Environmental Data Management, Analysis, and Compliance Systems - Rethinking the Creation and Use of Emissions Data by the Regulated Community

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ABSTRACT

In recent years the incorporation of environmental objectives into the business plan has become accepted as smart business management. Internal data such as human resource statistics, sales numbers, equipment inventories, and profit tracking have long been regarded as a corporate asset because they are used as a basis for decision making, Return on Investment (ROI) and risk management. It makes sense then to view collection and analysis of environmental data as more than a regulatory obligation but as a key component in status evaluation and corporate planning. Emissions inventories and estimations can be crucial considerations when planning production schedules, plant construction, fuel type usage, etc. To most effectively realize the benefit of such data, it is imperative not to create more work at either the facility or corporate level. Therefore intelligent data management is key to leveraging emissions data to deliver value.

For the Regulated Community maintaining compliance with environmental laws and regulations requires extensive data collection, record keeping, and reporting and compliance related activities are mission critical. The good news is the very same data that satisfies compliance obligations can be mined to provide insight and information about an organization at the facility, business unit, and corporate level. That information can then be used to turn compliance from a reactive process to a proactive one. It can also be used for decision support, risk management, efficiency upgrades, and project and planning purposes. The right data management system can transform your regulatory obligation into profit.

Historically there have been few tools available for managing environmental data in a manner that both facilitates regulatory compliance and allows for the automated integration of environmental data with other corporate systems. Windsor Technologies has developed an environmental data management system to resolve that deficiency. Based partially upon the RAPIDS[1] data model, it provides an excellent method for managing corporate environmental data in a manner that promotes compliance and transforms environmental data into a corporate asset.

INTRODUCTION

Traditionally many companies have viewed the collection of environmental data as primarily a regulatory obligation, essentially as a cost of doing business. Recently the more progressive companies have accepted environmental objectives incorporated into business plans as smart business management. This approach will transition businesses to a paradigm where economic, environmental and societal objectives are not discrete values, but are integral aspects of the business model.

The evolution to a less reactionary view of regulatory compliance makes good business sense for a number of reasons:

1) Increased Costs of Regulatory Non-Compliance – A quick review of the recent Consent Decrees signed by a number of refineries indicates the high costs of non-compliance. Many of these fines are associated with equipment maintenance and inadequate record keeping and

reporting. Corporations have increased incentive to stay ahead of the game with respect to compliance in order to avoid costly litigation and fines.

2) Better Real-time Data Acquisition & Analysis Tools– Acquisition and analysis of real time environmental and process data has matured in recent years. What was previously impossible or unfeasible is now simpler thanks to improvement in monitoring technology. Equipment, stacks, and outfalls can be scrutinized directly and the data analyzed immediately minimizing accidental releases, quickly identifying equipment operating out of tolerances, and ensuring that equipment is operating optimally.
3) Leveraging Enterprise and ERP Systems – Many large organizations have invested in Enterprise Resource Planning (ERP) systems, e.g., SAP, PeopleSoft, and Oracle E-Business Suite11i. These systems can interface with environmental data systems and provide corporate views of local environmental databases providing information about emissions, equipment, maintenance, operator certification, and training.
4) Introduction of Market Trading Systems[2] – Due to the implementation of air pollutant based marketing / selling / buying systems, many companies now have an asset that must be managed. Usually if the total pollution for a period of time is less than a capped value, then the unused pollution units can be sold or banked for later use. Therefore it has become more important to have and use reliable emission data.
5) Responsible Corporate Citizenship – Many companies have determined that there is a value to the company if it is considered to be a "green" company. Consumers have access to an overwhelming amount of information about companies and their actions via television, radio, and the Internet. The increased availability of news and information has raised public expectations of corporate social performance. There is a value associated with an environmental approach to environmental regulations.
6) Availability of Enterprise Ready Environmental Data Management Systems- The market place now offers environmental data management systems which support a proactive approach to emission, process and compliance management.
7) Corporate Merger and Acquisition Hyperactivity – The sustained trend common to many industries is seemingly constant merger and acquisition activity. As a corporation grows is it crucial to assess the process efficiency and environmental performance of new facilities in the organization in order to minimize risk, maximize profitability, and effectively plan production. Therefore having a strong, centralized environmental data management system that seamlessly accepts new entities is a critical factor in sound management.

Each of these variables has a measurable value in the corporate setting. Savvy, strategic use of Information Technology has been an enormous contributing factor in the positive trajectory the US economy has plotted over the past 15-20 years. Mining compulsory data to produce information and then transforming that information into knowledge creates a benefit where there was only a cost. The question, of course, is exactly what benefit? The accepted method of defining this value is to perform an ROI calculation. The challenge lies in determining a general method of calculating ROI for environmental data systems that accurately quantifies the value of such a system to a corporation. The highest hurdle is establishing metrics, both tangible and intangible.

1) Establishing what it costs to do the work now, and what it would cost after implementing an environmental data management system.
2) Estimating what further costs are avoided or minimized by accomplishing the same functions under a different paradigm.
3) Estimating and quantifying the entirely new benefits to be realized by using compulsory data gathered at a local level to generate information for decision making at a global level.

WHAT IS ENVIRONMENTAL ROI?

The key question is how does one measure the ROI of environmental data management, analysis, and compliance technology? It's one of many approaches to calculating the value of a capital investment. ROI traditionally equates with "cost savings." This is calculated as the total value or return minus the total cost (the savings) divided by the total cost. Breaking down each factor into quantifiable pieces is simply a matter of understanding and developing a method for calculating them. By calculating the savings, returns, and costs of each variable, one can calculate the total ROI.

$$ROI = (Return - Cost) / Cost$$

It's all about the bottom line…

The practical difficulty of calculating ROI is quantifying each variable. While the ROI equation is standard, environmental data management has introduced a new set of variables not standard to normal data management technologies. One can measure software investments in dollars and estimate manpower by calculating the hourly cost of each individual. But the real question is how one would factor in such variables as technological innovation; the competitive edge gained through minimizing pollution and maximizing efficient processes; and goodwill generated by being a good environmental corporate citizen.

The USEPA and others are developing an increasing number of methodologies to help measure the intangibles of environmental data management and present them in a financial light. These various methodologies create quantifiable models for business concepts such as the market value of pollution units; the financial impact of the regulatory environment, more and better real time environment data; corporate database integration; and public perception of the company.

One of the critical purposes of calculating ROI is the determining how to increase ROI. The economic goal of virtually every market is optimal efficiency, and technology is the principal agent for efficiency gains. This is specifically true of environmental data systems. By using technology to minimize pollution, one can optimize the efficiency of the desired processes and maximize profit

The ROI over time…

The ROI can be extended over time by using other indices. For example, there is "net present value" (NPV), which calculates future savings in terms of current dollars and maps that to investment costs. To the extent that future savings exceed the total investment, the benefits exceed the cost. Another approach is the "internal rate of return" (IRR), which focuses exclusively on future cash flows derived from an asset or investment. If the cost of capital is less than the IRR, there will be financial benefits from the initial investment.

Extending the Environmental ROI…

The ROI described above provides a core foundation for calculating the benefit of environmental data management, analysis and compliance software. The formula described above can be modified slightly for the environmental arena: Add "savings" and "derived income," and divide the sum by "investment." In this formula, "savings" refers to savings in operational costs and processes as well as savings derived through improved performance and greater efficiency of engineering processes. By minimizing pollution, the engineering processes are optimized for what they were intended. Derived income can be calculated from these more efficient engineering processes. By tracking all reporting requirements, many of the costs associated with penalties can be minimized or eliminated.

$$ROI = (Savings + DerivedIncome) / Investment$$

This business focus for environmental data is underscored by new approaches such as "return on opportunity," which focuses on revenue, and "return on asset," which focuses on profitability. Quantifying these advantages can be difficult for environmental data. The key to an accurate ROI assessment is to know the particular operational / regulatory environment.

There are some key factors to consider:

1) Cost – Calculating the cost of the environmental data management, analysis and compliance software is the first place to start. One must look at the costs of all the components, including installation costs in terms of services and internal labor and in-house personnel training (price and labor).
2) Deployment Timing – This is an additional part of the cost and it has both negative and positive implications for a good environmental data management solution. For an enterprise business, time to deployment will directly impact internal business efficiencies, either by disrupting them, or by delaying the availability of a new service.
3) Environmental Data History – It is important to be able to measure improvement against a past condition. For example, one could look for compliance violation reduction or lower average pollution values. One should also look for less obvious metrics: Does the environmental data management software enable one not only to deploy professionals more meaningfully, but also to begin restructuring to achieve new organizational dynamics? Can production be increased while maintaining compliance with the required emission limits?

In the perfect ROI study, a full record of past conditions would be documented and then the same metrics would be applied to the new conditions with new software.

The first question to ask about ROI is, exactly what is being assessed and why measure it? Calculators for specific products are good examples of this. They are all designed with a clear product-focus in mind: to assess the likely predicted ROI potential in a wide range of environments. In other words, they are designed to show why - and to some degree, how - a specific environmental software product is a good investment. One is probably better off by conducting one's own ROI analysis.

Good environmental ROI data very often can be gained directly through environmental data management, analysis and compliance software. With this type of software, one can gain substantial details about how the environmental management practices are performing. The bad news is that if these are the products, or components of the products one is seeking to evaluate, then there is no prior case. There will be no history against which it can be compared.

So what should one do? The solution maybe to perform a manual analysis or do an analysis on a subset of the data if a desktop system was used previously. If there are no previous data, then the best one can do is to benchmark the new software to measure progress as the software becomes integrated into the organization.

MAXIMIZE ENVIRONMENTAL DATA MANAGEMENT ROI

In the previous section we discussed the key issues and approaches in calculating an environmental ROI. There are really two purposes for which an environmental ROI can be used. The first is to evaluate environmental data management, analysis and compliance systems to identify the cost benefits of implementing such a system. In larger organizations, a one to two year return on investment is possible. Many organizations go through this type of ROI to determine if a new environmental system should be developed / purchased.

The second, and more important, use of an environmental ROI is to manage the environmental data as a corporate asset to contribute to the success of the company. Maximizing the environmental ROI would contribute, sometimes significantly, the bottom line of the company.

Based upon maximizing an environmental ROI, there are a number of criteria that an environmental data management, analysis and compliance system should have:

1) Event tracking module – The environmental data management system should have a flexible, industrial strength scheduling and tracking module. The module should have flexibility to track any compliance deadline or deliverable, document, event, or any item that has a time constraint. It should be able to use alarms (e.g., e-mails, log files, messages) to alert one when specific limits are being approached or have been exceeded.
2) Enterprise system that interfaces with corporate systems – The environmental data management system should be an enterprise system that interfaces with corporate management systems. For example, using an environmental data system for one facility would not produce benefits company-wide as the data would not well integrated (if at all) with other corporate data and local data would be unavailable to off-site stakeholders within the organization. Similar or identical data would be stored in multiple systems compromising data integrity and creating data redundancy representing duplicate efforts.
3) Real time data acquisition module – There is a need to obtain some of the environmental data on a real time basis. Measurements can be compared with permitted conditions to determine data discrepancies or incidents that should be analyzed.
4) Maintenance and leak detection module – If any equipment has leaks or is not maintained regularly, then the equipment is not operating optimally. In addition, leaks and repairs can be regulated and tracked. Problem equipment types can be identified. By minimizing equipment problems and failures, repair costs and downtime can be minimized.
5) Capacity to maintain extensive history for record keeping & analysis – To calculate an ongoing environmental ROI, there needs to be a history of emissions, throughputs, equipment, maintenance, permit conditions, regulatory conditions, and the like. These data would be analyzed to determine business strategies to increase the ROI.

COMMERCIAL ENVIRONMENTAL DATA MANAGEMENT SYSTEMS

Historically, there have been few automated tools available for managing multi-media corporate environmental data in a manner that both facilitates the satisfaction of regulatory obligations and allows for the automated integration of environmental data with other corporate systems. Most environmental systems have focused on helping the facility meet the regulatory requirements. Such a system can be defined as a “compliance-centric” system.

In recent years environmental objectives incorporated into the business plan have become accepted as smart business management. Internal data such as human resource statistics, sales numbers, equipment inventories, and profit tracking have long been regarded as a corporate asset because they are used as a basis for decision making and risk management. It makes sense then to view collection and

analysis of environmental data as more than a regulatory obligation but as a key component in status evaluation and corporate planning. For example, emissions inventories and estimations can be crucial considerations when planning production schedules, plant capacity, fuel type usage, etc. Intelligent data management is key to making emissions data a corporate asset. Such a system can be defined as a "environmental ROI-centric" system.

Currently, there are several commercial compliance-centric systems available. However, the new generation of environmental data management, analysis and compliance systems is designed to assist with maximizing the Environmental ROI in addition to meeting the regulatory and compliance requirements. In this paper we briefly describe the Ennovation suite of products, an environmental ROI-centric system.

The Ennovation Suite

The Ennovation environmental data management, analysis, and compliance system is designed to be environmental ROI-centric. It offers a toolset for managing corporate environmental data in a manner that reduces the administrative burden associated with regulatory obligations, promotes compliance with permit conditions and environmental laws and regulations, and transforms environmental data into a corporate asset.

Technical Approach

The Ennovation suite is a modular application, which can be installed as a complete package or incrementally. At the core of this system is the proven RAPIDS data repository, with over $5 million invested in development costs. The RAPIDS environmental data repository make extensive use of flexible attributes. This allows the user to add new parameters to the data repository without having to change the data model. Figure 1 shows the conceptual technical diagram of the RAPIDS model.

Key Modules

There are number of modules that support the Ennovation suite. The key components of the system are:

1) Environmental Data Repository (EDR) – As stated above, the EDR is based upon the RAPIDS data model and is the basis of the system.
2) Emission Inventory System (EMS) – The EMS manages air emission inventories, including criteria and toxics; solid waste streams; and wastewater / storm water streams. The information would be used for reporting, permitting and compliance activities.
3) Facility Management – The Facility module can store and manage facility and process data for every site in the organization. Here one could customize roll-up levels to evaluate data by region, business unit, state, or other definable parameter.
4) Scheduling & Events Tracking System (SETS) – The SETS module would allow the user to automate event scheduling and tracking and to generate reminders and other actions. One could can schedule e-mails to remind the responsible party when a certain report, such as a DMR is due to the state.
5) Analysis & Reporting (enSight) – The analysis portion of the system facilitates the comparison and analysis of environmental data to improve the performance of devices creating pollution. In general, minimizing the creation of pollution would maximize the resources used for the business. The module allows for "what if" scenarios to be analyzed. The reports part of the module would generate canned, custom, and ad-hoc reports.
6) Compliance & Permitting – The Compliance & Permitting module would allow the user to compare actual measurements to permitted values and run "what if" scenarios. This module could be used to store and manage permit applications and permits. From the compliance module the user could access a past permit application and easily create a similar application

for submittal by editing the appropriate fields. Combined with SETS it would be a powerful tool for monitoring compliance status company-wide.

7) Exchange Interface – This module would allow for data import and export to and from other databases, including regulatory databases.
8) ERP Interface – The ERP Interface would allow for automated data exchange with Enterprise Resource Planning software such as the SAP BIW (Business Information Warehouse) and PeopleSoft. This allows for the integration of ERP inventory, training, maintenance and other business related modules.
9) Laboratory Information Management System (LIMS) Interface – The LIMS module would allow for automated data exchange with a Laboratory Information Management System.
10) Environmental Data Acquisition – The data acquisition module provides an interface to various monitoring equipment via the data logger. The measurements can be compared with conditions to determine data discrepancies or incidents that should be analyzed. This module works in conjunction with SETS to provide automated comparisons, including early warnings if equipment is going out of limits.

These modules address the ROI criteria that we identified earlier to maximize environmental data management ROI.

CONCLUSION

Modern business practices incorporate environmental objectives into the business plan. It makes sense then to view collection and analysis of environmental data as more than a regulatory obligation but as a key component in status evaluation and corporate planning. Developing an environmental ROI is a good start in determining how the evaluate and manage environmental data. There are ROI-centric systems that are beginning to be available commercially to automate the management of environmental data.

REFERENCES

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KEYWORDS

Emission Inventory System
ROI
Enterprise Resource Planning Systems
Compliance
Environmental Data Management, Analysis and Compliance System
RAPIDS
Enterprise System

Figure 1. Conceptual Technical Diagram of the RAPIDS Model.