Prioritization Risk Integration Simulation Model (PRISM) For Environmental Remediation and Waste Management - 12097

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ABSTRACT

The PRISM (Prioritization Risk Integration Simulation Model), a computer model was developed to support the Department of Energy's Office of Environmental Management (DOE-EM) in its mission to clean up the environmental legacy from the Nation's nuclear weapons materials production complex. PRISM provides a comprehensive, fully integrated planning tool that can tie together DOE-EM's projects. It is designed to help DOE managers develop sound, risk-informed business practices and defend program decisions. It provides a better ability to understand and manage programmatic risks.

The underlying concept for PRISM is that DOE-EM "owns" a portfolio of environmental legacy obligations (ELOs), and that its mission is to transform the ELOs from their current conditions to acceptable conditions, in the most effective way possible. There are many types of ELOs - - contaminated soils and groundwater plumes, disused facilities awaiting D&D, and various types of wastes waiting for processing or disposal.

For a given suite of planned activities, PRISM simulates the outcomes as they play out over time, allowing for all key identified uncertainties and risk factors. Each contaminated building, land area and waste stream is tracked from cradle to grave, and all of the linkages affecting different waste streams are captured. The progression of the activities is fully dynamic, reflecting DOE-EM's prioritization approaches, precedence requirements, available funding, and the consequences of risks and uncertainties. The top level of PRISM is the end-user interface that allows rapid evaluation of alternative scenarios and viewing the results in a variety of useful ways.

PRISM is a fully probabilistic model, allowing the user to specify uncertainties in input data (such as the magnitude of an existing groundwater plume, or the total cost to complete a planned activity) as well as specific risk events that might occur. PRISM is based on the GoldSim software that is widely used for risk and performance assessment calculations. PRISM can be run in a deterministic mode, which quickly provides an estimate of the most likely results of a given plan. Alternatively, the model can be run probabilistically in a Monte Carlo mode, exploring the risks and uncertainties in the system and producing probability distributions for the different performance measures.

BACKGROUND

Over the past decade the Office of Environmental Management (EM) has been criticized for the lack of a formal risk-based decision tool for use at Headquarters to properly prioritize projects and funding throughout the EM complex. In 2002, the DOE Top-to-Bottom Review Team [1] recommended that DOE take steps to move toward a risk-based cleanup approach. The National Research Council in 2005 [2] recommended DOE revamp the way DOE goes about implementing risk-informed approaches applied to waste disposition decisions.

The Government Accountability Office (GAO) recommended EM adopt a risk assessment framework for the Hanford cleanup, and develop credible and complete life cycle cost and schedule estimates for all key elements [3]. An external technical review [4] at Hanford for evaluation of system level modeling and simulation tools recommended planning for the deployment of a general planning model suited for uncertainty analysis, sensitivity analysis, and feasibility/optimization. On July 29, 2009, the Defense Nuclear Facilities Safety Board, unanimously approved Recommendation 2009-1, Risk Assessment Methodologies at Defense Nuclear Facilities [5]. This Recommendation identified the need for adequate policies and associated standards and guidance on the use of quantitative risk assessment methodologies at the Department of Energy's (DOE) defense nuclear facilities.

Recently, Assistant Director for Natural Resources and Environment Ryan Coles said GAO has to keep EM and the National Nuclear Security Administration (NNSA) on its high-risk list this year, in part, because of the need to see DOE's project management improvements implemented on more complex projects. DOE still needs to do more to develop "credible, well documented, accurate and comprehensive cost and schedule estimates," Coles said. "In particular, adequate integration of project risk analyses into project schedules is a recurrent issue in a number of GAO reviews." In November, 2011[6], the DOE Inspector General recommended the Department should consider revising its current remediation strategy and instead address environmental concerns on a national, complex-wide risk basis.

INTRODUCTION

In 2008, EM initiated a procurement [7] to implement a formal approach to expand development of a sophisticated risk assessment process that structures and provides defensible inputs into a dynamic probabilistic project performance tool and apply it to the complexities and sensitivities involving EM sites. The process and associated tool would allow identification of alternate approaches to reduce risk and achieve compliance with multiple metrics for EM sites. This project is known as the Prioritization Risk Integration Simulation Model (PRISM).

The project scope was divided into two phases. Phase I was designed to assess existing risk management activities at the Hanford Site, so as to not duplicate previous or ongoing activities in the identification and mitigation of risk across the multiple offices, projects and contracts at Hanford. Phase I developed the overall architecture of the model and the associated formal process that defines defensible inputs and multiple metrics as outputs for the model. Phase II was intended to apply the PRISM model across the EM complex through training manuals, courses and hands-on implementation.

This scope of work and software simulation model are a logical and effective evolution of the GoldSim simulation software used by the Office of Civilian Radioactive Waste Management (OCRWM) to assess the risk for the Yucca Mountain Project and by NNSA to assess project risk at the Los Alamos National Laboratory (LANL).

The PRISM project was designed to achieve the following benefits/results for EM:

- Promote understanding of all project risks, technical and non-technical.
- Allow comprehensive, integrated risk evaluation over the entire life cycle of major projects.
- Provide flexible and rapid evaluation of changes in funding profiles (short and long term) on the portfolio of EM projects.
- Allow efficient sorting and optimization of options and priorities for EM projects.
- Provide effective visual communication and rapid adaptation during interactions with stakeholders (Administration including the Office of Management and Budget, Congress, State, Local, and NGO).

- Allow rapid assessment of alternative management approaches.

PRISM CONCEPTS

In general terms, decision support and performance assessment tools can be broadly divided into two categories: those based on a "top-down" approach, and those based on a "bottom-up" approach. In order to meet the requirements for an EM complex-wide simulation tool, PRISM is based on a "top-down" method.

Bottom-up planning tools attempt from the outset to acquire detailed information needed to develop a project plan. Bottom-up approaches utilize project management tools, such as Primavera P6, to develop the project plan and other tools, such as Primavera Risk Assessment, Pertmaster, or Crystal Ball, to analyze risks associated with that plan. Individual activities are planned in detail and logically linked (successor-predecessor logic) and then resource requirements are estimated and loaded into the plan, resulting in a very detailed plan of what is a *single scenario* for a given project. These detailed plans can be rolled up to higher levels to portray the plan to different audiences, but they are always based on a bottom-up plan. Risks are typically assessed at an activity level where the occurrence of a risk event has the consequence of delaying the activity and/or adding cost.

Bottom-up approaches are excellent tools for laying out the plan to complete a project and allow for efficient tracking of progress against that plan. However, they do have limitations when used for strategic assessments:

- The level of detail in a model developed from the bottom-up is often inconsistent with the limited amount of available information. That is, a model is only as good as its inputs, and if detailed information is not available, a detailed model is generally no better than a simple one. As an example, the EM mission extends over several decades with many remediation activities not being started until well in the future of the life cycle. Furthermore, the scope of these future remediation activities is often yet to be defined and alternative strategies may be considered. These uncertainties and the inability to easily consider alternatives limit the applicability of bottom-up approaches applied over the life cycle of many EM projects.
- It is often difficult to appropriately integrate and capture interdependencies among the various model components in a bottom-up model, since it is often impossible (or computationally impractical) to dynamically couple the various detailed bottom-up models used for the large number of projects being performed across the EM complex. Frequently contracts have specific assumptions that are subject to change. As a result, important interactions between projects are often intentionally or unintentionally ignored in a bottom-up approach. One such assumption is the startup date for a geologic repository.
- Bottom-up plans are often grounded in major assumptions, sometimes referred to as "enabling assumptions". These assumptions are needed in order to develop a bottom-up plan, but if they were found to be invalid then significant re-planning would be required. Rather than applying a bottom-up approach to assess the potential impacts if enabling assumptions turn out to be false, they are simply assumed to hold. Such assumptions may represent significant risks to successful completion of EM's projects, yet this risk cannot be readily evaluated in bottom-up approaches.
- It can be difficult to evaluate alternative scenarios and strategies using bottom-up planning tools. Detailed logic and resources must be estimated for an alternative scenario/strategy and they must be integrated separately into the detailed project plan. This can be resource intensive, leading to inflexibility in answering "what-if" type questions.

"Top-down" modeling approaches start from the top (i.e., the ultimate objective of the task or project) and concentrate on the *integration* and coupling of all system components. The goal is to dynamically couple the large number of projects being performed across the EM complex, providing management with coherent information and the ability to weigh options at a strategic level. Key activities are represented by approximations in high-level models and parameters. Additional detail is added as needed to capture important activities. Such an approach keeps PRISM focused on total system performance without getting lost in what may prove to be unnecessary details at a strategic level. Moreover, because a properly designed top-down model tends to be only as complex as necessary and is well organized and hierarchical, it is generally easier to understand and explain to others. Additionally, a structured top-down model allows for the rapid evaluation of alternatives by either simply changing model input parameters to reflect different scope (i.e., cost and duration parameters, waste generation rates, waste processing rates) or by having the flexibility to rapidly include logic that represents different activities or sequencing of activities.

There are two key points in the application of a top-down modeling approach:

1. Top-down models should incorporate an appropriate representation of the *uncertainty* resulting from the approximations.
2. As opposed to representing all activities with great detail from the outset, details are only added when needed (e.g., when simulation results indicate that performance is sensitive to an activity that is currently represented in a simplified manner). That is, details are only added to those activities that are identified as being important with respect to system performance and where additional detail will reduce the uncertainty due to model simplifications.

PRISM Hierarchy

The underlying concept for PRISM is that EM "owns" a portfolio of ELOs, and that its mission is to transform the legacy obligations from their current conditions to acceptable conditions, in the most effective way possible. There are many types of ELOs - - contaminated soils and groundwater plumes, disused facilities awaiting D&D, and various types of wastes waiting for processing or disposal. For a given suite of planned EM activities, PRISM simulates the outcomes as they play out over time, allowing for all identified key uncertainties and risk factors. As shown in the model diagram below (Figure 1) PRISM is a representation of the life cycle (source to ultimate disposition) of the individual ELOs that are managed by EM.

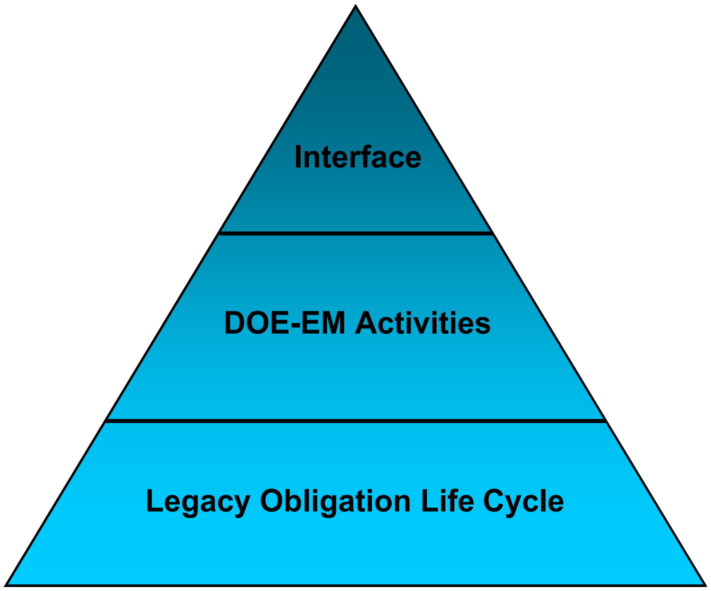

Figure 1 Hierarchy of the PRISM Model

The foundation layer is a dynamic model of the logistics of the different waste streams (source terms). Each waste stream is tracked from cradle to grave, and all of the linkages affecting different waste streams are captured. Thus, for example, if a waste disposal facility fails to open on time all of the activities that were planned to ship wastes to that disposal facility will be delayed, with repercussions in terms of either storing the wastes locally or suspending waste generation activities, and so on. The primary outputs of the PRISM foundation layer are time histories showing the status of different ELOs, represented by a number of associated metrics, as they evolve over time.

PRISM's middle layer of the diagram is the engine, a dynamic model of the EM activities that lead to the disposition of the environmental legacy obligations as they progress through time, similar to the logic in conventional project simulation software. The progression of the activities is fully dynamic, reflecting EM's prioritization approaches, precedence requirements, available funding, and the consequences of risks and uncertainties.

Finally in the diagram, the top level of PRISM is the end-user interface, which allows EM Federal managers at Headquarters and at the field sites to rapidly evaluate alternative scenarios or mitigation actions and to view the results in a variety of useful ways.

To help develop the hierarchy, three sets of interactive workshops were held with EM Federal and prime contractor staffs at Hanford to develop the framework for PRISM. The workshops are identified below.

1. Success Precedence Diagram Workshop: Success Precedence Diagrams (SPDs) are graphical tools that describe the basic logic structure reflected in the components and sequences of a modeled project or activity. An SPD for a project begins with the desired outcome and then holistically details the various precedence requirements and their pathways that lead to the desired outcome. SPDs serve as an independent way to identify all of the logical precedence requirements for project success. Once the holistic logic structure was established, it was mapped to the Work Breakdown Structure (WBS) for the Project Breakdown Structure (PBS) projects in the contract. This was done to identify whether any major activities were omitted.

2. Abstracted Project Baseline Workshop: The Abstracted Project Baseline (APB) is a high-level representation of the baseline set of activities that EM Federal and the prime contractor intend to execute for the major PBS projects that are being modeled. Since PRISM is a top-down model, it will not model specific project activities to deep levels of the WBS in detail, but instead it will model them at a high level while capturing important aspects related to each PBS. The APBs developed for each PBS project element establish the conceptual foundation of the PRISM representation of the Hanford project. Next, the APB is compared to the SPD, to ensure that the project plan incorporates all necessary components, and then the APB is used to develop the preliminary model.

3. Preliminary Risk Identification Workshop: An interactive workshop that engaged DOE and prime contractor experts identified a broad spectrum of risks affecting not only the individual PBS projects but also the Hanford site and the entire DOE complex. The objective was to "risk-inform" the APBs. These risks include not only environmental, health and safety, technical, schedule and funding risks but also the risks arising from linkages with other program elements, and various socioeconomic, legal, political, and other non-technical "soft" risks that can significantly impact the PBS projects in the overall contract.

PRISM is a fully probabilistic model, allowing the user to specify uncertainties in input data (such as the magnitude of an existing groundwater plume, or the total cost to complete a planned activity) as well as specific risk events that might occur. PRISM is based on the GoldSim software that is widely used for risk and performance assessment calculations. PRISM can be run in a deterministic mode, which quickly provides an estimate of the most likely results of a given plan. Alternatively, the model can be run probabilistically in a Monte Carlo mode, exploring the risks and uncertainties in the system and producing probability distributions for the different performance measures.

PRISM User Interface Layer Design (Top Layer)

The top user Interface layer consists of a hierarchical layering of maps. This structure allows the user to explore the structure of PRISM from the top-down, starting at a national level and going deeper into individual sites. Hyperlinks allow for efficient user navigation to all of the EM projects. The initial development of the PRISM hierarchical interface is shown in Figure 2. This screenshot is from the PRISM development model as output from the GoldSim software.

The highest level of the PRISM interface is a geographic image of the United States with links to EM Headquarters and all EM sites. All EM sites that could be modeled ultimately in PRISM will be accessible through this interface. The EM Headquarters button allows the user to access overall model run-controls and roll-up charts of the various metrics tracked in PRISM (metrics are discussed further below).

Figure 2 shows the Hanford Site, with controls allowing the user to browse into specific areas within the site. A similar hierarchical layering has been developed for the other Richland Operations (RL) PBS projects and future extension to the Office of River Protection (ORP) PBS projects.

In addition to controlling PRISM through the user Interface, PRISM is also controlled through two input files (Microsoft Excel spreadsheets). The first is the PRISM Model Scenario Definition Worksheet. The PRISM Model Scenario Definition Worksheet is structured on a hierarchical basis: PBS → Analytical Building Block (ABB) → PRISM Activity/Process (discussed below). The user can adjust start dates and activity priorities for an entire set of linked activities (i.e., an ABB) or for individual activities (i.e., within an ABB). Note that although the user can adjust early start dates, the initiation of an activity can only occur if all precedence requirements for that activity have been achieved, and if all necessary waste handling, processing, or transporting systems are currently operational. The activity priorities allow for an activity's progress to either be decelerated or accelerated compared to a reference work plan.

The PRISM Model Input Worksheet defines the attributes of each activity included in PRISM. These attributes, for example the quantity of contaminated soil at a site or the rate of a removal activity, can be changed giving the user tremendous flexibility in modeling different methods and approaches for remediating a site. Other attributes would include cost, worker risk, stakeholder acceptance and specific risk events that could be associated with each activity.

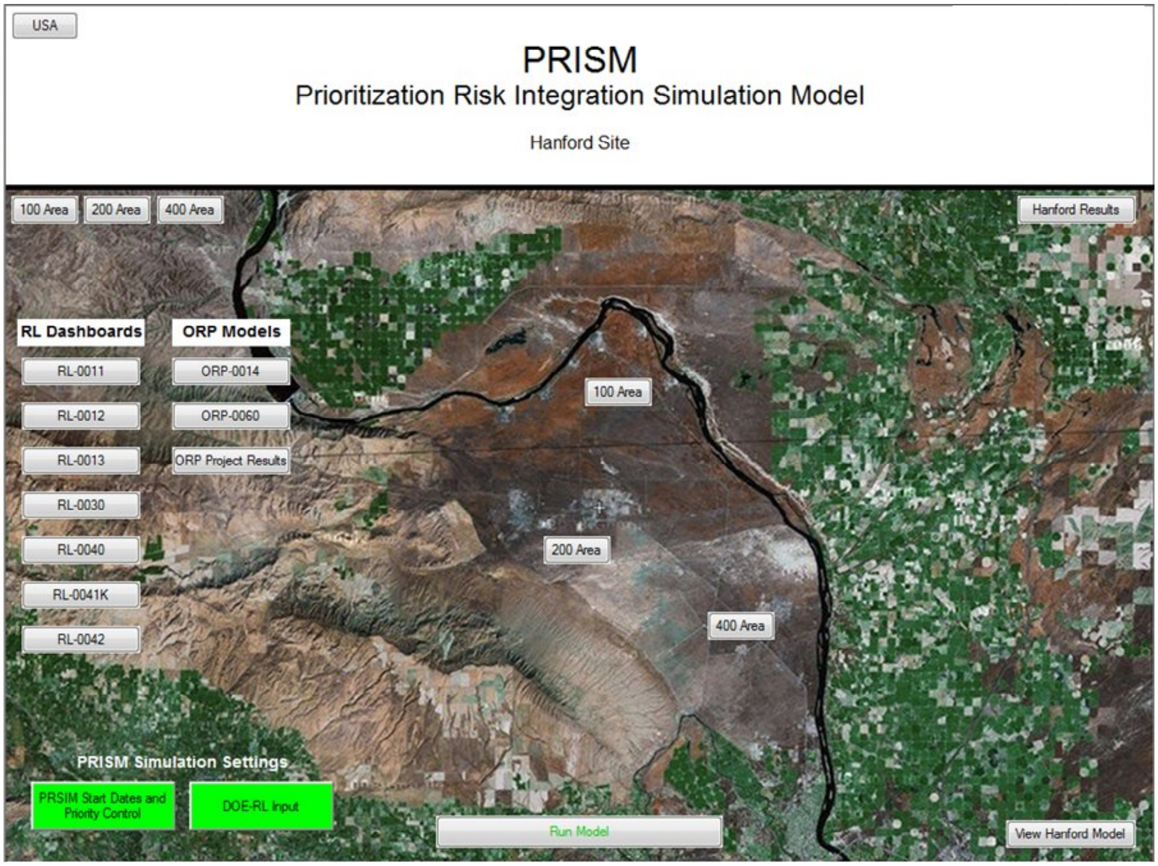

Figure 2 Screen Image of the Hanford Site Level of the PRISM User Interface

The combination of the PRISM Model Scenario Definition Worksheet and the PRISM Model Input Worksheet allow the user to define a wide range of strategic planning scenarios and investigate the performance of these scenarios over the life cycle of the EM mission. Once a scenario is defined and PRISM is executed, the results can be accessed through the PRISM user Interface. A variety of charts can be viewed for the metrics that are tracked in PRISM.

EM Activities and Processes (Middle Layer)

The central layer of PRISM is a representation of EM's set of tasks for addressing the environmental legacy obligations, both current and planned. The EM program is being represented in PRISM using a top-down approach, capturing an appropriate level of detail, but not so much detail that the model is unwieldy and not so little detail that it cannot capture important aspects. PRISM contains both “Activity” and “Process” elements to represent these tasks.

A PRISM Activity is used to represent an EM task that does not directly alter an ELO. Activities are, by their nature, associated with one or more ELOs. As an example, a series of activities could be used to represent the regulatory process that must be completed before one or more ELOs could be remediated.

A PRISM Process refers to components of the PRISM model that represent for ELOs the creation, removal, or other operations with a defined purpose. Typical processes are:

- Excavation of retrievably stored or buried wastes at a site.
- Processing or packaging of received wastes.
- Shipping of wastes from one location to another.

The rate of progress for a PRISM Process may be constrained by various factors (physical capacity, input availability, funding, ability to ship or store process outputs), and influenced by risks. Each PRISM Activity and PRISM Process has a number of attributes, which may be uncertain, and are sampled using the Monte Carlo approach.

Legacy Obligation Life Cycle Data (Bottom Layer)

The bottom foundation layer is a dynamic model of the logistics of the different waste streams. Each waste stream is tracked from cradle to grave, and all of the linkages affecting different waste streams are captured. Thus, for example, if a waste disposal facility fails to open on time all of the activities that were planned to ship wastes to that disposal facility will be delayed, with repercussions in terms of either storing the wastes locally or suspending waste generation activities, and so on. The primary outputs of the PRISM foundation layer are time histories showing the status of different ELOs, with a number of associated metrics, as they evolve over time. Due to proprietary data restrictions, this paper does not present details on the proprietary data that were utilized to demonstrate this model.

Model Metrics

Model metrics refer to things of interest to EM that PRISM calculates. Many of these metrics are associated with items in the legacy obligations portfolio such as the current condition and the amount that has been accomplished as time progresses. Other metrics are associated with the EM activities: costs; milestones achieved; schedules met; and perhaps worker or public risk incurred/mitigated. The primary metrics calculated by PRISM are cost, schedule and compliance milestones. The cost of transforming the legacy obligations is tracked at a project level, at a site level, and at the corporate level. The duration of the EM activities is also tracked, including when key milestones are achieved.

Project Risks

PRISM is capable of explicitly modeling the impact of programmatic risks associated with EM's program. These risks have a variety of origins, including technical risks, construction risks, risks of previously unidentified legacy obligations emerging, integration risks (due to couplings between program elements), and non-technical "soft risks."

Technical and construction risks should already be well quantified in EM's risk management plans. These risks are evaluated in the development of PRISM for a specific EM project and its key risks can be directly incorporated into PRISM either explicitly as risk events or implicitly by using the ranges of activity cost and duration that are output from project risk analysis tools (i.e., Pertmaster).

However, non-technical "soft risks," such as external interfaces, political risks, etc., can have a significant influence on EM's ability to meet its site remediation goals. Identifying these "soft risks," determining their likelihood of occurrence, and assessing the resultant impacts to the EM program are a very important part of the PRISM process: their explicit inclusion in PRISM is essential.

In addition to the 16 primary metrics tracked by DOE EM Headquarters, PRISM also has the capability to track other metrics important to EM. These include:

- Risk to the Public: PRISM does not explicitly calculate risk to the public, but rather represents the risk state of a legacy obligation as it is transformed (high, medium, low).
- Worker Risk: PRISM does not explicitly calculate worker risk, but rather represents the risk associated with transforming a legacy obligation (high, medium, low).
- Funding allocation: PRISM utilizes the cost metric information it tracks to show funding allocations across sites, EM offices, projects within an EM site, and at the state level.
- Jobs: PRISM estimates the level of employment (jobs) associated with EM's activities.
- Requirements: PRISM provides status when key requirements and milestones (i.e., enforceable milestones and others such as performance based incentives (PBI)) are met or not met.

The realization of a risk could potentially affect a project activity by:

- Delaying it
- Accelerating it (an opportunity)
- Halting it
- Increasing or decreasing its cost
- Increasing the amount of material that must be processed
- Transferring execution (halting the activity and starting another one)

In addition to the risk information that is included, either implicitly or explicitly, from existing risk management information, the PRISM process, through formal elicitation, defines risk likelihoods and consequences quantitatively (including their uncertainty). Also, the elicitation process may define activities that could be taken to either reduce the risk likelihood (mitigation) or to address the risk should it arise. These alternative activities can be included in the PRISM framework, along with their associated uncertainties.

Model Design Concepts

The primary components of the PRISM model include spreadsheet input data, user input options, Activities/Processes, and ELOs. As discussed above, data is input into PRISM from both input spreadsheets or from the user Interface (referred to as a dashboard). Data input from the spreadsheets corresponds to data related to the attributes of an Activity or a Process. This allows the user to explore different alternatives and strategies. Spreadsheet inputs can also be easily modified to further expand the range of alternatives and strategies that can be explored.

Processes

A PRISM Process is an "enhanced" form of a PRISM Activity that is used to represent an EM task that directly alters one or more ELOs. Each PRISM Process has an input buffer and an output buffer as shown in Figure 3. An input buffer represents an ELO that is initially present within the Process (i.e., a quantity of waste or a remediation "job") or is received by the Process at a staging/receipt area (i.e., waste shipped to a Process from an "up-stream" Process). The ELO in the input buffer is then processed at a calculated rate. The ELO can be transferred to the output buffer or transformed into additional ELOs that are transferred to one or more output buffers. The processing of an ELO residing in an input buffer may generate or be transformed into additional ELOs that are placed into the output buffers. The ELOs residing in the output buffers are then transitioned to downstream PRISM Processes for subsequent treatment/processing or to ultimate disposition. The output buffers represent staging areas prior to ELO shipment.

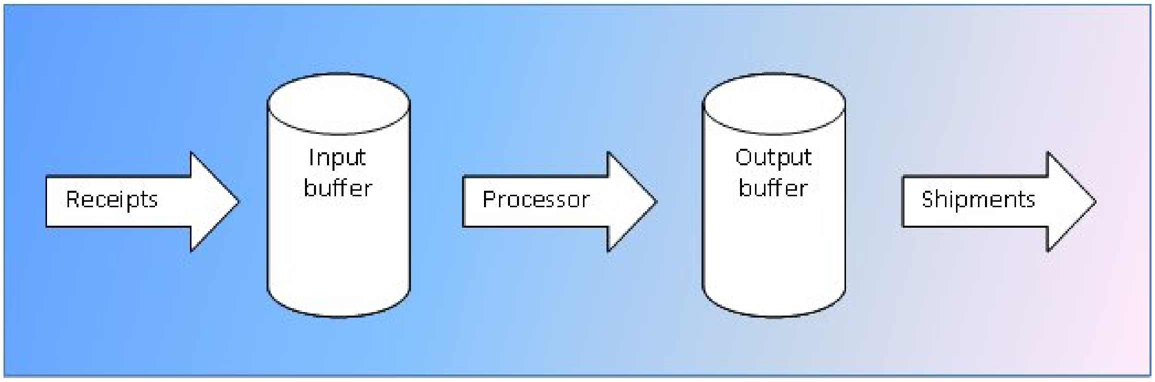

Figure 3 PRISM Process – ELO Buffers

As with Activities, PRISM is designed to be very flexible in simulating Processes – in fact, the logic is essentially identical. In general, the processing of an ELO is modeled as a threshold processing rate, below which costs are incurred at a fixed rate. Above this threshold, increasing the processing rate requires additional expenditure. However, the rate that the ELO can be processed may be constrained to a physically maximum processing rate. This approach has been incorporated into the PRISM Process logic. The user has the flexibility to define the fixed spend rate, ($K/day), the threshold above which variable costs are incurred (ELO units/day), the variable cost rate ($K/ELO unit), and the physically maximum achievable processing rate (ELO units/day) for each PRISM Process.

Linking of Processes

PRISM Processes and their buffers can be linked as shown schematically in Figure 4 to simulate the transition of ELOs from their un-remediated state to their ultimate disposition. PRISM Activities can also be included as precedent tasks that must be completed before Processes can begin.

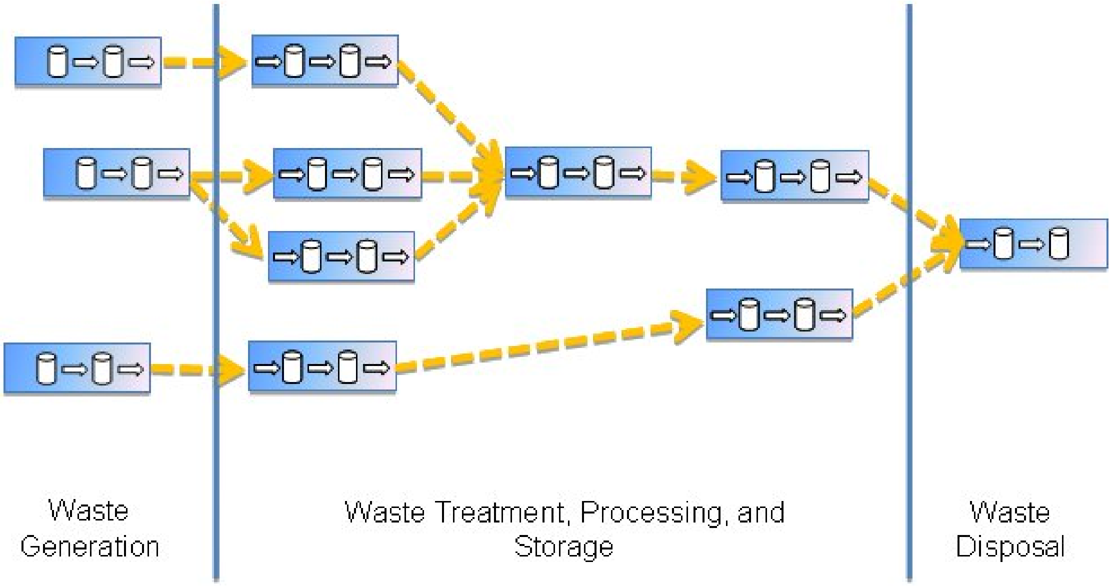

Figure 4 Linking of PRISM Processes and ELO Buffers

SUMMARY AND LESSONS LEARNED

The current model is valuable for its early development of concepts and data requirements. The hard creative work is done; development of future models can be streamlined. Cyber security and data management requirements were a big challenge but were successfully addressed within the Richland Operations Office. Unfortunately due to funding limitations demonstration of project integration between Office of River Protection and Richland Operations Office was not completed as planned.

The PRISM model on the GoldSim platform demonstrated that life cycle cost analyses of multiple scenarios were very effective. Unlike a single baseline P6/Pertmaster plan, PRISM provided a comprehensive, fully integrated planning tool that can tie together all of EM's projects. Systems integration modeling would help EM managers develop credible and complete life cycle cost and schedule estimates and defend program decisions. This would provide a better ability to understand and manage programmatic risks.

PRISM was able to demonstrate to senior EM leadership its utility for decision makers who are focused on a high level view, typically at the WBS 4 level and for ABB levels of detail typically used in DOE briefings for managers and key external stakeholders. The PRISM process brings a truly dynamic model to the EM program where one does not currently exist; Pertmaster cannot do the kind of multi-project analysis that is needed for a truly dynamic systems model. PRISM could effectively support Hanford Site requirements to integrate all project baselines to do rapid evaluations of "what if" scenarios to accelerate cleanup. Assessing EM Federal risks beyond 2018 at Hanford is a particular vulnerability that goes beyond current baseline plans and analysis. It could also be used to effectively evaluate the probability of achieving Tri-Party Agreement (TPA) milestones and addressing uncertainties intrinsic to technology development for future cleanup requirements.

One of the biggest problems for the PRISM project is the lack of logic-linked baselines that roll up the individual contractor baselines to support an integrated Federal baseline. This is a major challenge since the Hanford Site has multiple project baselines with different enabling assumptions. Alternate scenarios were generated by extracting data and then manually adjusting the performance measurement baseline schedules. It was anticipated that the concept of ABBs would provide a basis to identify and track the logic, costs, and risks of the key building blocks of EM's program. However, ABBs don't map well into the Hanford Site program documents yet. As a result attempts to parse out and allocate cost and risk components relevant to each of the PBSs were not straightforward. As identified in the external technical review [2] this process needs to be adequately addressed in any future systems integration model. The very low overall levels of risk and uncertainty that result from the Pertmaster analyses appear to underestimate the risks and uncertainties.

CONCLUSIONS

The PRISM model demonstrates how EM can evaluate a portfolio of ELOs, and transform the ELOs from their current conditions to acceptable conditions, utilizing different strategic approaches. There are many types of ELOs - contaminated soils and groundwater plumes, disused facilities awaiting D&D, and various types of wastes waiting for processing or disposal. This scope of work for the PRISM process and the development of a dynamic simulation model are a logical extension of the GoldSim simulation software used by the OCRWM to assess the long-term performance for the Yucca Mountain Project and by NNSA to assess project risk at its sites.

Systems integration modeling will promote better understanding of all project risks, technical and non-technical, and more defensible decision-making for complex projects with significant uncertainties. It can provide effective visual communication and rapid adaptation during interactions with stakeholders (Administration, Congress, State, Local, and NGO). It will also allow rapid assessment of alternative management approaches.

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