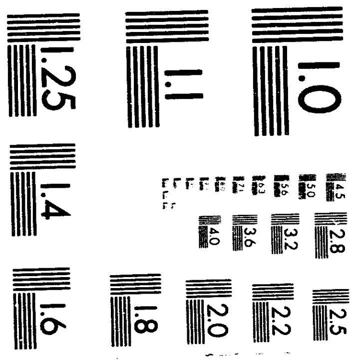

1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

1 of 1

RFP- 4829
Conf-9405126--21

COMPREHENSIVE EVALUATION OF FUTURE SITE ALTERNATIVES

Primary Author: Daniel I. Shain, EG&G Rocky Flats, Inc., Golden, CO. 80401

Contributing Authors: Michael E. Jones and Kay Ryan, EG&G Rocky Flats, Inc., Golden, CO., 80401

ABSTRACT

Due to rapid changes occurring within the Nuclear Weapons complex, the need for integrated planning designed to combine multiple program needs into one strategic plan has become a necessity. This is more apparent as diverse DOE programs compete for dwindling resources. These programs range from traditional production operations, environmental and waste management, to facility transition, economic development, decontamination and decommissioning, and environmental restoration activities. Each program can influence another, thus increasing the difficulty of distinguishing program elements. The method in developing comprehensive plans becomes even more complicated when environmental compliance issues, regulatory agreements and stakeholder values are considered. At the Department of Energy's (DOE) Rocky Flats Plant (RFP), all of these program conditions exist. This paper addresses a set of tools which are being developed at RFP that provides key planning elements and alternatives assessment for the DOE's Office of Planning and Integration (OPI) and National Environmental Policy Act (NEPA) Compliance Officer at RFP. This set of tools is referred to as the Systems Engineering Analysis (SEA).

BACKGROUND

The Rocky Flats Plant (RFP) was targeted by the Department of Energy (DOE) to initiate a combination of planning methodologies presently used in the Weapons Complex. These methodologies include both traditional roadmapping which has been used at RFP, and mission planning, which is presently employed at the Hanford facility. In response, a team of personnel was brought together to evaluate both approaches and devise an integrated strategy to accomplish this task.

The purpose of this paper is to detail the efforts and accomplishments within only one small part of the integrated planning task. This part, referred to as the Systems Engineering Analysis (SEA), provides the technical baseline for comprehensive alternative analysis of RFP options. This analysis includes the evaluation of RFP end-states as a function of technology requirements, material movement, inter-site issues, risk issues associated with public, worker and ecological impacts, and economic factors including operational, remedial and facility life-cycle components. Additional efforts are underway with both Pacific Northwest Laboratories and Oakridge National Laboratories to modify elements within the SEA for application on multi-site issues.

PLANNING APPROACH

Developing a strategic plan is the process of projecting likely or logical

MASTER

futures.[1] This requires identifying the steps in achieving a desired future, implementing the course of action and repeating the process to incorporate changing times. As such, the approach taken in the development of the SEA involves the incorporation of tools which allow for the development and evaluation of not only future end-states for the RFP site, but also the steps needed to achieve those end-states. The SEA tools are a blend of components which can be used by either stakeholders for the development of future use scenarios or site personnel involved with the daily planning and assessment of operational functions at RFP.

RELATIONSHIP TO PLANS

Near-Term Planning Needs

Near-term planning focuses on operational considerations typically associated with major industrial facilities. At RFP, these considerations are primarily associated with Waste and Environmental Management issues facing the site.

Waste Management issues at RFP often focus on storage capacity and regulatory compliance issues. Both physical and regulatory constraints continually challenge waste program personnel on meeting waste storage requirements. In meeting these challenges, the SEA incorporates current storage capacities with projected waste generation quantities. Algorithms are being developed, which provide operations personnel with the capability to quickly evaluate the storage capacity of a particular room/facility and the resultant waste generation caused by conversion of the room/facility to a storage function. Projections of waste quantities assist compliance reporting associated with Federal Facility Compliance Agreement, and the RFP Residue Compliance Order.

Environmental Management issues are addressed by the SEA in several ways;

- The forecasting of chemical storage and consumption rates for SARA Title III reporting;
- Projecting chemical consumption and releases to aid in compliance with Executive Order 12856, "Federal Compliance With Right-To-Know Laws and Pollution Prevention;
- Future source modeling of air emissions for air permitting procedures; and
- Alternative impact assessment for the National Environmental Policy Act (NEPA).

Overlooking of these issues would be a failure to provide key information to decision makers and thus diminish chances of success of any planning/assessment project.

Long-Term Planning Needs

Long-term planning includes the ability to project outward of greater than five years. This is important for major program needs including site end-state analysis, RCRA/CERCLA cleanup strategies, site development plans, economic development or conversion programs and technology needs assessment. These major programs rely upon consolidation of multiple plans and incorporation of risk analysis, regulatory implications, economics, and operational issues into a decision making framework.

PLANNING ELEMENTS

Primary Elements of Site Planning

Planning of industrial facilities relies upon five primary elements of information.[2] These elements are:

- What *products* (materials or services) are provided or handled?
- How much (*quantities*) is the facility to produce or handle?
- How will the facility produce or handle them (*routing*)?
- With what *support* will they be produced or handled?
- When and how long (*timing*) will the facility operate?

These key elements are needed prior to initiating the planning process. It is also important to note that these elements will change over time as programmatic needs, funding levels, and regulatory elements vary.

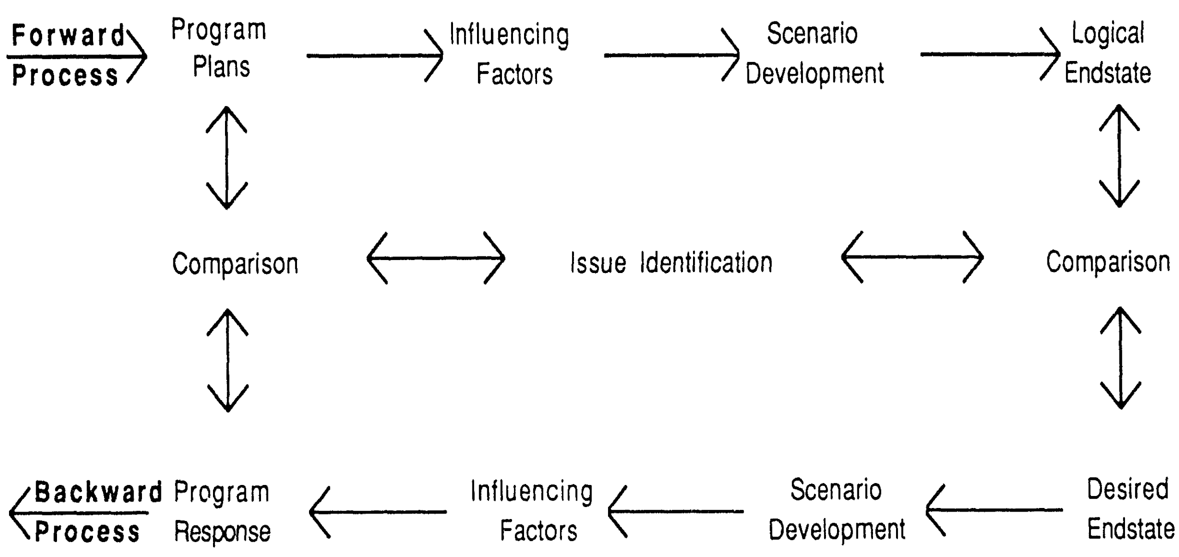
SEA Approach

The SEA employs a tactic in analytical planning involving the development of future use scenarios for RFP. Scenarios are defined as hypothesized outcomes that are developed by making assumptions about the current and future needs and trends for RFP.

These scenarios are developed in several steps: (1) Examination of the logical sequence of activities and programs; (2) Determining the set of objectives established for RFP and their corresponding paths for realization; and, (3) Characterization of both a desired and a feasible future or end-state. When combined, these steps provide a "composite" scenario for RFP which generates a wide range of considerations for the site.

To evaluate these scenarios, both a forward and backward process are used. A forward process incorporates present program plans, site influences (regulatory drivers, political trends, technology capabilities, etc.), and management objectives in the development of a future scenario. In contrast, a backward process begins with a future end-state, and then examines the programs and objectives needed to achieve the end-state. Combination of the two processes in an iterative approach narrows or converges the gap between the logical and desired scenarios and end-states.

Figure 1: Systems Engineering Analysis Evaluation Process



SEA COMPONENTS

To deliver key planning elements and provide mechanisms to evaluate scenarios in a composite approach, the SEA contains eight major tasks:

1. Inventory/Facility Characterization
2. Facility/Land Use Analysis
3. Process Logic Diagrams
4. Comparative Economic Analysis
5. Comparative Risk Analysis
6. Engineering Analysis Simulation
7. Scenario Development
8. Scenario Evaluation

When the components are combined, the SEA contributes to the overall understanding of the programs, processes, linkages, and influencing factors associated with a selected end-state.

Inventory/Facility Characterization:

Products and Quantities
Logical Future Facility Uses

Inventory and facility characterization provide baseline information for the SEA regarding site inventories and the nature and extent of contamination of RFP facilities. Material inventories were defined to be inclusive of all property within RFP that will require disposition in accordance with future end-states. The material inventory has been delineated into treatability groupings consistent with Federal Facilities Compliance Agreement (FFCA) requirements.

A facility characterization was performed on several RFP facilities to determine: (1) equipment loading within each building; and, (2) the preliminary nature and extent of contamination. Both points of information are essential for evaluating future building uses, as they are the basis for formulating operational compatibility and identification of impacts from building decontamination and demolition.

Facility/Land Use Analysis:

Logical and Desired Future Uses

Land-use planning for RFP considers land uses contiguous to the site, economic feasibility of potential land uses, in context of constraints and opportunities. These constraints and opportunities are identified by analyzing several general planning factors (see Table 1), which apply to any land-use development, and other specific factors related to historical operations at RFP.

Table 1: Planning factors

- Ecological and Natural Features
- Air Resources
- Water Resources
- Infrastructure
- Transportation
- Visual Analysis
- Archaeology and History
- Socioeconomic Analysis
- Regulations
- Facilities
- Waste
- Contamination
- Risk Analysis
- Technology Development
- Safeguards and Security

Knowing that plans and objectives are subject to change, the SEA bounds potential end-states by using two conditions: restricted and unrestricted use. Restricted use assumes that the site is under DOE institutional control, whereas unrestricted use assumes that the entire site has been released for unconditional uses[3]. Bounding the land use limits creates a spectrum of facility/land use possibilities for the site. Through stakeholder involvement and the application of land use constraints, both desired and/or feasible end-states can then be determined.

Process Logic Diagrams:

Routing

Process logic diagrams are intended to support a systematic evaluation of the process and technology options available for taking the existing inventory at the RFP to the proposed end-state. As such, development of the diagrams is an iterative process with Technology Development functions at RFP and various program offices. The diagrams are not intended to replace program specific technology assessments but rather integrate these plans into a single evaluation of process options for the site.

Comparative Economic Analysis:

Support Requirements, Influencing Factors

Economic constraints are typically the foremost factor of influence in the decision making process. They are also the most easily recognized results produced in any analysis, especially when compared to risk analyses. Additionally, when performing an economic analysis it is difficult to predict exact figures due to the variety of economic factors and their dependency on consistent site assumptions.

As such, the Economic Analysis is designed to provide relative comparisons between alternatives, aid in the identification of factors that drive both good and bad outcomes, and provide a bridge into detailed engineering cost estimates. This approach helps minimize the financial risks associated with the end-state scenario and mitigate differences in budgetary projections and actual accruals.

Comparative Risk Assessment:

Influencing Factors

The perpetual question of "how clean is clean" is common for many programs in different areas. It can be formulated in determining release levels for surplus equipment and facilities, regulatory requirements for releases, and remediation levels for decontamination and restoration activities. One common thread used to answer the clean-up question is risk to both worker and offsite public receptors, and with recent emphasis on Natural Resource Damage regulations, ecological receptors as well.

The problem with providing the necessary risk information to a decision maker is that the science of risk assessment and thus its results are difficult to comprehend. Furthermore, risk assessments provide different results dependent upon the requirements they meet. These differences in approach make it difficult to understand the cumulative impact they pose. Additionally, the costs associated with performing assessments can easily multiply if one needs to evaluate variations in cumulative impacts over numerous alternatives. The SEA risk analysis utilizes a multidisciplinary approach to qualitatively and quantitatively address incremental and cumulative risk presented by various RFP end-states. Cumulative risk assessed includes potential health risks to the public and workers as well as potential ecological impacts. The use of risk analysis for making informed decisions about these options should allow RFP to strategize, in a manner consistent with the National Contingency Plan's goal of protection of public health and the environment, and to identify the most efficient and cost-effective option at the outset of the investigation. This risk-driven approach prevents the collection of unnecessary field data and fosters a negotiating stance with the regulatory agencies that minimizes the potential for major expansions of scope later.

Engineering Analysis Simulation (EAS):

Quantities,Timing
Routing Interrelationships
Composite Evaluation Process

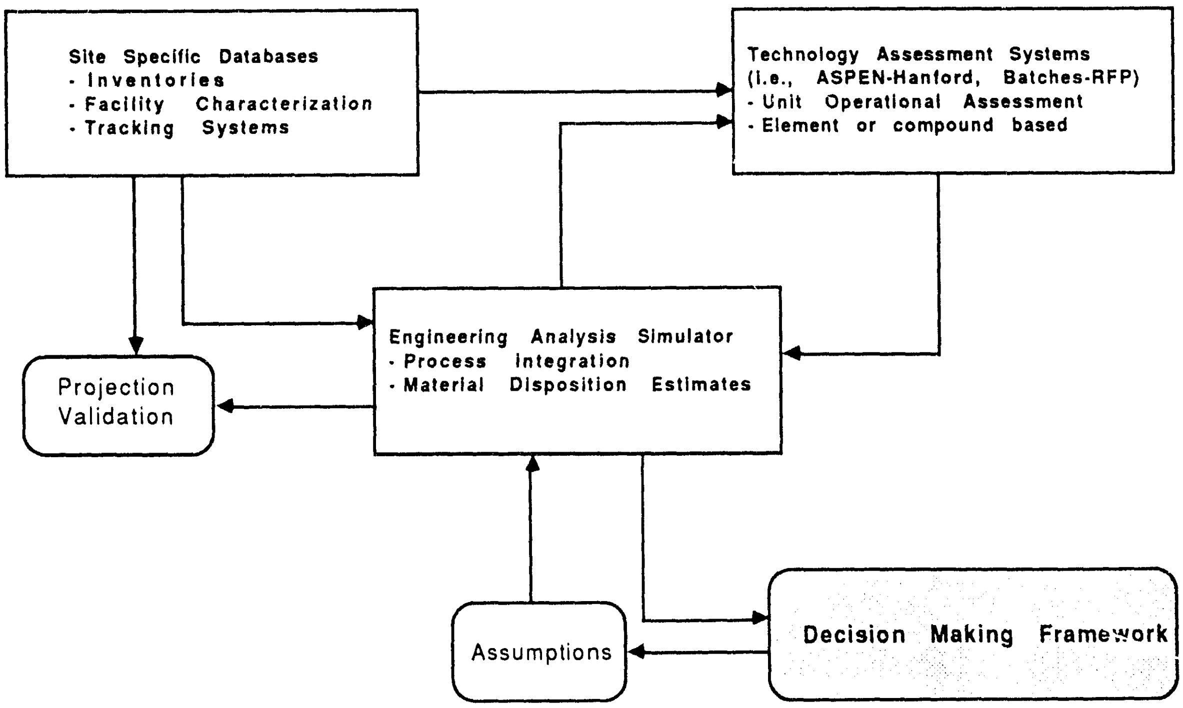
The EAS is a computer-aided system that allows for a sensitivity or "what if" type of analysis by demonstrating and evaluating the linkages between complex facility components as they relate to time, material movement, operational capabilities, and resource requirements. The primary benefit of the EAS is that it provides a common platform for RFP programs to integrate their future plans and evaluate the interrelationships among programs.

The primary focus of the EAS is to perform a material balance. The material balance is accomplished by modeling present site operations and planned technologies. Process modeling incorporates throughput capabilities, operating constraints, resource requirements, process interrelationships, dependencies, and facility/land use relationships. This information is presented in a powerful visual format which allows stakeholders to view the operations, understand the complexities and interactions, and visualize constraints under evaluation. This diminishes much of the mystery and confusion historically associated with RFP operations.

Scenario Development:

Scenarios are defined as the series of process needed to achieve an end-state. A scenario can be developed by either the forward process of carrying an inventory through available technologies to its associated end-state, or by the backwards process of starting with the end-state and performing a technology needs assessment to determine which processes are required.

Figure 2: Engineering Analysis Simulator Operational Concept



Development of scenarios involves the coordination and acquisition of stakeholder input on values, desires, requirements, and capabilities. To say the least, this is a very difficult process. A strong support framework must be in place to allow for conflict resolution and consensus building. In the SEA, this is done by developing baseline scenarios with the bounding endstates that can be used as templates for discussion and evaluation. Additionally, integration of the SEA into major planning functions such as the present RFP site-wide Environmental Impact Statement provides an effective format for stakeholder involvement.

Scenario Evaluation:

Composite Evaluation Process

Scenario evaluation starts with results generated from the SEA components. Once time-phased material flows are generated by the EAS, associated resource requirements and operational issues can be listed. These resources are provided in the form of direct personnel requirements, consumable levels, and time-phased material disposition estimates. This information is then exported for evaluation of relative risk and economic values.

During the evaluation process, issues can arise with operational conflicts, space competition, storage capacities, facility or land use conflicts, etc. These issues are transferred to the decision maker for further evaluation, resolution and eventually incorporation into the decision making framework. Resulting changes to the scenario will be fed back into the SEA components for re-evaluation and assessment. This cyclical process can be repeated until necessary information has been generated.

CONCLUSIONS

The development of future use alternatives and their associated impacts is a complex and difficult task. Factors that must be considered range from operational components typically associated with industrial facilities such as inventories, processing rates, and regulatory compliance, to those encountered in the private sector for community planning such as transportation, utilities, and contiguous land use. Assessment of these alternatives requires a delicate balance of meeting both short- and long-range planning needs. The assessment must also present results in an easily recognized manner. Not only must the results be recognizable, but the methodologies and tools used to generate results must have a shared understanding and appreciation by all stakeholders.

REFERENCES

1. *Analytical Planning, The Organization of Systems I,* Thomas L. Saaty, RWS Publications, Pittsburgh, PA, 1991.

2. *Systematic Planning of Industrial Facilities*, Volume 1, Richard Muther and Lee Hales, Management & Industrial Research Publications, Kansas City, Missouri, 1988.

3. *FY93 Systems Engineering Analysis Facility/Land Use Component*, U.S. Department of Energy, Rocky Flats Plant, June 11, 1993.