Executive summary
The IBM® Asset and Plant Lifecycle Management (APLM) solution is designed to help companies manage their plants, processes and assets. It can merge all of a company's enterprise and departmental content sources, improving access to information by linking engineering, facilities, maintenance, compliance, legal, suppliers and operations departments—regardless of location—to speed business processes, optimize operations and aid in making the decisions that are critical to success.

Making the most of physical business assets
Utilities, oil and gas companies, chemical producers, pharmaceutical companies and other manufacturers are all under pressure from many directions: global competition, increasing regulations, shrinking margins, pricing pressures and shorter product life cycles. Meanwhile, customers expect continuous innovation and service improvements.

To respond to those pressures and develop a sustainable competitive advantage, companies are searching for ways to use their information infrastructure to operate more effectively, reduce costs and drive innovation. They need answers to critical questions:

- How can we achieve greater operational efficiency while reducing costs?
- How can we turn content and data that the organization is already creating into intelligence for improving operations?
- How can we operate our facilities so that we can benefit from the introduction and application of new technologies?
- How can we reduce the time and cost required to perform scheduled and unplanned maintenance?
- How do we create and maintain the institutional memory necessary to properly operate our facilities as our experienced workers reach retirement?
- How can we minimize the amount of cost and time spent on compliance issues?

As they ask those questions, companies are looking closely at some of their most important resources: the physical plants and assets that they use to create and deliver products. They want to use existing information to gain insight into plant operations. They need to find ways to more efficiently manage their plants and related assets, and to make sure that information related to those resources can be instantly accessed by decision makers and critical systems across the enterprise.

The IBM Asset and Plant Lifecycle Management solution
The IBM Asset and Plant Lifecycle Management (APLM) solution is designed to provide companies with a strong platform that helps increase process performance, reduce cycle times and improve productivity by automating, streamlining and optimizing complex processes as well as managing the flow of work throughout the enterprise. The APLM solution includes the IBM Enterprise Content Management (ECM) portfolio of solutions, leveraging the unification of business content, processes and connectivity to speed critical business decision making at the heart of the enterprise. The APLM solution is designed to build relationships between disparate information to help aid in the decision-making process. Content and processes can be made to work together to facilitate and accelerate information exchange, thereby helping organizations respond to business events or transactions.

With APLM, companies can leverage their critical business information to manage and integrate data across the entire design, build, operate and maintain cycle; manage their supply chains more effectively; and optimize construction and operations to take advantage of new technologies in both new construction and upgrades to older facilities. By working with IBM and its partners, companies also benefit from years of domain- and industry-specific experience as they work to build faster, more agile and smarter businesses.
Manage content and monitor business processes

The IBM APLM solution enables companies to create, manage, monitor and integrate the key business processes required for efficient plant operations. Typical processes to be managed include:

- Management of Change (MOC) process development, tracking and auditing
- Building and operating permit applications
- Handover of plant from design and construction phase to operation phase
- Creation, approval and updating of plant operating procedures
- Coordination, planning, approval and execution of scheduled maintenance activities
- Collaborative design and approvals
- Contractor training processes and testing
- Annual review of process safety, management documents and procedures
- Scheduling and managing inspections
- Approval and incorporation of as-built documentation
- Maintenance work schedules and work packs
- Procurement approvals

Addressing the entire plant life cycle

The APLM solution supports the ongoing processes involved as plants progress through several distinct life-cycle phases. Most companies struggle to address those issues because plant facilities are complex and are built and modified at different times by different organizations. Because of this, information related to their operations resides in isolated, difficult-to-use and out-of-date repositories.

With the APLM solution, companies can bring together, manage and store all of the content that is accumulated throughout a plant or other asset’s life. Organizations can also plan plant work more efficiently because the APLM solution provides a hub for all information related to a plant. For example, changes to a plant typically only affect some areas of the plant, and only those specialists who have knowledge of the affected subsystems need to be involved in planning and approval.

With the IBM APLM solution, efficient, highly tailored processes can be created on an as-needed basis to solve the unique problems faced in each stage of the plant life cycle.
### Documents required to operate a complex plant and assets include:

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### The plant life cycle

Most plants and facilities move through a life cycle with approximately eight distinct phases, starting with the specification of the plant objectives and ending with decommissioning (see Figure 1). Each of those phases has its own set of data and information management challenges. With the APLM solution, companies can track critical information across phases, domains and geographies and deliver that information to decision makers precisely when it is needed, enabling them to make smarter, better-informed business decisions.
The life cycle of a manufacturing facility

Specification of the plant objectives
- Document size, cost and capabilities of new plant

Design
- Create, share and manage engineering and architectural documents

Construction
- Update, revise and approve construction drawings

Handover and commissioning
- Manage license, permit and compliance requirements

Operation
- Manage safety and environmental regulation compliance; control change management and document access

Maintenance
- Plan, manage and track routine and unscheduled maintenance activities

Refurbishment and reconfiguration
- Plan for plant expansion, reconfiguration and refurbishment

Decommissioning
- Maintain audit trail of decommissioning actions

Figure 1: As a plant progresses through its life cycle, the requirements for sharing, accessing, updating and archiving information change.

Specification of the plant objectives
The process begins with a vision and specification of the plant's mission. This is usually a strategic corporate decision that requires collaboration among high-level executives from sales and marketing, business development and strategic planning. In this phase, fundamental decisions are made about the size, costs and capabilities of the new plant and core plant requirements are established and documented. These requirements must be captured so they can be referenced throughout the entire life of the plant.

IBM APLM facilitates the sharing of documents with partners and contractors, helping to streamline the process of detailing plant objectives. And by capturing requirements and enabling quick access to those documents, it can help the planning teams obtain—and document—approvals and buy-in from various managers and executives.

APLM benefits for this stage include:
- Better control over document workflow and collaboration
- Streamline process of obtaining and documenting management buy-in

Design
Most businesses today focus on their core competencies of managing and operating their assets, which could range from large power or process plants to power distribution networks. Much of the engineering design is outsourced to one or more engineering, procurement, construction (EPC) contractors or subcontractors. For such an arrangement to be effective, the company must be able to manage the design as it evolves and coordinate the work of multiple design groups. This requires timely and precise communication of many types of documentation (especially marked-up drawings) between all parties. IBM APLM captures all of the design information as well as the rationale for the decisions that were made, eliminating coordination breakdowns between design groups that can lead to serious delays and unanticipated problems in both construction and commissioning.
Because multiple groups are often working on the same portion or related portions of the plant, all drawings and documentation must be available to all involved. With the ability to integrate and manage information across departments, IBM APLM can support the quick exchange of in-flux documentation between relevant parties both within and outside the company. This is very important, as the design and the supporting documentation often need rapid updates to support the design group, which can’t proceed with its work until key issues are resolved. Also, the amount of time and resources required to find, package and send a transmittal for review and then to refile and distribute the resulting modification cannot be underestimated, even though this function is often overlooked.

Formal processes need to be put in place to cover the exchange of information (reports, specifications, drawings, contracts, etc.) between all parties. There must be a high degree of visibility into the design status at key stages in the design process. IBM APLM includes business process management technology that helps ensure that information is passed from the contractor to the owner/operator at regular, planned stages, and that processes are auditable. This is especially critical if the owner/operator is in a regulated industry where every step of the design process must be documented.

APLM benefits for this stage include:

- Improved communications with and between subcontractors
- Improved document change and review processes

**IBM APLM leverages years of domain expertise**

Understanding how to apply the IBM APLM framework to a particular application or industry segment is as crucial as the quality of the technology that supports it. The true value of the IBM APLM solution emerges only when it has been optimized for the industry, the business processes and the technology infrastructure of the company it serves.

To accomplish this, IBM works with a variety of partners who contribute years of domain expertise and specialize in deploying applications in specific industry segments. This experience in working with industry-knowledgeable partners helps IBM create a flexible, scalable and highly customizable framework.

**Construction**

The construction phase is fluid and dynamic, requiring intense collaboration and a constant flow of information. As construction begins, many ideas, documents and drawings are generated to determine what needs to be built and the best way to build it. Although much of the information is generated during the design phase, documentation of the as-built status needs to be developed and maintained as construction progresses.
Construction often commences before all of the design drawings and documentation are complete. Consequently, the set of construction documents constantly evolves to meet the demands of the project. But before any drawing or document can be released for construction, it must be checked to make sure that it reflects the latest approved changes. It is also important to carefully check documents and drawings with pending changes to determine if the changes will affect the overall design or construction.

Meanwhile, on the construction site, problems in the original design will inevitably arise as the paper design is converted into the physical structure. This leads to drawings and documents being marked up at the construction site and sent back to the people responsible for the original design. Construction on the affected portion of the plant is then usually halted until the design problem is resolved and new drawings are generated—an iterative process that can delay the construction phase.

In all of those cases, changes to the original design must be sent to both contractors and subcontractors to ensure that only the latest drawings and documentation are used. There must also be a process in place for active acknowledgement and confirmation that the latest updates have been received.

Managing all of the drawings and documentation throughout the change process poses a major challenge in any construction project. The IBM APLM solution is specifically designed to bring structure and overall visibility to the construction phase, while speeding document turnaround times and ensuring the integrity of all changes.

APLM benefits for this stage include:

- Manage the flow of information critical to maintaining timelines
- Manage multiple versions of drawings and mark-ups
- Minimize turnaround time delays that can stall plant construction

Managing content in a distributed enterprise

With the combination of content, process and connectivity, IBM ECM solutions allow customers to build and sustain competitive advantage by managing and sharing content throughout their organization. With IBM ECM solutions, content is shared, information silos communicate and business processes are consistent across the enterprise—automating and streamlining operations while providing a full spectrum of connectivity to help simplify critical everyday decision making.

The IBM system repository supports all types of content, including word-processing documents, engineering drawings, manuals, correspondence, spreadsheets, graphics, photos and video. By intelligently managing business content and processes, organizations can benefit from:

- Better communications and improved processes that drive faster and better decisions by linking customers, business partners, suppliers and employees
- Reduced cost of demonstrating compliance
- Informed decision making based on current and accurate information
- Increased organizational speed and agility by accelerating access to critical content
- Maximized content value through integration with enterprise systems such as Maximo®, SAP/R3, Siebel, PeopleSoft and Oracle
Handover and commissioning

Depending on the regulatory bodies involved, several licenses and permits must be obtained before a plant becomes operational. This usually requires assembling the numerous documents and drawings that were created and modified throughout the design and construction phases. Safety authorities also require operators to create safety procedures, hazards analysis, operating procedures, training procedures, work authorization systems and other processes to meet compliance requirements. All of those processes must reflect the current, approved versions of organizational documents.

The IBM APLM solution helps prepare and organize all of the documents required for plant handover and commissioning. The system also manages the internal and external processes that must be executed before the plant can be brought online. For example, when creating a procedure or licensing application, the developer must locate and refer to numerous pieces of supporting content. IBM APLM can reach across enterprise silos to help the developer find the information necessary to create the application, as well as manage the output documents from that application.

This capability can also aid operators that want to become ISO 9000 certified and face a massive amount of required documentation. Aside from completing and compiling those materials, operators must install document-tracking systems with complete audit capabilities. The IBM APLM solution can accommodate all of those requirements and has been used in many installations to manage ISO 9000 certification.

APLM benefits for this stage include:

- Prior to commissioning, create and store all plant operating procedures in an easily accessible content repository
- Track operating permits and licenses
- Simplify compliance with legal records retention requirements to meet health, safety and environmental requirements
- Streamline the creation and documentation of quality (ISO 9000) procedures

Operation

Once the plant is up and running, the IBM APLM solution provides information where and when it's needed to help ensure successful plant operations. Whether it involves quality-related programs or safety, health and environmental regulations, managing compliance documents is an ongoing activity. Compliance documents are continually being revised to reflect changes in the plant, procedures and installed equipment. The process for reviewing and approving those documents must be controlled before a drawing or document can be updated and put into use.

The IBM APLM solution includes workflow components to help implement and enforce the document change management process. For example, controlled drawings and documents typically require several reviews and sign-offs by a variety of personnel; IBM APLM can track the status of those
documents over time. Current engineering notices can also be maintained and managed, ensuring that critical jobs performed in the plant or in the field are based on easily accessible, up-to-date information.

The IBM APLM solution can help control and manage the process of creating, changing and referencing plant documentation, as well as the review, approval and tracking of all documentation reflecting plant changes. APLM can also help simplify the assembly of maintenance work packages with all relevant documents, manage the work status of maintenance activities and track vendor-supplied documents, including subsequent updates.

APLM benefits for this stage include:

- Reduced costs and staff required for regulatory compliance, records management and quality management
- Business process management rules can be created and enforced
- Audit trail verifies compliance

**Maintenance**

IBM APLM solutions are designed to streamline the maintenance process and provide all of the tools necessary for successful planning, management and tracking. The result is less downtime and greater plant availability, which can lead to additional revenue.

Routine maintenance requires referencing a number of documents, including plant configuration documents, current drawings, vendor manuals, maintenance procedures, material safety data sheets (MSDS) and previous work orders. All approved and pending changes must be reviewed before any work is done. The IBM APLM solution can be integrated with the enterprise asset management system (EAMS) to provide required documents for each work package. This automated work package production can save large amounts of manual labor and help improve work package quality, while ensuring only the most current documents are used as reference material.

Unscheduled maintenance activities can be even more difficult to manage without the IBM APLM solution. When an unforeseen problem occurs, the ability to turn the APLM system into a research tool can be critical to finding problems, identifying what action needs to be taken and compiling the current documentation to get the plant back online as quickly as possible. The same system can then be used to capture all of the changes and markups to reflect what was done in the process.

Because APLM assists in managing information workflows and surfacing the most current version of information, it helps ensure that the people doing the maintenance work start with accurate drawings and documentation of the current plant configuration. Plant management can use the system to document contractors’ work so the modifications will go smoothly. Any problems with this process can result in additional plant downtime and lost revenue.
Before the plant is brought back online after maintenance, it is often necessary to modify procedures, update vendor information and review any impact on the safety and quality plans. The APLM solution can help improve the quality of the process, reduce the time involved and increase the accuracy of those modifications. As work is completed, the latest as-built/installed changes are incorporated, approved and recorded for future reference.

The IBM APLM solution can be used to improve both scheduled and unscheduled maintenance activities while allowing integration with enterprise asset management systems and scheduling of work to be performed. It can also facilitate the preparation of work packages containing accurate, relevant and up-to-date documents, including appropriate procedures, drawings, vendor manuals and other related information.

APLM benefits for this stage include:

- Reduced plant downtime for both scheduled and unscheduled maintenance
- Simplified integration with ERP, maintenance and other systems
- Complete audit trail of all actions

Refurbishment and reconfiguration of the plant

Today’s plants are in a constant state of flux. New and improved products and processes replace outdated ones and require updated documentation to accurately reflect the changes to the physical plant. Expansion and reconfiguration planning may take place months or even years before the work is initiated.

The APLM solution can provide the dynamic links required to manage the change process and ensure that the most current documentation is used throughout. Authorized contractors and subcontractors can view all requested, approved and pending changes along with the supporting documentation. This allows for resolution of as-built versus as-designed conflicts. Changes to operating procedures and as-built drawings are all incorporated into the operating documentation before the plant is brought back online.

The activities performed during major plant expansions and reconfigurations reflect the same activities associated with design, construction and commissioning.

APLM benefits for this stage include:

- Enforcement of business process rules in the MOC processes
- Accurate as-built information available for plant operations after reconfiguration
- Clear documentation of updates and changes to maintain compliance

Decommissioning of the plant

As a plant reaches the end of its useful life, it requires a conscientious effort to effectively plan and document the decommissioning process to minimize liability and adhere to health, safety and environmental requirements. In this era of environmental awareness, it is necessary to carefully assess what must be done to shut a plant down and to leave the site into a condition that will allow it to be put to other uses. This process requires plans to be put in place. The foundation of those plans is contained in the documents that have been generated in all previous phases of the plant’s life cycle.
The APLM solution can help companies plan, document and manage the decommissioning and reconstitution of the plant site. The solution handles the flow and content of documentation required in the complex permit process, and can help manage contractors and subcontractors. Throughout the decommissioning process, authorized personnel can view all plant documentation to aid in safe demolition. Finally, the IBM APLM solution helps organizations maintain concise documentation and accurate content to reduce liability and provide an audit trail of all actions.

APLM benefits for this stage include:

- Faster document availability and distribution
- Easier management of decommissioning/remediation compliance with complete set of documents and audit trails

**Make better decisions faster**

Today, companies need every advantage to differentiate themselves, to maximize their competitive edge and to build shareholder value. Competition is intense, and in the race for market share, companies must think and act globally.

The IBM APLM solution can be deployed quickly and scales easily to the needs of your business, creating a unified infrastructure that connects both users and applications. Its event-driven architecture activates content to efficiently process millions of transactions and support thousands of users. Real-time and historical tracking of plant life-cycle processes, combined with process analysis and simulation capabilities, allows for maximum utilization of your resources. Plus, the process optimization capabilities allow you to effectively manage change through enhanced operational visibility and improved agility. In short, the APLM solution can help you become more competitive and make better business decisions faster.

**About IBM ECM**

IBM ECM solutions help organizations make better decisions faster by managing content, optimizing business processes and enabling compliance through an integrated information infrastructure. The IBM ECM portfolio delivers a broad set of capabilities and solutions that integrate with existing information systems to help organizations drive greater value from their content to solve today’s top business challenges. The world’s leading organizations rely on IBM ECM to manage their mission-critical business content and processes.
For more information
For more information about the IBM APLM solution and IBM ECM, please contact your IBM representative or IBM Business Partner, or visit: ibm.com/software/ecm

Join the conversation at ibm.com/community/ecm

Additionally, financing solutions from IBM Global Financing can enable effective cash management, protection from technology obsolescence, improved total cost of ownership and return on investment. Also, our Global Asset Recovery Services help address environmental concerns with new, more energy-efficient solutions. For more information on IBM Global Financing, visit: ibm.com/financing

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