INEEL/CON-03-00039
PREPRINT

Idaho National Engineering
and Environmental Laboratory

'Mini'–Roadmapping – Ensuring Timely Sites' Cleanup/Closure by Resolving Science & Technology Issues

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February 23, 2003 – February 27, 2003

Waste Management 2003

‘MINI’-ROADMAPPING – ENSURING TIMELY SITES’ CLEANUP / CLOSURE BY RESOLVING SCIENCE & TECHNOLOGY ISSUES

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ABSTRACT

Roadmapping is a powerful tool to manage technical risks and opportunities associated with complex problems. Roadmapping identifies technical capabilities required for both project- and program-level efforts and provides the basis for plans that ensure the necessary enabling activities will be done when needed. Roadmapping reveals where to focus further development of the path forward by evaluating uncertainties for levels of complexity, impacts, and/or the potential for large payback.

Roadmaps can be customized to the application, a “graded approach” if you will. Some roadmaps are less detailed. We have called these less detailed, top-level roadmaps “mini-roadmaps”. These mini-roadmaps are created to tie the needed enablers (e.g., technologies, decisions, etc.) to the functions. If it is found during the mini-roadmapping that areas of significant risk exist, then those can be roadmapped further to a lower level of detail. Otherwise, the mini-roadmap may be sufficient to manage the project / program risk. Applying a graded approach to the roadmapping can help keep the costs down. Experience has indicated that it is best to do mini-roadmapping first and then evaluate the risky areas to determine whether to further evaluate those areas.

Roadmapping can be especially useful for programs / projects that have participants from multiple sites, programs, or other entities which are involved. Increased synergy, better communications, and increased cooperation are the results from roadmapping a program / project with these conditions. And, as with any trip, the earlier you use a roadmap, the more confidence you will have that you will arrive at your destination with few, if any, problems. The longer the trip or complicated the route, the sooner the map is needed. This analogy holds true for using roadmapping for laying out program / project baselines and any alternative (contingency) plans.

The mini-roadmapping process has been applied to past projects like the hydrogen gas generation roadmap and the subsurface contaminant focus area (SCFA), and it’s basic form is being applied in the formulation of the ‘2012 Plan’ at the Idaho National Engineering and Environmental Laboratory (INEEL). There are also plans to apply this process in the near future for other projects/programs.

BACKGROUND

The mini-roadmapping process is a scaled down version of the typical roadmap discussed in DOE’s draft guidance document (1). The mini-roadmap differs from a typical roadmap in that it is only partially developed (through the Technical Response Phase (Phase III) of the draft guidance). This means that the product can be used for strategic decisions, but may not contain the detailed development path needed to deliver the technology desired. It will still describe the problem(s), identify who has the problem(s), and identify what performance improvements are needed, when they're needed, what technical advances are needed, and what types of research and development (R&D) could be used to deliver the technology to fill any technology gaps. Because mini-roadmaps do not provide much detail about the development pathway, the system delivery to solve the problem(s) may have to be done later using detailed roadmapping methods.

MINI-ROADMAPPING APPROACH

The following is the typical approach and scope of work (SOW) for performing the mini-roadmapping process:

- Planning the logistics for the mini-roadmapping process, including definition of any 'homework' that needs to be performed prior to any meetings of the roadmapping team.

- Kicking off the roadmap by meeting with the roadmapping team of identified subject matter experts (SMEs) that will continue with exploring potential solutions (this may be a Technical Solutions assistance team or a team to continue roadmapping the potential solutions and the path forward to a "Closure Project"). The team will preferably include those tasked with implementation. This team will perform the initial step of the mini-roadmapping process (all steps are listed in this and the following bullet). The activities for the kickoff meeting consists of:

  Step I, Problem Definition
  - Understanding and defining the problems and opportunities. Team members define the current state and identify and evaluate the functions required and the needed capabilities (enablers to the functions) to be able to reach the desired end-state. This helps define the problem and put it in the context of the work/schedule at the site.

  - Identifying and determining the timing and the status (qualitatively) of the functions and enablers (which may or may not be technology). The 'when needed' defines the insertion date for an enabler (e.g., technology). There are two types of technology insertions, those that offer improvement and those that fill gaps. An improvement technology has a positive impact on the activity in terms of cost savings, worker safety, etc., but the activity could proceed without the technology. A technology gap insertion defines the need of an activity to have a specific technology before the work can be accomplished.

  - After the kickoff meeting, develop a brief report/display of the results and suggested path forward, including future activities, milestones and due dates, and assignments of responsibility.

- Continue developing the roadmap. After the kickoff meeting, the following steps are performed individually by SMEs and by meeting as a roadmapping team, when deemed necessary:

  Step II, Technology Needs Definition (Needs Assessment)
  The potential technology insertion points that are identified from Step 1 are evaluated to identify what and when improvements would best fit the majority of the needs. Step 2 focuses on the identification of the function and technology components needed to solve the problem(s). At times, multiple functions must be performed to fully solve the problem. To define the system technology

needs, an assessment of the system performance across each of the components is completed. This assessment also describes the goals of the function and its components.

The current state of the enabler (e.g., technology) is assessed for each component in terms of capability to meet the performance ultimately needed. Figure 1 is an example of a capability

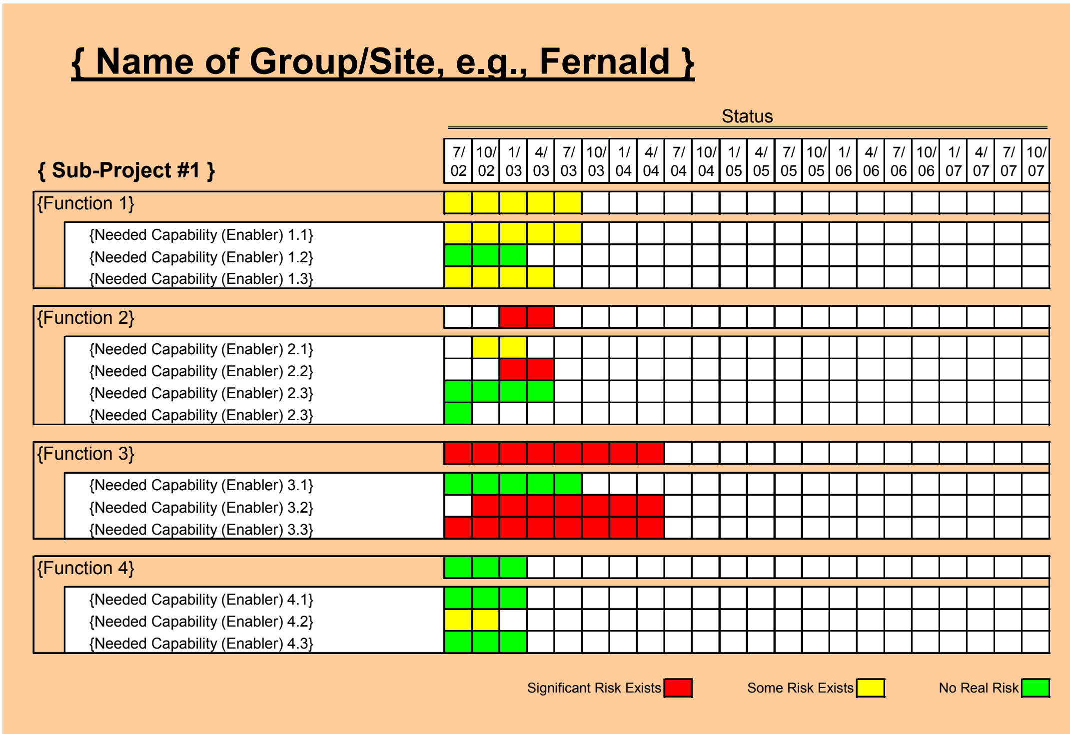

Figure 1. Example of a Capability Maturity Chart

maturity chart, which is used to communicate what capabilities are needed and the need (insertion) dates. Green bars are used where no real risk is expected related to component capability performance. Yellow bars indicate that there is some risk that an existing capability can meet the needed improvement or that it can only do so with additional development. The red bars are reserved for those components where a new capability is needed to meet the desired performance or that an existing capability will not be adequate, hence there exists a significant risk.

This graphic is also the input to Step 3 where a technology development plan is initialized. Where there are red capability areas, it may be desirable to perform contingency planning to improve the probability of finding a viable pathway to achieving this function.

Step III, Capability (e.g., Technology) Development Plans (Technical Response)

The capability development plan will be defined to the level where the type of R&D or other capability development activity is identified for each component and time phase. This activity is kept at a high level for the mini-roadmapping process so that only those capabilities that reveal themselves to be most important are more fully defined during the process. The mini-roadmap process helps to define the steps needed to mature the key components of the system and identifies the right timing to make the next insertion most successful.

Step IV, Implementation

Mini-roadmapping typically doesn't get into detailed implementation planning and execution. However, the products from mini-roadmapping can be used for limited execution activities, including tracking the status of R&D and other Technical Response Activities. Some instances of mini-roadmapping can be used fully for integrating cost and schedule into a managed project and reviewing its progress.

- Display the results of the roadmapping in a way that assists the team (and others) in quickly understanding the details of the roadmapping. The Capability Maturity Chart, as shown in Figure 1 above provides much information about the roadmapping process as already noted. Figure 2 is another type of depiction of the roadmapping results. This is an example of a depiction of the gas generation mini-roadmap that shows the status of the various functions for each program that shared the gas generation problem.

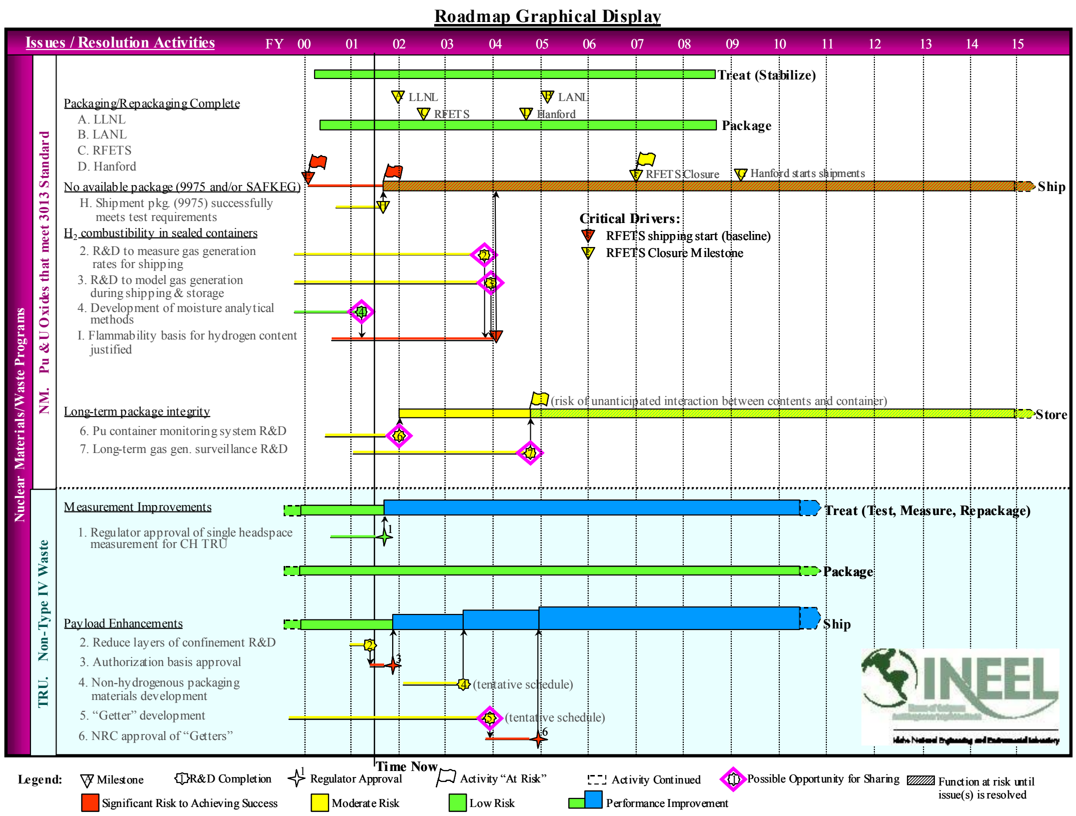

Figure 2. Example of a Possible Mini-roadmap Depiction (Gas Generation Roadmap)

For this roadmap depiction, the timeline column identifies four dimensions for an activity: 1) risk, 2) time, 3) type of activity, and 4) possibility for sharing across programs. Risk is depicted by the colors and time is shown by the location of an icon in relation to the timeline. The shape of the icon, as defined in the legend, shows the activity type. Other depictions can be used and customized to show the most salient parts of a mini-roadmap.

RESULTS

The following paragraphs provide examples of the results of mini-roadmapping efforts to date:

Gas Generation Roadmap (2) - The "program level" roadmapping involved linking technology development (and deployment) efforts to the programs' needs and requirements for dispositioning the material/waste that generates gas through radiolysis and chemical decomposition. The roadmapping effort focused on needed technical support to the baselines (and to alternatives to the baselines) where the probability of success is low (high uncertainty) and the consequences of failure are relatively high (high programmatic risk). A second purpose for roadmapping was to provide the basis for coordinating sharing of "lessons learned" from research and development (R&D) efforts across DOE programs to increase efficiency and effectiveness in addressing gas generation issues.

The roadmap effort found that there were many opportunities for sharing of R&D efforts and lessons learned, that gas generation issues can adversely affect DOE milestones in a variety of programs at different sites, and that gas generation issues represent a large risk to accomplishing DOE's environmental management mission to clean up DOE sites.

SCFA Roadmapping – The SCFA initiated development of mini-roadmaps for each of its technical targets to outline specific performance requirements, where improvements were needed, when the improvements were needed, and the significance to the DOE programs.

It was planned that after mini-roadmapping, the end-users would help describe the potential impact of these improvements to their programs and the technical community within SCFA would develop the potential targeted improvements. It was expected that the end product from these mini-roadmaps would include the target's technical objectives with a definition of the performance objectives and potential impacts. Though the SCFA (since it was eliminated) did not use the results of the mini-roadmapping, it may be used in the future on such environmental restoration and waste management tasks.

The Voluntary Consent Order (VCO) Program Roadmap (3) – The roadmap for this program was the result of an agreement between the INEEL and the State of Idaho to bring over 700 overlooked legacy process tanks and other items into compliance with current regulations in an orderly fashion. The managers for the INEEL VCO Program and the INEEL Science and Technology Programs Department recognized the need to apply technology solutions to reduce personnel and environmental risks associated with the characterization effort and saw a potential for significant programmatic savings in time and resources through roadmapping.

The VCO roadmap was a mini-roadmap by default rather than by plan. Due to funding constraints, the roadmap needed to be completed before the end of fiscal year 2000. This limited the roadmap development to a three-month period. Given these schedule constraints, the roadmap scope was restricted to encompass the full initiation and technical needs assessment phases and part of the technical response development phase recommended in the EM guide. The development of the integrated R&D schedule and the implementation plan were therefore deferred.

The roadmapping process allowed the VCO Program to focus its technology efforts into those areas with the greatest potential for near-term deployment of methods that could significantly reduce worker exposures, costs, and schedules. This 'mini-roadmap' ended up being very beneficial for the project and was used extensively to select needed technologies for the program.

'2012 Plan' at the INEEL - Roadmapping techniques and processes were used to gather information about the site's cleanup programs, review the system boundaries, identify the enablers (including technologies) that allow the cleanup tasks to be accomplished, and to help recast the projects to meet the stewardship requirements for that portion of the site.

Major benefits were achieved by using the roadmapping process. The most important benefit was that the EM Project was able to understand the overall direction it needs to proceed to meet the challenge given it by DOE EM-1 (Jessie Roberson) to do the work cheaper, better, and faster. Even though the destination (end-state) has not yet been fully defined, the entire program is now moving in one direction, facilitated by merging the EM work into a single integrated project. A benefit of having a common destination is that it provides the opportunity to define a common set of project objectives that are consistent across all elements of work. This commonality also provides a consistent basis for all future decision-making, such as alternatives evaluation and selection and funding prioritization. Mini-roadmapping techniques helped define specific problems that need to be quickly resolved to help the project be successful.

Each of the major site areas had special teams formed that were made up of subject matter experts. These teams utilized mini-roadmapping's focus on defining the functions and enablers required to be able to arrive at the desired destination. This helped the EM Project see the commonalities of the work and whether the work fell under the auspices of CERCLA, RCRA, or DOE Order regulations. The commonalities also provided the ability to evaluate logical sequencing of work that avoids the need for rework.

Roadmapping's sequencing evaluation led to a logic-driven, critical-path schedule that helped define the key challenges and roadblocks to completing the cleanup at the INEEL. It also helped identify opportunities that could reduce the project costs.

The mini-roadmapping techniques listed above were instrumental in identifying a consistent and improved method of work organization. The revised work structure resulted in a change in organization structure with subsequent changes in roles and responsibilities that were focused on a consistent project end-state. Considerations for performing similar functions multiple times by different organizations were challenged. Mini-roadmapping techniques were a definite benefit to this project.

CONCLUSIONS

Mini-roadmapping efforts to date have proven to be very worthwhile. Mini-roadmapping allows us to use detail where required and avoid detail where it isn't needed. Mini-roadmapping's simple, qualitative/semi-quantitative analysis techniques can be useful in focusing limited budgets on the scope with greatest value or payback (e.g., high cost or high risk). Programs will benefit from identifying issues and then tying them to research and development needs identified in the mini-roadmap. Additionally, further definition of the technology development plans by more detailed roadmapping may be desirable if the mini-roadmapping shows that the complexity is too great or the confidence of delivery is too low.

REFERENCES

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