

Science.

Technology.

Innovation.



Key project assessment capabilities

- Developing integrated baselines
- Analyzing the impacts of changes to baselines
- Working with nationally recognized scientific experts.

# Looking at the Big Picture: Life Cycle Modeling

Pacific Northwest National Laboratory (PNNL) researchers help clients understand and manage the logistics, costs, and risks of a complex system or program over its full life cycle, from technical feasibility through budget development to implementation. Complex systems contain thousands of linked scientific, technical, and economic activities that take place in a highly sensitive environment, including national and international political and economic pressures. These systems have or influence yearly budgets from \$100 million to over \$100 billion, often significant capital purchases, carry significant risks, and occur over several years or several decades. Examples of complex systems range from entombing the damaged Chernobyl nuclear reactor to civilian radioactive waste programs for the entire United States. Using specially developed tools, models, and databases, PNNL helps regulators, corporate executives, and government agencies



*Life cycle modeling can help owners understand and manage the costs, logistics, and risks during the life cycle of complex systems, such as hydroelectric dams and nuclear power plants.*

- Visualize the relationships in complex systems
- Establish better methods to plan and manage complex systems
- Understand the magnitude of the impacts of internal or external changes on all of the elements of the system.

## Life Cycle Model Software

PNNL developed an integrated, flexible, and comprehensive tool for collecting and graphically displaying the cost, schedule, and scope of complex systems. Called the Life Cycle Model (LCM), this tool can store and simultaneously manipulate detailed planning data, cost algorithms, scientific and technical data, and complex logistics models.

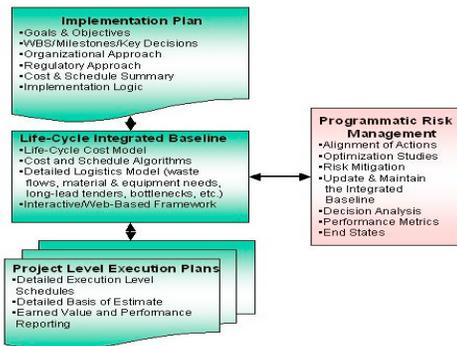
The LCM allows researchers to evaluate how changes in key parameters would impact costs, schedules, and risks, such as increased hazards to workers and the public. This tool is often used to provide detailed information in support of strategic planning, evaluate alternative scenarios, and develop long-range plans.

The LCM was developed by PNNL for the U.S. Department of Energy (DOE) to track high-level costs and work flow for the Hanford Site, a former plutonium production site in Washington State.

**Pacific Northwest  
National Laboratory**

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*PNNL builds implementation plans, creates integrated baselines, and helps clients manage programmatic risk.*

## Integrated Baselines

PNNL researchers work collaboratively with clients, regulators, government agencies, and stakeholders to develop and populate an integrated baseline (planning framework) that makes maximum use of existing information and established tools. This allows PNNL to expeditiously assemble a reliable planning baseline for client's use in the execution and future refinement of programs. Using this planning approach, clients gain

- Comprehensive description of the scope of work, implementation logic, and key milestones
- Record of the key planning assumptions and pending key decisions
- Schedule that shows key connections and key problems
- Defensible estimate and basis for the total cost along with annual funding profiles

- Structure for identifying priorities and critical work items
- Lists of areas of uncertainties, issues, or information gaps and the plan to resolve them
- Identification of opportunities for reducing cost, improving performance, and accelerating schedule.

Key clients include

- DOE's Office of Civilian Radioactive Waste Management
- Italy's National Nuclear Decommissioning Program
- European Bank for Reconstruction and Development Chernobyl Shelter Project Management Unit
- DOE's Richland Operations Office and Office of River Protection Hanford Site Planning and Integration
- Bonneville Power Administration, Energy Northwest, and DOE Waste Treatment Plan energy savings plan
- DOE's Accelerator Transmutation of Waste System.

## Change Management

Complex processes often have schedules measured in decades; during this time, external and internal changes to the processes can have far-reaching impacts. The people responsible for these complex processes need to understand how these changes and a host of possible responses could impact the systems. PNNL can simultaneously show the ramifications on thousands of activities within a system using sophisticated tools, such as the LCM, and a broad range of scientific expertise, including

- Integrating new science and technology to environmental cleanup systems
- Identifying potential failure modes using expertise in chemical and mechanical engineering
- Analyzing international, national, and state regulations
- Examining risks associated with uncertainties in schedule and scope
- Gathering, interpreting, and communicating stakeholder concerns
- Analyzing economic changes within the system and on the broader context
- Examining risks associated with cost uncertainties
- Developing contingency budget requirements.

With this expertise, PNNL can describe, analyze, simulate, and communicate complex systems or processes.

## Multidisciplinary Teams

The expertise held by PNNL's staff members includes nearly every scientific, engineering, and business discipline. For example, we have award-winning scientists in hydrology, geology, physical-chemical biology, interfacial chemical catalysis, and climate physics. We have professional engineers and specialists in chemical engineering, mechanical engineering, and material sciences. We have business administration and analysis specialists in finance, accounting, and economics. This expertise is combined with state-of-the-art equipment and facilities, such as the Environmental Molecular Sciences Laboratory.

## About Pacific Northwest National Laboratory

A multiprogram national laboratory, PNNL conducts breakthrough research in environmental and energy science and technology, national and homeland security, and fundamental science. Located in Richland, Wash., PNNL has approximately 3,800 researchers and staff. In addition to its main Richland complex, PNNL operates the Marine Sciences Laboratory in Sequim, Wash., and has offices in Portland, Ore.; Seattle, Wash.; and Washington, D.C.

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