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Integration of RBI with an Inspection Data Management System

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Inspection Data Management System, or IDMS, is the generic term in the oil and gas industry for a software program that organizes the data in a facility's fixed equipment analysis (inspection) program. The software programs most widely used in the industry have been in use since the early 1980s, and the methodologies in these programs have been historically based on relatively simple inspection requirements. In the last few years, Risk Based Inspection (RBI) has become a standard in the development and execution of an inspection plan. Currently, most operating companies utilize two different software packages for these functions. Although this is the most common situation, it is far from an industry "best practice". Some systems already exist that integrate the methodologies for RBI analysis with the functionality of an IDMS, and these systems are becoming more and more widely used. But in the future, further developments in the technology as well as advancements in the philosophies behind RBI will enable facilities to achieve substantially greater results from their personnel and their programs. The future integration of RBI into the industry's leading IDMS packages will hinge on those improvements and will, in turn, become critical to the industry.

IDMS ELEMENTS

Typically, these software systems perform two primary functions. First, the software establishes and tracks schedules for inspection tasks, utilizing a degree of logic to establish schedules for all equipment items. Second, the software houses the results of those inspections. Although there can be a wide variance in the additional attributes of various packages, these two elements are essential in an IDMS. RBI can have a significant impact on both of these aspects.

Scheduling

With regard to the scheduling of inspections, most software packages contain the logic to predict required inspections as derived from relatively simple requirements. The most established independent software programs, such as UltraPIPE® by Berwanger, Inc. and PCMS® by Conam Inspection, as well as operating company-developed packages such as Shell's EMPRV and ExxonMobil's IDM, contain the functionality required to establish inspections as outlined in the American Petroleum Institute's inspection codes, API 510 (pressure vessels), API 570 (piping), and API 653 (storage tanks), each of which essentially requires inspections at some fixed interval or portion of remaining life, whichever is less.

Some of the variances in these programs are in how the remaining life is calculated. API codes simply require that remaining life be established by dividing excess wall (actual thickness – minimum thickness) over corrosion rate. Actual thickness is a fixed number, established via some sort of measurement; however, minimum thickness and corrosion rate can be established with some variation. Although ASME codes are generally accepted as the defining standard for pressure vessels and piping design, the application of these codes and individual company practices may vary. For instance, nominal thickness minus corrosion allowance is frequently used as the "minimum thickness" despite the fact that an ASME Section VIII Division 1 calculation may yield a markedly smaller number. Several IDMSs give the user the ability to perform the ASME calculations or some subset of them and give a more accurate minimum.

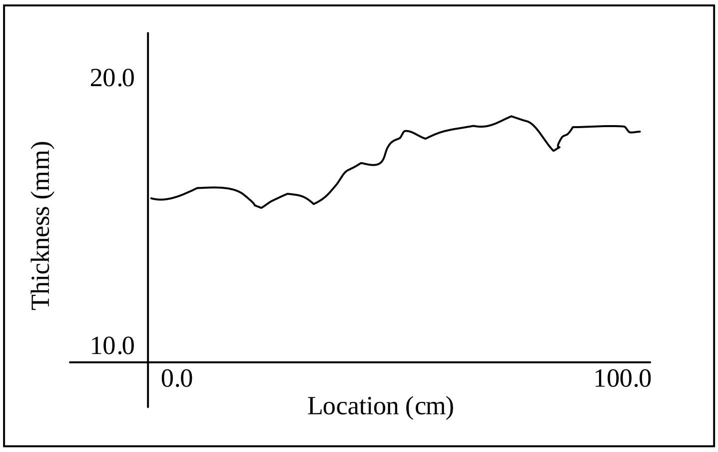
Corrosion Rate is also a variable. The simplest method evaluates each inspection location, or "Thickness Monitoring Location" (TML), independently and entails the following: previous thickness minus present thickness divided by the time between measurements. This corrosion rate is then applied, utilizing the remaining life equation above, to the actual thickness and minimum thickness at the point for which it was calculated, and the remaining life at that location is established. Because the various locations will have different values for remaining life, the smallest remaining life is used for the entire equipment item, and the next inspection for that equipment item is set accordingly. More advanced methods like statistical analysis can also be used to establish the corrosion rate. This can be especially applicable for equipment or piping circuits that see large swings in corrosion rates. For instance, a piping circuit with multiple TMLs ranging from 0.1mm to 1.0mm corrosion in a 5-year span has obviously experienced a wide range of corrosion rates across it. The inspector or engineer who evaluates the circuit may decide to apply a "best fit" corrosion rate established over the entire circuit to each TML. Since different points in the circuit will likely have different excess wall thicknesses and possibly different minimum thicknesses, this will produce a more conservative remaining life, and therefore an earlier requirement for inspection.

Regardless of which IDMS software is utilized, its functionality must match the philosophy of the operating company. Since most operating companies have based their inspection programs, at least loosely, on the API codes, the systems have many scheduling similarities.

Results and Data Tracking

Industry-wide, there is a much wider variation in the second primary function of IDMSs. Although virtually all widely-used systems will store and analyze thickness measurements, how these data are input and how data from other types of inspections are housed varies considerably. For example, consider a UT scan. A "B-Scan" refers to one pass with a UT probe to establish a thickness profile over the section scanned. The results from this inspection would be more appropriately represented in a graph, indicating the thickness of the wall evaluated over the section measured. Figure 1, below, shows an example result of a B-scan performed over a 10cm section of pipe with pitting on the interior wall:

Figure 1 – B-Scan Result



In some systems, the above graph can only be stored as a graphic, i.e., the user must scan or capture it as a graphic and link it through a viewer. In some systems, the data that make up the graph is stored electronically, which enables more advanced analysis such as min/max or averaging over the curve.

Over one hundred different inspection techniques are generally accepted and regularly employed throughout the industry. Results of these techniques can be tracked with varying degrees of complexity within an IDMS. Should the IDMS not have the ability to house the specific data as in the case above, results are typically captured in one of two ways. First, the user can key text comments into the IDMS, and in some cases, utilize customizable checklists within the system. Second, the information may also be captured in a "linked" document. The results of an inspection are tied to a file on the user's computer, which can be launched from the IDMS utilizing whatever third-party software is required for viewing (software associated with the individual technique, picture viewers, or Microsoft® products such as Word or Excel).

The limitation of both of these methods is that there is no capability for objective or automatic analysis. The user must perform all analyses, such as determining that a crack is not severe enough for immediate action, but should be inspected again in a year, and manually re-enter the results into the IDMS. As most jurisdictions and inspection codes only explicitly require visual, UT, and radiographic techniques for inspection, this limitation of the software is acceptable.

RISK-BASED INPSECTION

When compared to inspection programs based on the traditional fixed interval codes, *Risk-Based Inspection (RBI)* typically results in a much wider variation in inspection requirements. Although RBI is still in the process of becoming accepted by many jurisdictions in the industry, it has already been both accepted and implemented all over the world and, to varying degrees, within most major operating companies. Although some companies focus their programs somewhat differently, RBI is most commonly used to help focus the inspection resources to most effectively mitigate the potential for loss due to an equipment failure. In all risk analyses, two components are considered: the consequence of an event, and the likelihood that the event will occur. For the most part, inspections can only have an impact on the likelihood of failure. More accurate inspections not only tell *whether* damage is occurring, but *when* that damage is likely to result in a failure so that it can be avoided. Since an IDMS's primary focus is the management of the inspections, for the purposes of this document, we will focus on the likelihood of event occurrence.

One of the most significant differences between a "traditional" inspection program and one that utilizes RBI procedures is the variation in inspection intervals and techniques. An RBI program in which each equipment item is evaluated completely, including non-containment (tube bundles) and non-pressure boundary requirements (column trays), will typically identify many more inspection techniques. Each equipment item will have a separate requirement for next inspection date, which will vary for each application. These can then be refined to coordinate with turnaround schedules.

As a fundamental step in the risk calculation, RBI has a more defined methodology for evaluating equipment for multiple damage mechanisms and a more defined approach to specifying the use of other inspection technology beyond the traditional visual, UT, and radiograph. In practice, likelihood evaluations are based heavily on the active damage mechanism and its rate of damage. Evaluation of that equipment condition may require a specific technique optimal for evaluating that flaw. For example, evaluation of cracks may call for shear-wave or wet fluorescent magnetic particle (WFMP) inspections to accurately determine the crack characteristics, so that the likelihood of the crack causing a failure can be established.

As a final key point regarding RBI and its application to this topic, we must briefly discuss quantitative versus qualitative RBI. In the simplest sense, quantitative studies, whether RBI or other, are based on value inputs (numbers) and precise rule sets to calculate the final result. Qualitative would be more heavily dependent on user or expert opinion to drive the analysis. In theory, quantitative would be more objective, and qualitative more subjective. For example, a calculation for likelihood may include complicated probability rules and equations utilizing actual numbers for corrosion rates, existing damage size, and remaining life. These numbers, derived from standardized methodologies (510 or 579), should be the same regardless of who performs the analysis, and therefore be both objective and quantitative. The results may also be a number, representing actual probability of failure at a point in time. Conversely, the likelihood portion of the analysis may simply consist of the question, "What is the likelihood of pressure vessel 'PV-101' experiencing problems due to galvanic corrosion, high, medium, or low?" This would be a qualitative – and subjective – approach and result.

In practice, none of the RBI techniques utilized in the industry are 100% quantitative or qualitative. The most quantitative approaches still depend on owner and/or expert opinion as an input to perform the calculation. On the other side, the most qualitative packages utilize the subjective input of an individual who will be reviewing some objective information available to him at the time of his analysis.

Regardless of which methodology is engaged, the result – at least the outcome, which is the most pertinent deliverable in the analysis – is the inspection plan. This can come in many forms, but the essentials include, for each individual item, the types of inspections that should be performed as well as the next inspection date, or interval for that technique. With this, the facility can begin to implement the RBI plan and move away from the traditional 510/570/653 plans.

SOFTWARE INTEGRATION

RBI to IDMS

What information is passed between the IDMS and an RBI analysis? The answer to this question comes in two parts: first, what goes from the IDMS to RBI, and second, from RBI to the IDMS. The specifics depend on what RBI analysis philosophy is used and what RBI software (if any) is used. The function of each program should be considered when determining where specific pieces of information are housed. For example, one common error would be defining the specific locations (TML or CML locations) in the RBI analysis tool, which is not designed to handle this information. This may be very difficult to migrate as the method for housing the information can vary widely – from a text description to 3-D a drawing – making automatic transfer virtually impossible.

The quantity and variation of the information transferred is much less from an RBI system to the IDMS than the other direction. The output of most RBI analyses is an inspection plan, which should detail the active corrosion mechanisms, inspection techniques applied, and the dates that those inspection techniques should be performed. Depending on the IDMS, these data should be relatively easy to migrate. A typical format for the migration of the above three pieces of data would be the use of customizable "activities" or "tasks" within the IDMS. For example, in *UltraPIPE*®, a user can establish as many custom *Activities* as he or she chooses (similar functionality exists in *PCMS*). These can be for anything from scaffold erection to painting. The most common use is to identify and separate different techniques that may be applied in the facility. The software comes pre-loaded with generic inspections such as "510 internal visual" and "510 external visual." When using advanced techniques coupled with the RBI analysis, the user may establish individual activities, including the visuals, and may go into detail for things such as wet fluorescent magnetic particle, automated UT, shear wave, radiography, eddy current, infrared thermography, etc. The user may choose to establish activities not only by technique, but by damage mechanism. For example a facility may have one activity for shear wave inspections for cracks around welds, and another for shear wave inspections targeting weld imperfections.

Once the activity is created, information can be added in comment fields or checklists. In these fields, to ensure association with specific activities, the following information should be entered:

- Details regarding the location or performance of the test (whether to look along or transverse to a weld)
- Specifics regarding the corrosion mechanisms under evaluation
- Format for results and data should be defined (for later use)

With the list of techniques for an item, a corresponding list of activities could be chosen and applied within the IDMS. If a cross reference exists electronically, it can be easily automated. The final trigger would be to apply the due date from the RBI plan to the activity schedule date in the IDMS.

IDMS to RBI

This is the more challenging of the two tasks. In theory, the movement of information in this direction *could* be much more involved. This is illustrated by the amount of time that users spend "gathering" data from various sources, which includes a large percentage of time collecting data from the IDMS and formatting it for use in the RBI system. This is where the qualitative vs. quantitative nature of the RBI systems has a large impact on the ability of the two systems to work together.

In dealing with a qualitative system, there may be no integration; or the integration may be as simple as a view screen within the RBI calculator that presents data from the IDMS portion useful to the "expert" formulating his or her opinions. At most, some logic may be employed to drive a qualitative input from the numbers. It could be as simple as an "if/then" statement such as:

IF CORROSION RATE < 0.1mm PER YEAR, LIKELIHOOD = "LOW"

Integration in this case is limited, as the relationship between quantitative data and a qualitative analysis is difficult to define. However, to date, this constitutes the furthest integration of RBI within major industry IDMSs.

The more quantitative RBI packages perform RBI analyses utilizing actual numbers. For example, in the API RBI software (version 5/6/7) actual thickness, minimum thickness, corrosion rate, time in service, number of inspections, corrosion allowance, material of construction, and design and operating temperature and pressure are all numerical values entered and utilized in the likelihood calculations. All of this information is also housed in most industry IDMSs. Furthermore, a majority of industry personnel prefer the quantitative approach, to promote the objectivity and form a stronger basis for their results. Finally, if all the data already exists in an IDMS or other electronic system, *and* it can be automatically mined, the process would be much faster and therefore cheaper to implement. It is for these reasons the quantitative approach is recommended.

Although this seems to be the most logical integration of systems, the industry is still struggling with the proper format for such a combination. While much information is used from UltraPIPE® or PCMS in the implementation of API RBI, the "live" links are not there, and the data often requires a significant amount of "massaging." One solution to this could be the "linking" of two separate databases, instead of moving to an integrated system. Although there are major initiatives to "link" databases in almost every industry, it is often not a practical solution.

The primary reason for this is evidenced in the integration of RBI and an IDMS. The massaging steps involved in going back and forth between the two packages are required because the data in the two systems is not in identical format. For example, in looking at the diameter of a component in PCMS, the user may see the dimension shown as "8-6". In RBI, that dimension must be input as "8.5". To a user, these values are the same. To a database, these subtle differences make the two fields completely different values. Therefore, the first half of facilitating a good integration is standardization of the data. In theory, it would allow the calculators in the RBI program to draw their inputs directly from the fields in the IDMS database. This, alone, would add significant value, because eliminating manual steps saves both time and potential errors inherent in a manual process. However, to fully integrate the systems, a change in most existing RBI philosophies should be implemented.

To explain this change, we must discuss the fundamental principle that divides many of the jurisdictional requirements and industry regulations currently in place regarding inspection practices: the application of a prescriptive vs. an interpretive system of defining program requirements.

Prescriptive vs. Interpretive

A *Prescriptive* program is one in which there is very little room to alter the implementation, as requirements are based on absolute numbers like time or size. Under a prescriptive program, an inspector may have to simply inspect a vessel every five years, with no exceptions. For example, the current standard in place for the Russian facilities, Gosstandart (commonly referred to as GOST), maintains very strict requirements on how pressure vessels are classified. Depending on the vessel's classification, full inspections (internals, externals, etc.) are required every two, three, or five years. Similarly, the API 510 and 570 codes for pressure vessels and piping respectively, require internal inspections at a fixed interval or half of remaining life.

The term *interpretive* is less uniform throughout the industry. In practice, it refers to any system that can be implemented with a range of variation. For instance, the Occupational Safety and Health Administration's (OSHA) regulations state the following regarding mechanical integrity and inspections:

1910.119(j)(4)
Inspection and testing.
1910.119(j)(4)(i)
Inspections and tests shall be performed on process equipment.
1910.119(j)(4)(ii)
Inspection and testing procedures shall follow recognized and generally accepted good engineering practices.
1910.119(j)(4)(iii)
The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.

- OSHA 1910.119 – "Process Safety Management of Highly Hazardous Chemicals"

This leaves much room for interpretation. The industry has applied its own codes, most predominantly the API and ASME codes. However, these codes are simply industry documents, and do not constitute law. All PSM facilities must adhere to the OSHA standard referenced above.

Although there are varying degrees of its application, RBI is a much more interpretive methodology than the fixed interval. For example, the API produces two standards that govern RBI. API 580 (RBI Recommended Practice) defines the requirements of a valid RBI approach, and gives guidelines for its implementation. API 581 (RBI Base Resource Document) is a much more specific document, defining *an approach* to performing RBI analyses. Virtually all RBI software packages tout API 580 compliance. Only the API RBI software strives to be compliant with API 581*. Therefore, according to the API documentation, relatively large differences can be seen in various RBI approaches, yet all are compliant with "industry" requirements.

Although the above explanation describes the general level of interpretation in RBI application, the application of the terms "prescriptive" and "interpretive" to this topic goes beyond the simple move from traditional inspection programs to Risk-Based Inspection. Within the application of RBI, different levels of "prescriptiveness" can be utilized. This is important to note because it can define exactly how the integration of systems should work. For example, the RBI implementation process can reaches a point where damage mechanisms have been identified, relative likelihood of damage due to that mechanism is projected, existing likelihood of failure has been calculated, and next inspection "level" and date have been determined. At this point, an inspection program can be developed. This can be a subjective process, in which an inspector or engineer considers the conditions and determines the appropriate technique to employ. However, most companies provide at least some direction through inspection "effectiveness" or "confidence" tables. These tables detail inspection activities and their relative levels of effectiveness in accurately locating and detailing damage. The more specific these tables are, and the more they are utilized to build the actual inspection plan, the more prescriptive the process becomes. In addition, the process has become more objective. Although prescriptive and objective are not always directly tied, both imply a decision process based more on standard rules or criteria and therefore tend to be a common result.

One final parallel to draw between prescriptive and interpretive philosophies is in the acceptance of the approaches across the industry. Government regulators, auditors, insurance companies, and other jurisdictional bodies prefer a very precise process that can be repeated throughout a cross section of participants. This is primarily to simplify measuring the compliance of one individual compared to the rest. While a large number of these groups are accepting, even endorsing RBI as a best practice, in nations like the United States, the burden of proof that that the operating company has followed good practice falls on the company itself. Therefore, any process that involves interpretive steps will bear some risk to that company. Since inspections and RBI are primarily centered on preventing incidents, there is very little technology that divides one company from another. In fact, most companies follow the philosophy that their engineering practices related to safety or environmental compliance should be very similar to those of other companies. Therefore, as the industry moves forward in its application of RBI, the processes will become more quantitative, more objective, and intertwine as many prescriptive steps as possible. In its current subjective format, one negligent RBI user could tarnish the application of the technology for the entire industry.

*Footnote – the API's methodology for revision and documentation of its RBI approach produces technical and software changes prior to formal documentation. Consequently, no software package is truly API 581 compliant.

Next Generation Integration

The integration of RBI into IDMSs has stalled into two options. First, the owner can perform a "manual" integration: get all applicable data from the IDMS and any other system and massage the data into the RBI program for calculation. Then, once the RBI process results in an inspection plan, this plan can be entered back into the IDMS manually so that inspection schedules can be developed. The second option, as seen in UltraPIPE®, includes a qualitative RBI analysis, which is facilitated through easy viewing of appropriate data. The resulting plan can be then automatically loaded into the IDMS side of the application, seamless to the user. While effective, this is, for the most part, a one-way street. Some applications claim to be fully integrated, joining relatively quantitative analyses with inspection data and planning functionality. However, these software packages either exhibit very limited IDMS functionality, or still require several steps in manipulating data, so the integration is cumbersome at best. Regardless, the current practices indicate that fully integrated systems, while on the horizon, are still very much in the minority in terms of actual market application.

As fully integrated software packages begin to be more prevalent in the industry, their application and effectiveness will hinge on a number of issues. One of the biggest technical challenges will be to migrate the current qualitative portions of the analyses to more quantitative and prescriptive ones. As described above, the quantitative approaches have a much higher probability of gaining industry-wide acceptance, due to their increased levels of objectivity. However, most of the widely-used quantitative methodologies still include a number of subjective steps. For instance, common practice is to engage an "expert" in corrosion/materials to identify active damage mechanisms and the subjectivity of the equipment to the damage mechanism identified. The inherent risk in this methodology is that the primary driver behind likelihood (the rate at which a damage mechanism is active) is based on a very subjective input. This subjectivity can severely weaken the technical strength upon which the RBI results are based. To strengthen the process, this step could be altered to utilize one or a combination of various systems on the market for calculating damage mechanism application. API 571, NACE corrosion tables, Compass Corrosion Guide, and/or the corrosion calculators in the API RBI BRD could be used to define the active mechanisms and establish approximate rates. This can require an additional layer of input data (stream composition, start-up/shut-down, operational fluctuations, etc.), but the result is that the percentage of the process driven by opinion is minimized.

Another example would be the quantification of damage. Currently, the subjectivity of various equipment items to issues such as cracking, creep, or blistering is dependent on a user-entered: "very, medium, or not." Furthermore, when an actual crack is found, the input simply changed from "predicted" to "detected." The quantification of thinning is much simpler. If a wall has thinned by 1mm over 2 years, and there are 10mm to go, the wall will last 20 years. The same will be developed for other damages, and the guidelines for this already exist. API 579 (Fitness-for-Service) outlines precise methodologies for determining remaining life based on actual flaw (damage) details. A subset or simplified set of calculations could be built to define remaining life due to damage mechanism activity, and likelihood could then be based on that remaining life. Although not exact, it will still be much more objective than current practices. There are several steps in almost all RBI processes that are driven by user opinion and input, and virtually all of them could be streamlined in such a way.

Regarding integration, there are some systems that have some of the advantages that integration provides. However, state-of-the-art systems over the next few years will look and feel much different. The primary function of an integrated system will be that virtually all analyses will occur within the system. In addition, users will eliminate the population of two systems. This will not cut the implementation time in half. More accurately, implementation resources can be cut to below 33% of non-integrated system implementation time. The implementation of some non-integrated systems requires three steps. First, the population of the IDMS. Second, the data in the IDMS must be massaged in order to be useful in the RBI software and to ensure congruency between the two databases (equipment lists). Third, further research must be done to capture any data required for the RBI software not currently in the IDMS. Finally, results from the RBI calculation must be entered into the IDMS for inspection planning. In the best cases, if the two systems are being implemented in parallel, the data research and massage time may be minimized, but will still be required. Existing integrated systems, even qualitative RBI packages, reduce this to one-step population of data required by the system. This population will take more time than the population of *just* the IDMS, but it is still a significant savings over two systems.

In the future, advancements in integrated systems will provide the owner significant advantages in system maintenance. Once rule sets and methodologies have been developed (as described above) to process raw data, the system cost will be limited almost completely to implementation. For example, current practices include "evergreening" exercises every five years. Evergreening describes a process by which the base data and assumptions are reviewed and updated with changes. Process alterations, equipment upgrades, and inspection results constitute the bulk of update information. Existing integrated systems can already reduce the amount of effort required for this, but in the future, once users have invested the time and energy to bring the initial data sets into the program, the application of evergreening will be gone. MOC processes will capture process and equipment changes. Inspectors will record the results of inspections into the IDMS, as they currently do, and the RBI analysis will be automatically updated. Finally, the critical information will be included for review in facility PHAs – often required every five years – to catch anything that is missed.

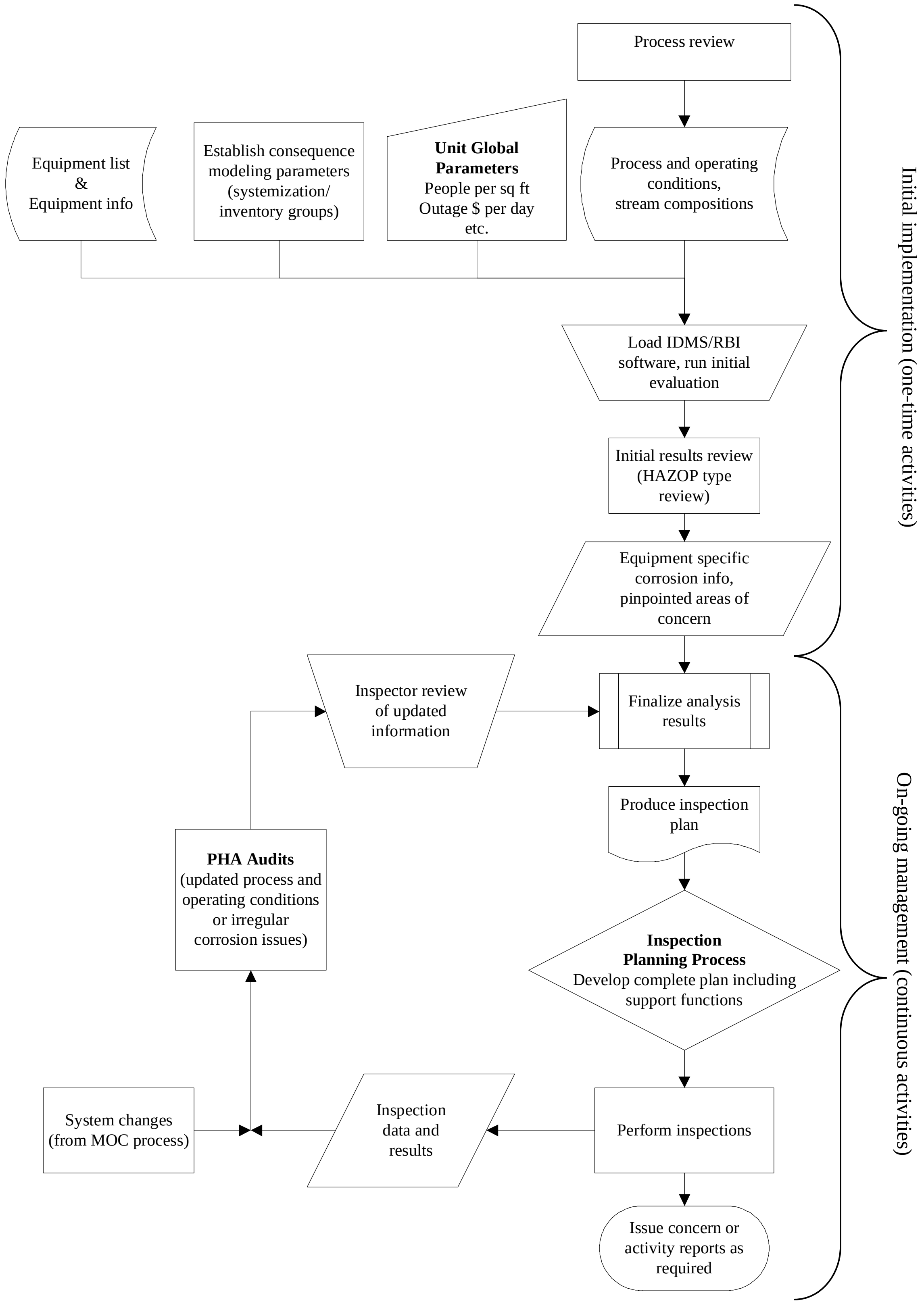
Some of the savings here are obvious. Integrated corrosion modelers, RBI calculators, turnaround planning tools, etc., will save countless hours of personnel time and effort, as well as the expense of hiring outside industry expertise to facilitate already cumbersome processes. Some of the intangible advantages are:

- *Instantly or always updated inspection requirements and plans*. As soon as an inspector enters thickness data, updated risk numbers are calculated and future inspection plans produced. External thickness measurements may return results that lead to a requirement for internal visuals and UTs for localized corrosion. If this occurs during a turnaround, the vessel can be isolated during the same turnaround and the additional inspections performed, rather than forcing an additional shutdown sooner than planned. Or, if a shutdown occurs six months earlier than planned, the inspection plan is ready at the push of a button.

- *Impacts of process changes are known instantly.* If a process change is proposed, the new process conditions and stream compositions can be entered and run through the calculator to see what the new inspection requirements would be as driven by corrosion and RBI. It would also raise flags associated with potential corrosion issues, shortened turnaround cycles, or overly abundant inspections that would justify equipment upgrades.

The full integration will provide substantial benefits to its users. The workflows will be significantly streamlined so that facility inspectors can focus on actual inspections, results of inspections, and immediate issues. The following diagram shows the future workflow as a completely integrated system is fully utilized. The diagram divides the initial implementation phase from the ongoing maintenance. Note that if implemented correctly, the ongoing maintenance of the system requires no additional effort beyond what an inspector expends performing inspections today, yet the benefits of a focused inspection program – as outlined in any RBI marketing material – are achieved. The system will streamline the workflow process and significantly enhance the effectiveness of each individual engaged in the mechanical integrity program.

Inspection Management Workflow With a Fully Integrated System



CONCLUSION

Currently, an average facility can invest anywhere from one to five million dollars (US) per year on a program to inspect, assess, and ensure the continued integrity of its equipment. The IDMS and RBI programs play a key role in determining the expenditure of that money. In addition, the implementation and maintenance of those systems can require a significant percentage of that money as well. The business climate today calls on personnel across the board to make themselves, and their positions, as effective as possible in the implementation of their tasks. Integrated systems can be one of the strongest tools in elevating the contribution of those personnel.

The technology to create and implement a fully integrated system has been in existence for years. In fact, the *ability* to integrate is evidenced in the current integrated systems that have already come half way. The challenge going forward is not a technical one, but a business process one. In order to complete an effective integration of an IDMS and an RBI software (including all of the functionality needed to fully manage mechanical assets) the rules, guidelines, workflows, and decision processes that are currently found only within our own personnel expertise must be logically identified and defined. Although no system can completely replace human judgment, performing most of the organizational steps is within reach. As the future brings further advances in this technology, the end users will demand that rules be defined to guide the process, when possible. And as those rules are integrated into the tools we use, we spend less time navigating through software, and more time focusing on the true issues and the small number of situations that existing rule sets cannot handle for us. With the information at our fingertips, we will be in the best position possible to take actions. The result will be lowered costs and a decreased number of incidents. Although this has been the primary promise from RBI implementation in recent years, cumbersome systems have driven the cost of implementation up significantly. Once the steps forward are taken as described here, the systems will not only deliver on the increased effectiveness, but will be able to demonstrate that savings to the user.