California Dig Safe Board

STRATEGIC PLAN

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Introduction

The World As It Is

The Board's vision statement proposes to tell the world what the world should be:

> *The Dig Safe Board seeks to affect a California in which the state's excavators and subsurface installation owners know and understand:*
> - *how to identify the locations of subsurface installations*
> - *how to protect against dangerous contact with those installations*
> - *how to resolve unexpected situations that may arise, and*
>
> *in which the state's excavators and subsurface installation owners exercise that knowledge and understanding to promote a culture of mutual respect and dedication to the belief that everyone goes home safe.*

We rely on infrastructure that in many cases was built more than a century ago, though age is no clear proxy for unreliability, as many newer installations were placed without creating effective records, with existing paper records management "downsized" and not making the transition to digital,[1] managed in underfunded departments, and dug up by workers whose jobs are among the lowest paid in high hazard occupations.[2]

The oldest systems are often among the best-built. Following the discovery that cholera outbreaks were caused by untreated waste water and a "Great Stink" of human waste that rose from the Thames in a record-breaking August 1858 heat, London built the world's first great sewer system, running 13,000 miles and using 318 million bricks, and effectively eliminated cholera within its borders.[3] London still uses this sewer system today.

Little of the rest of our infrastructure is so well-characterized. According the Transportation Research Board (TRB), reasons for this include:

- Multiple ownership changes have left original records in disarray.
- Drawings reference roads, trees, buildings, and parking lots that are either no longer present or appreciably changed since facility installation.
- Abandoned line records are either not kept or have not been changed to recognize them as abandoned.[4]

For records created before the widespread use of GPS, there was no way to indicate depth aside from depth of cover, which can change for various reasons.

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[1] Jaxon Van Derbeken, "PG&E might have discarded records" *San Francisco Chronicle*, July 22, 2011; Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, *Encouraging Innovation in Locating and Characterizing Underground Utilities*, National Academies Press, 2009, p. 18.
[2] https://www.monster.com/career-advice/article/high-paying-dangerous-jobs
[3] Stephen Halliday, *The great Stink of London: Sir Joseph Bazalgette and the Cleansing of the Victorian Metropolis*, Sutton, 1999.
[4] TRB 2009, p. 18.

The problem isn't merely with old installations. As TRB identifies, "different parties may be responsible for utility depictions for differing phases of the project (for example, planning, design, and construction)" and responsibility may not be well delineated.[5] Nor is the problem solely isolated on the installation and record creation process. When public agency transportation designers and design consultants were asked what were the greatest contributions to inaccurate utility locations, they answered cost, time, and lack of management support.[6]

The reliability of our infrastructure depends not just on the strength of its construction but the capability of the people who operate and maintain it, as well as their relationships with those who work around it. In looking at the challenges of managing our highly-interconnected infrastructure, Paul Schulman and Emery Roe of the University of California at Berkeley Center for Catastrophic Risk Management find that "[c]ommonly proposed solutions to the infrastructure crisis, such as finding new financing mechanisms to generate the trillions needed for new assets, are inherently ill-advised, we argue, when the real organizational and institutional dimensions of the reliability challenge have not been recognized."[7] and that the "experience, background, and memory of system operators move center stage in the reliable performance of these large sociotechnical systems."[8]

Those operators are aging out of the workforce, and their experience is going with them. A 2017 survey by the Center for Energy Workforce Development found that a large wave of the experienced workforce in the electric, natural gas, and nuclear generation industries had retired in the past ten years and that the workforce is now considerably younger.[9] The construction industry has also faced considerable turnover, in that time, as anticipated by a 2009 study identifying the shifting age demographics of the construction workforce as a significantly greater challenge for its employers than for other sectors of the economy, as manifested in problems transferring knowledge from experienced employees to less experienced employees.[10]

Given the experience that has already transferred out of the utility and construction workforce, the opportunity window for knowledge transfer is closing. In addition to rebuilding much of the nation's deteriorating physical infrastructure, only a similar effort to rebuild and sustain its knowledge infrastructure will prepare its workforce to manage the mess buried below.

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[5] TRB 2009, 15.

[6] Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, *Encouraging Innovation in Locating and Characterizing Underground Utilities*, National Academies Press, 2009, p. 9.

[7] Emery Roe and Paul R. Schulman, *Reliability and Risk: The Challenge of Managing Interconnected Infrastructures*, Stanford (2016), p. 9

[8] *Ibid* p.7.

[9] Center for Energy Workforce Development, "Gaps in the Energy Workforce Pipeline: 2017 CEWD Survey Results." http://cewd.org/documents/surveyreport/2017CEWDSurveySummary-FNL.pdf

[10] Stephen Sweet, Marcie Pitt-Catsouphes, Elyssa Besen, Shoghik Hovhannisyan, Farooq Pasha, "Talent Pressured and the Aging Workforce: Responsive Action Steps for the Construction Sector," Sloan Center on Aging and Work, 2010, p. 30.
https://www.bc.edu/content/dam/files/research_sites/agingandwork/pdf/publications/TMISR05_Construction.pdf

To maintain the trust and confidence of the Legislature and the people of California, State governmental agencies like the Dig Safe Board must adhere to statutory and administrative law, but should also develop program-specific methods to track, report, and improve agency performance. A system approach to program that quantifies outputs and creates benchmarks for process stages using a published methodology would improve agency performance.

Board History

The California Underground Facilities Safe Excavation Board was created by the Dig Safe Act of 2016 (SB 661 (Hill), Chapter 809, Statutes of 2016) to investigate accidents, develop excavation safety standards, and coordinate education and outreach programs. The Board receives administrative support from the Office of the State Fire Marshal, which is part of the Department of Forestry and Fire Protection (CAL FIRE). The Legislature authorized funding for the Board in the Budget Act of 2017 (Chapter 14, Statutes of 2017), including 21 positions—9 authorized for Fiscal Year 2017-18 and an additional 12 investigators for the 2018-19 Fiscal Year.

The Board was created out of a belief by members of the Legislature that the way the State's "call before you dig" law was being enforced—through statutory liability provisions (Government Code 4216.7)—was not conducive to maintaining public and employee safety. Federally-mandated public awareness programs conducted by natural gas and petroleum pipeline companies appeared to have only limited effect, as 55% of the State's more than 5,200 natural gas pipeline strikes in 2015 occurred without a "call before you dig" ticket.[11] Contractors and utilities blamed each other: the utilities would state that contractors would rather plow through buried infrastructure than spend the time and cost to uncover them, while the contractors would maintain that utilities would never take responsibility for their poor locating but would instead invoice contractors for damages regardless of who caused it.

In a 2015 hearing before the Assembly Utilities and Commerce Committee, Senator Hill stated that "the worst part about these disputes is how they are resolved—in settlements with non-disclosure agreements where both sides walk away feeling they got the short end of the stick and learning nothing."[12]

The Legislature's concerns would be validated in 2015 with fatal natural gas explosions in Fresno and Bakersfield. Governor Brown signed SB 661 on September 29, 2016.

Mission, Vision, and Values

The Board's first action in its inaugural January 2018 meeting was to adopt policies, including mission, vision, and values statements.

Policies that express the image an organization has of itself can rally internal stakeholders around goals the organization sets for itself and sets expectations of external stakeholders in

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[11] 2015 California Regional Common Ground Alliance Facility Event Report.
https://osfm.fire.ca.gov/media/4123/carcga-dirt-report_2015.pdf
[12] July 6, 2015.

their interaction with the organization. Such statements play a fundamental role in the creation of direction and can be particularly powerful in a new organization, such as the Dig Safe Board.

Mission, vision, and values statements have a special purpose in strategic planning, a commonly-understood direction unified across the organization.

Mission (Policy B-02)
The California Underground Facilities Safe Excavation Board improves public and worker safety by facilitating communication and learning among excavators and the operators of subsurface installations, by investigating accidents to determine their causes, and by developing solutions to improve safety outcomes. The California Underground Facilities Safe Excavation Board strives to be a model regulatory and investigatory Board for other states to emulate.

Vision (Policy B-03)
The California Underground Facilities Safe Excavation Board seeks to effect a California in which the state's excavators and subsurface installation owners know and understand
- how to identify the locations of subsurface installations,
- how to protect against dangerous contact with those installations, and
- how to resolve unexpected situations that may arise, and

in which the state's excavators and subsurface installation owners exercise that knowledge and understanding to promote a culture of mutual respect and dedication to the cause that everyone goes home safe.

Values (Policy B-04)
The actions and decisions of the Underground Facilities Safe Excavation Board members and staff will be guided and informed by their commitments to:
- Respect for and attentiveness to the expression of differing backgrounds and perspectives of the Board's members, the public, and stakeholders, as well as for the missions of excavators, operators of subsurface installations, and other federal, state, and local agencies.
- A culture of continuous learning based on the development and free exchange of safety information.
- Inquiry into the facts of and context behind accidents, near misses, and latent safety-related conditions in the field.
- Accessibility to the public and stakeholders, within the bounds of the law, constitutional principles of due process, and ethical conduct.
- Integrity in serving in the public interest and devotion to maintaining the public's trust.

Models for Organizing Board Activities

Government Performance and Results Act

One framework for organizing Board activities is the federal Government Performance and Results Act (GPRA), passed in 1993 and amended in 2010, which outlines the basic strategic planning requirements for federal agencies.[13] In preparing the law for adoption, a congressional conference report highlighted Congress's view on its need: "At present, congressional policymaking, spending decisions, and oversight are all seriously handicapped by the lack both of sufficiently precise program goals and of adequate program performance information. Federal managers, too, are greatly disadvantaged in their own efforts to improve program efficiency and effectiveness by that same lack of clear goals and information on results."[14]

In general, GPRA requires federal agencies to develop strategic plans every four years, coordinated with the presidential elections, and performance plans annually. The strategic plans outline high-level strategic objectives, while the annual performance plans describe the activities that agencies will undertake in advancing toward those objectives. Objectives may be mission-focused, contributing directly to an agency's strategic goals, or management focused, building the capabilities (human capital, information technology, financial stewardship, etc.) upon which the agency can meet strategic goals.
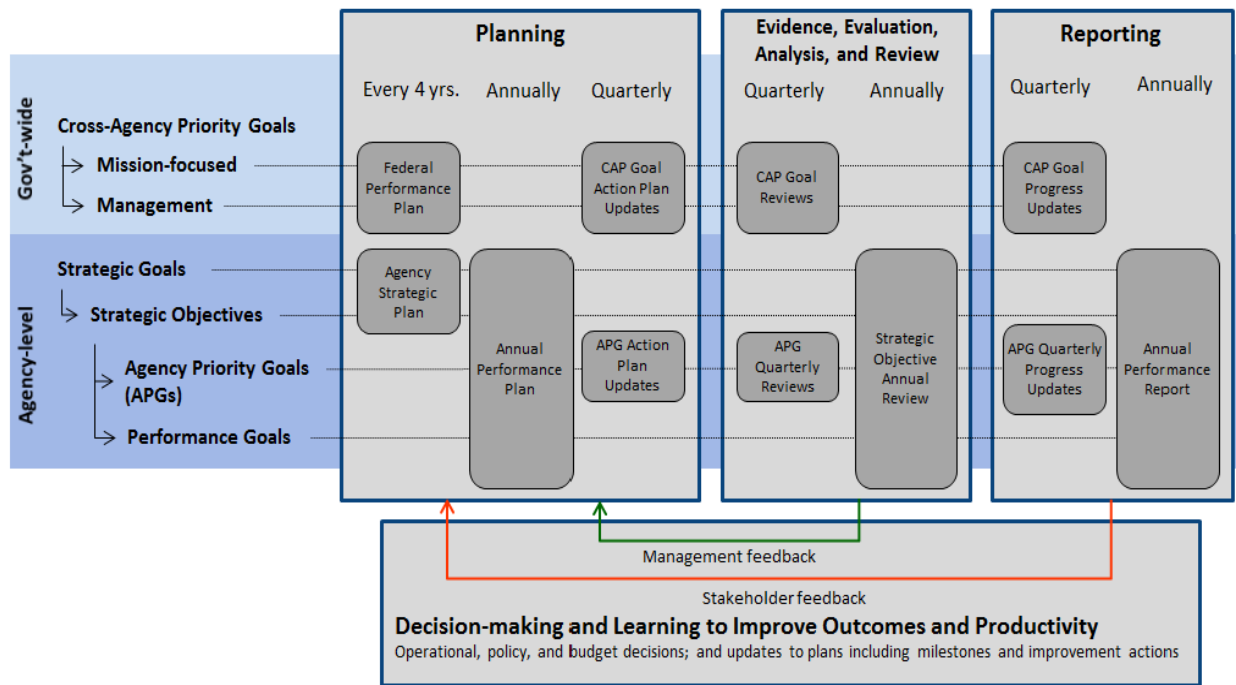

Figure 1: Government Performance and Results Act workflow. From OMB Circular A-11, Part 6, Executive Summary-3.

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[13] Part 6 of the Office of Management and Budget's OMB Circular A-11 sets the specific requirement for agencies and offers guidance.
[14] Report 103-58, Government Performance and Results Act of 1993, to Accompany S. 20. Senate Committee on Governmental Affairs, June 16, 1993. https://obamawhitehouse.archives.gov/omb/mgmtgpra/gprptm

Safety Management Systems

While the GPRA strategic planning framework creates transparency in goal-setting and performance, it is too broad a tool to specify the processes for continual improvement of safety. To fill this void, administrative units within the Department of Transportation— the Federal Aviation Administration (FAA) in particular—have adopted and continue to develop elements of a safety management system approach to regulatory oversight. The safety management system approach—as envisioned by the FAA and International Civil Aviation Organization (ICAO)—focuses on safety policy development, safety culture promotion, and a process for safety management and continual improvement.

In general, adopting a safety management system approach[15] would, among other things, require the Board to identify the safety problems that currently exist, determine all the possible causes to the problems, analyze those causes and how they contribute to the problems, determine the possible solutions for dealing with the identified problems, and then act to resolve those problems. Once action is taken, the Board will need to monitor the success of a safety resolution by performing audits, investigating incidents and accidents if they occur, and soliciting stakeholder feedback to determine whether any updates need to be made. If not, assessments are done periodically. If so, changes are made to address issues and another assessment is done.

In its most fundamental form, a safety management system workflow follows the Shewhart Cycle presented in the 2018 Plan, **Figure 2**.
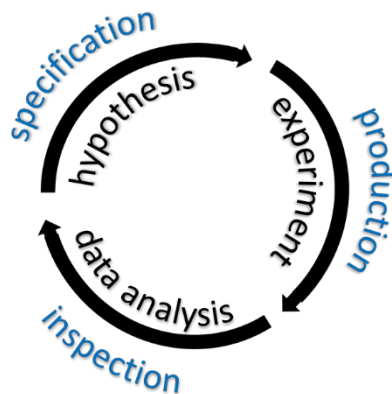
Figure 2: Shewhart Cycle of knowledge production and quality control

The underlying premise of the workflow is that safety performance is only improved iteratively and can't be determined ahead of time. To have some assurance that safety is being maintained, controls need to go through a continual cycle of design, implementation, monitoring, and redesign. The relevant question is not "does the system work?" but "in what areas does it not work?"

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[15] Based on the presentation of Don Arendt to the Pipeline and Hazardous Materials Safety Administration, "Culture, Safety," August 31, 2013, minute 00:50:50. http://www.youtube.com/watch?v=4HzxDvTengM#t=3010

The civil aviation community, through the International Civil Aviation Organization (ICAO) and in the United States, the Federal Aviation Administration (FAA), has built on the Shewhart Cycle and adopted a safety risk management/safety assurance workflow for monitoring and making changes to the aviation industry.
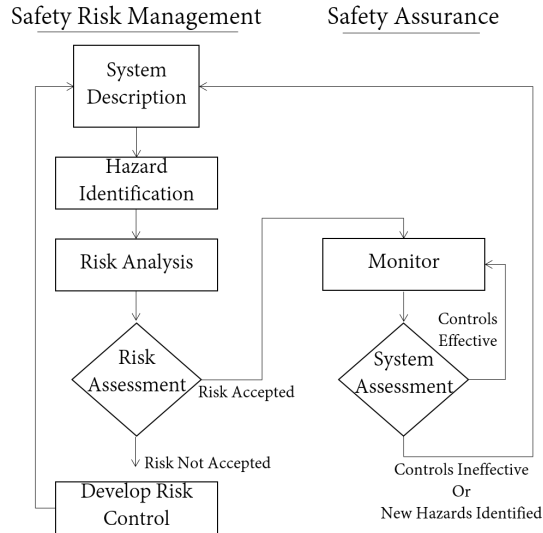

Figure 3: Modified Safety Risk Management/Safety Assurance Workflow. Simplified from Federal Aviation Administration Order 8040.4B: Safety Risk Management Policy, May 2, 2017, p. 9.

The actions on the left of **Figure 3**—safety risk management—are for the design of risk controls, and the actions on the right observe and assess the effect of those controls on the production environment. Note the different usages of the words *analysis* and *assessment*. *Analysis* is a sense-making activity, which may be either quantitative or qualitative, whereas *assessment* is a decision-making activity. The implementation of a risk control is the action whose effectiveness is monitored.

This model has been designed with industry players—not regulators—in mind. It assumes that every business activity a company undertakes must be performed safely, and that if safety issues are identified, they must be addressed expeditiously. If a company wants to put off addressing safety in a business process for other priorities, it ceases that business activity until it can be performed safely. For a regulator, on the other hand, monitoring and improving safety *are* its fundamental business processes, and the regulator must prioritize what areas it will address given its resources.

Strategic Directives

In the fall of 2019, the Board began to develop its strategic plan by combining the goals of the GRPA and the safety management system approach. Through this process, the Board has identified four directions to focus on over the next three years:

1. Improve Compliance by Reaching Parties in Effective Ways.

The State's one-call law forms the foundation of California's relevant safety policy, and is characterized by the requirements for excavators to notify the one-call center before beginning work, for operators to timely and accurately locate their buried infrastructure, and for excavators and operators to communicate and use reasonable care to maintain safe operations near that infrastructure. The experience of Board members and investigative staff supports the assertion that much of the law's non-compliances are the result of a lack of understanding of the law's requirements and the risks associated with ignoring it. Ignorance is not, however, the only reason for unsafe practices, and effective outreach to knowledgeably non-compliant actors will need to involve enforcement.

2. Improve Accessibility of Buried Infrastructure Location Knowledge and Understanding.

An operator's access to accurate information can be hampered by a multitude of ownership changes have left original records in disarray, the original drawings being referenced to roads, trees, buildings, and parking lots that are either no longer present or appreciably changed since facility installation, and abandoned line records that are either not kept or not changed to recognize the lines as abandoned. Different parties may be responsible for managing buried infrastructure in differing phases of a project, and the lack of consideration for buried infrastructure in the engineering phase may place excavator and operator in conflict that could have been avoided. The transmission of available information may benefit from improvement. Additionally, the techniques used by excavators and operators alike—such as potholing—may need further standardization for a practitioner to know the extent to which he or she has taken reasonable care in determining the locations of buried lines.

3. Identify Proximate and Contributing Causes to Safety Accidents and Non-Compliances.

The Legislature provided the Board with investigative staff and vehicles for them to use with the expectation that they would investigate accidents to determine their causes. The author of the Board's founding legislation stated in a legislative hearing that one of the great problems of the time was that conflicts over safety issues were resolved by claims departments in settlements with non-disclosure agreements "with both sides feeling they got the short end of the stick and the industry learning nothing", leaving the situation to repeat.

4. Build Board Operations to Achieve Compliance, Reporting, and Operational Excellence in a Resource-Efficient Manner.

The State Leadership Accountability Act requires agencies to have effective internal controls to manage their operations, reporting, and compliance obligations. Given the Board's breadth of different functions (e.g. education, regulations, investigations, and enforcement), the Board has a list of operations, reporting, and compliance requirements rare in State government for such a small staff to manage—a point exacerbated by the fact that it is still building its operational capabilities.

The Board is still working to fully develop the first step of its safety management system approach by identifying the safety problems that currently exist through stakeholder outreach, preliminary investigations, and developing a system model to assess incoming data. The variety of industries and stakeholder groups the Board's work touches makes this process complex. The Board's strategic plan will therefore remain broad and overarching. Specific objectives and activities will be developed in annual plans.

Annual Plans

Annual plans articulate specific objectives of the Board, which include how an objective is planned to be achieved and who is responsible for undertaking it. Objectives are not subordinate to strategic directions and goals—that is they are not under any one strategic direction in an organizational hierarchy—but they will instead advance one or, often, more than one strategic direction and goal. Annual results reports will articulate the outputs and outcomes of the previous year's annual plan and are inextricably linked to the development of the subsequent year's annual plan. Board staff propose that the strategic plan be effective for three years.

Use of Models, Strategic Directives, and Annual Plans in Prioritizing Board Activities

The Regulatory Model

The Board has no shortage of good ideas about what activities to undertake. The Legislature assigned it the varied tasks of education and outreach, standards, investigations and enforcement, and broad regulatory authority to improve safety, and Board members, staff, stakeholders, and the Legislature all see ways in which the Board can advance its mission in these different directions.

At the highest level, prioritizing the advancement of safety goals requires the integration of the linear, goal-oriented strategic planning model and the cyclical, inductive safety risk management/safety assurance workflow. To determine how to marry these two different approaches, we can first visualize the fundamental process the Board has undertaken to take ideas and turn them into finished products.
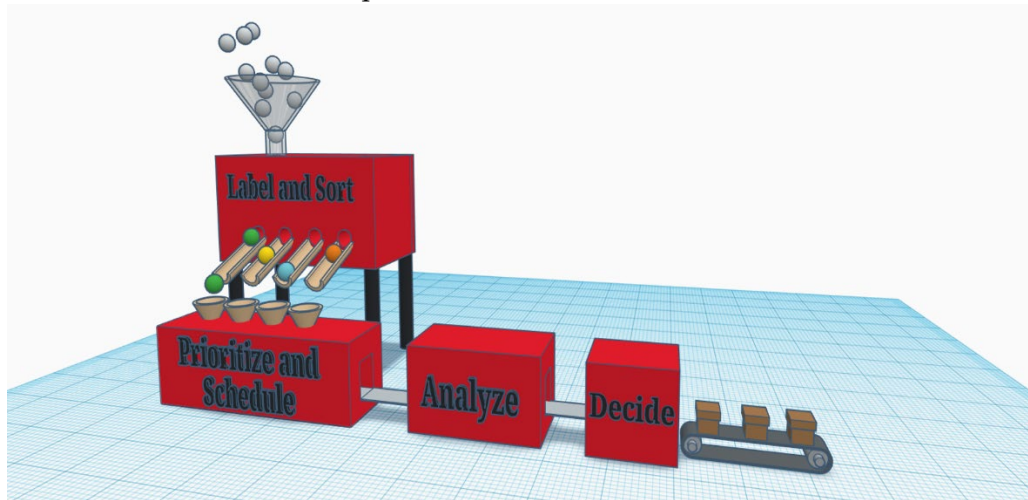
Figure 4: A high-level visualization of the process by which ideas are accepted, labeled and sorted, prioritized and scheduled, analyzed, and decided.

The model shown in **Figure 4** shows familiar Board activities. In accepting the multitude of tasks and ideas, the Board has, through its annual plans, categorized the various "to dos" and scheduled the ones with the highest priority. Its process has been, utilizing both staff and Board members, to analyze the problem over several meetings before deciding on an outcome. The Board has not yet tied safety assurance activities—such as investigations—to its standards and rulemaking activities, and this element is not shown in **Figure 4**.

In trying to elaborate on the high-level picture in **Figure 4**, we start with reimagining the FAA/ICAO safety risk management/safety assurance workflow in a manner more specific to Board activity.
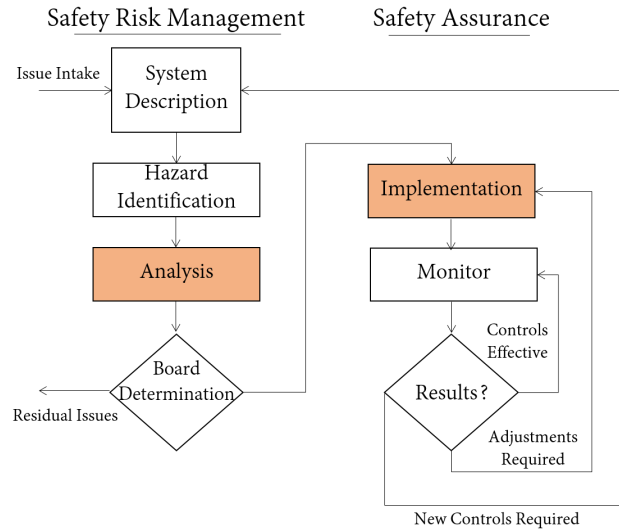
Figure 5: Board version of safety risk management/safety assurance workflow, with "Analysis" and "Implementation" items highlighted to indicate that the activities are resource-intensive.

The workflow in **Figure 5** differs from that in Figure 3 in several ways. Under the safety risk management workflow, the evaluation of a proposed risk control is implicit and is not shown. Rather, a Board decision, which may leave some issues unresolved, leads straight to the safety assurance workflow, with implementation of the Board's decision explicitly represented. The workflow also recognizes that an initiative that is not producing expected or acceptable results will often be modified with notification to the Board through informational items without restarting the Board decision process. Items will come before the Board for re-analysis if acceptable results cannot be otherwise achieved.

Also, different in Figure 5 are two boxes, "Analysis" and "Implementation," that are highlighted in orange to identify them as particularly resource-intensive, or "expensive," processes. While some processes, such as "System Description," with its system modeling, may require significant up-front effort, "Analysis" and "Implementation" will be expensive processes for every initiative the Board undertakes—especially those that require new standards or regulations. The Board will therefore need to place its prioritization activities above the "Analysis" activity.

The Idea Register

The Board has already, as described above, determined how it will prioritize its efforts over the next three years—through its strategic directions and annual plans. All the ideas considered by the Board may be ordered into one of its strategic directions (or outside of them). These ideas may be organized into an *idea register*.

Strategic Direction 1	Strategic Direction 2	Strategic Direction 3	Strategic Direction 4	Other
Idea 4	Idea 1	Idea 6	Idea 2	Idea 5
Idea 12	Idea 3	Idea 9	Idea 7	Idea 11
Idea 13	Idea 8	Idea 17	Idea 15	Idea 19
	Idea 14		Idea 18	
	Idea 16			
	Idea 20			

Figure 6: Example "idea register" table, showing how ideas are categorized by strategic direction (or outside of strategic direction) and listed underneath each.

While the ideas are binned within one strategic direction, many will likely touch on multiple. The Board may also find that many of these ideas are interrelated—both within a strategic direction and across strategic directions—and may be best addressed together. The register is a tool to record and visualize the various ideas in order to take the next step—developing strategic objectives and activities for the annual plan.

As the development of strategic objectives and activities requires prioritization, the Board will need to consider the following in doing so:

- What are the tools at the Board's disposal to advance the objective?
- What resources (funding, staff time, Board member time, etc.) are necessary to undertake the activities associated with this objective?
- What resources are available?
- What evidence is available *a priori* to justify priority based on safety considerations?
- What external factors compel activity?

Using the idea register, the strategic directions, and the considerations listed above, the Board will annually develop its strategic objectives and activities. These activities will require the use of different tools, some of which are:

- Statutory change requests
- Regulations
- Standards
- Education/outreach efforts
- Enforcement
- Data acquisition

While not all entries in the idea register will be added to the objectives and activities in the annual plan, the Board will use the full spectrum of ideas to decide what activities to undertake.

Dig Safe Board Prioritization/Safety Risk Management/Safety Assurance Workflow

With an idea intake and prioritization scheme developed, we may insert it into to the workflow in **Figure 5**. **Figure 7** shows how prioritization occurs prior to the "Analysis" step.
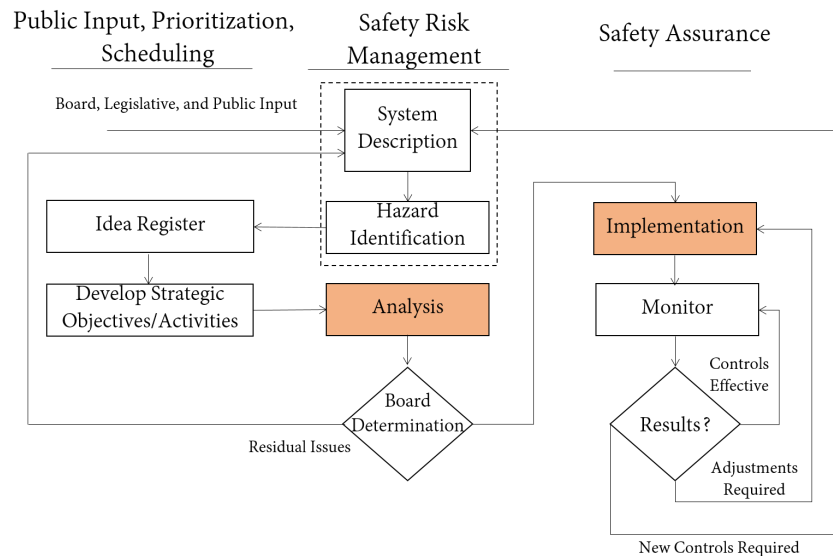

Figure 7: Board's Safety Risk Management/Safety Assurance workflow with public input, the idea register, and the annual planning process explicitly shown.

Note that unresolved issues and results of monitoring that require new controls are fed back into the top of the workflow to be placed back in the idea register.

The "System Description" and "Hazard Identification" items are grouped together within a dotted line. These two items are the foundational elements of safety risk management, but haven't received much discussion up to this point. For the Board to decide what items in the idea register to pursue, it must have a clear understanding of the safety issues and the context around each idea.

Staff proposes to create a form for stakeholders to complete to provide the Board with this context, with questions that may include:

- What is the problem?
- Who does the problem affect?
- Under what circumstances does the problem arise?
- What are possible solutions to address these hazards? And what are the possible arguments for or against these solutions?

- What new or residual hazards could be created in pursuing this idea?
- What information (data or qualitative) is necessary to make an informed decision on this issue?
- What organizations may be willing to assist in developing a solution?

The answers to these questions would then be provided to the Board in developing its annual plans.

This workflow is most relevant to mission-focused strategic activities. Management-focused activities, which address management functions such as strategic human capital management, information technology, or financial stewardship, and capability-focused strategic activities, which improve the function of elements of the workflow in **Figure 7** (*e.g.* improving investigations or data modeling) may skip steps or function outside the workflow altogether.

Conclusion

Following the GPRA model, the strategic plan is no "plan" at all, but an overarching set of directions by which the annual plans—the true planning documents—are developed.

Annual plans articulate specific objectives of the Board, which include how the objective is planned to be achieved and who is responsible for undertaking it. Objectives are not subordinate to strategic directions—that is they are not under any one strategic direction in an organizational hierarchy—but they will instead advance one or, often, more than one strategic direction. Annual results reports will articulate the outputs and outcomes of the previous year's annual plan and are inextricably linked to the development of the subsequent year's annual plan.

As the Board matures and begins processing its nascent safety assurance activities, such as investigation and enforcement, the processes above will be further articulated or modified, and the regulatory contraption will become more of an accomplished machine. The underpinnings of how the Board prioritizes and undertakes its responsibilities should be revisited in a new strategic plan in three years or when otherwise deemed necessary.

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