 1st DOE Nuclear Safety Rule issued
- 1995, 2009 DOE studies external regulation
- 1995, 2002, 2005, 2010 DOE pilots new governance models
- 2000 NNSA formed
- 2005, 2010 EH/HSS new oversight models

Selected DNFSB Recommendations

- 90-2, *Codes & Standards*
- 91-1, *Safety Standards Program*
- 92-2, *Facility Representatives*
- 94-5, *Integration of Rules, Orders, etc*
- 95-2, *Safety Management*
- 98-2, *Safety Management at the Pantex Plant*
- 04-1, *Oversight of Complex, High-Hazard Nuclear Operations*

Major Directives Reforms

- 1991 SEN-35-91 issued, initiating modern nuclear safety within DOE
- 1994 1st DOE Nuclear Safety Rule issued
- 1995 DOE considers shift of orders to rules
- 1995 Directives shift: 4-digit to 3-digit
- 2001, 2002, 2007, 2009 Major HQ-led streamlining reviews
- 2010 DOE Safety & Security Reform
NNSA Governance/Contract Reform

Creating a good set of standards and directives is not easy, but frequent changes cause turmoil.

18

Developing and maintaining an effective set of directives and standards is not easy. But today's set contains over 60 years of learning from our experiences and growing more mature in our expectations. We need to focus more on what is good about the standards we have now; they have guided us and shaped our success. Why do we continually chip away at these basic tenets of our safety posture? Are we trying to re-write our own history?

The Board is closely monitoring the directive reform effort to ensure that the existing margin of safety at defense nuclear facilities is not compromised, and **we have been assured that nuclear safety requirements are "fenced" from substantive changes. The Board is always interested in strengthening safety and oversight at defense nuclear facilities and views this as an opportunity to do so, if done with care.**

The Board is concerned with the turmoil that can be generated during large scale revamping of DOE's directives and standards. There are workers who are asking "aren't we safe enough already? Will these changes make me less safe?" There are resources drawn from operational safety programs to implement the new requirements. There is significant potential for unintended consequences and unforeseen implications. We must be extra cautious as we continue these efforts to ensure that changes are fully analyzed and vetted before putting them into place and that we have not done more harm than good.

Throwing these directives away would be like Columbus throwing his compass overboard.

Conclusion



- The pathways to new missions have not been charted; navigational aids are needed
- Many of those navigational aids exist within your ISM toolbox and DOE's framework
- Some tools, such as leading indicators and metrics need to be aggressively deployed
- Leadership and culture are the foundations of safety and mission accomplishment; we must learn to manage them
- Directives and governance reform may be necessary, but they should only be done with great caution
- Nuclear safety research and regulatory enforcement are important functions that need renewed attention



19

To sum up, you have the tools and navigational aids already laid out for you to begin charting the pathways to new missions. In fact, every new day is an uncharted future to be explored; we do not know what we will find at the end of the day. But, we do know what direction we want to take and we know that we want to get to the end of the day safe, secure, and successful.

Many navigational aids are already deployed in our workplaces, leading the way and pointing out the hazards. Some, such as Integrated Safety Management and Safety in Design, have been widely accepted and are working well. Others, such as awareness, assurance, oversight, and enforcement, have fallen into some disrepair and need to be rejuvenated. The technical basis underpinning DOE's nuclear safety practices is beginning to show its age, and new nuclear safety research is necessary to get it back up to full strength.

Finally, there are new tools becoming available to us that will prove extremely valuable as we look to the future. If we can create well prepared leaders and organizations possessing strong cultures that equally value safety, technical competency, ethical responsibility, and environmental sustainability; if we can give them both the current tool set and powerful new tools like leading indicators, then we will be able to take on and conquer any thin_ the future can throw at us.