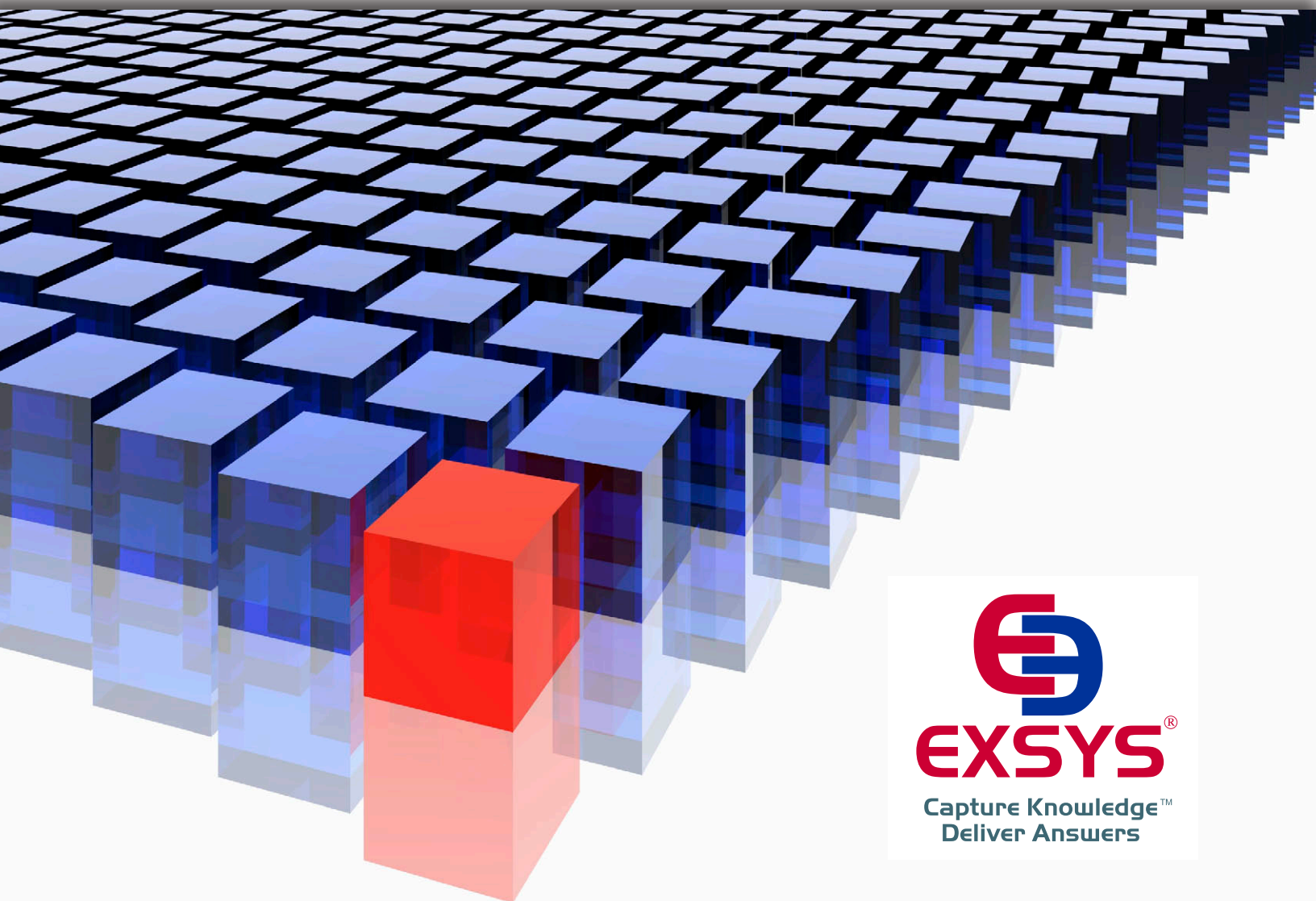# Simplifying Regulatory Compliance and Business Policy Requirements Using Exsys Technology

- The Problem
- The Solution
- The Proven Results
- The Implementation
- The Case Studies

EXSYS®

Capture Knowledge™
Deliver Answers

The Problem – Information Overload Confusing Interpretation

Businesses have a wide range of regulatory requirements placed on them by many government agencies. Being aware of all the compliance responsibilities is difficult, and fully understanding the details and specifics is not only very time consuming but almost impossible. It is no wonder there is so much confusion, error and delinquency, plus non-compliance can carry substantial fines. Lawyers and other experts that can assist a company in meeting requirements are an expensive option, especially when many people need answers.

The traditional government approach has been to provide information through various pamphlets, brochures and often slow "help lines". More recently, Web sites have been used to present and explain the regulations to the public. In theory, all the information needed is available. But actually finding the appropriate parts, reading it, understanding it and acting on it is still a daunting task.

Information Overload
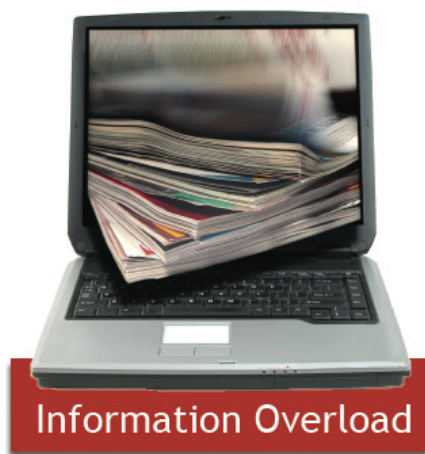
This is a classic example of the difference between "information", and "knowledge". What has been made available is "information", and the Web has made access to information and data easy. The government has many Web sites that provide a wide array of informative resources, and search engines allow access to vast amounts of information on any subject, from many sources, to be found quickly.

So, with all the regulatory information readily available, the problem is solved - right? Unfortunately - NO. Instead of being able to get specific answers that business owners need, they become overwhelmed with information, opinions and "guidance". They must consider:

1. Is the source of the information is authoritative?
2. Is the information up-to-date?
3. Is the information complete and consistent?
4. Does the information actually address their questions?
5. Does the information consider their special situation?

Even if they can answer, "Yes" to those questions, they then have to read and understand the information well enough to feel comfortable acting on it. For the typical businessperson this may be confusing, as regulations are likely to be written in legalistic terminology that the reader may not be familiar with. Even "simplifications" of the regulations tend to use technical terms, since official government documents must convey the same meaning as the regulations. Non-government "explanations" while easier to understand, but may not be authoritative, and may even be inaccurate.

Compliance errors can expose businesses to potential fines for not following regulations. Also, assuming the requirements have a valid reason for being on the books (and most do), non-compliance can lead to issues with health, environment, worker safety, and even national security. There is a huge cost incurred in attempting to "educate" the public and employees on regulations, and answer questions in a correct and consistent way. What makes this even more challenging is employee turnover, new regulations with varied interpretations that require continual retraining, production of new documents, and the effective promulgation of any changes.

In large companies the problem is compounded by internal regulations and company policies, which can either expand on government requirements or require implementation of unique company conditions.

The Solution - Knowledge Automation Expert Systems

Government agencies are well aware of the problems that businesses face in dealing with the myriad of regulations. Hiring outside experts is expense and difficult. Training staff to handle compliance issues and documentation can also take its toll, especially if there is a high turnover or employee retirement. Rapidly changing regulations further complicate things.

Forward-thinking organizations have found it far more effective to distribute "Knowledge" rather than "Information". This is a very important distinction, and a great step forward in bringing usable, practical problem-solving knowledge to the public.

Information and data can be viewed as a source of knowledge. However, it requires analysis, usually in a formal learning setting or through years of experience, to generate understanding and knowledge. Even though all the information is widely available, few people have the time and inclination to study it thoroughly enough to convert it to knowledge - even for one regulatory area, much less all of them.

Using interactive online systems, many government agencies, and companies as well, are using well-proven Exsys technology and services to encapsulate the "know-how" needed to comply with various regulations. Now, instead of business owners searching the Web and reading page after page of data, they simply answer questions presented by the systems, through the user's Web browser. They are only asked relevant questions that the user can easily answer. At the end of the session, the user is presented with situation-specific recommendations and answers. The entire process emulates a consultation with a human compliance expert to get their questions answered – available over the Web, 24/7, having all the latest regulatory expertise.

For over 29 years, Exsys knowledge automation expert systems have proven to be the most efficient and effective way to represent human decision-making processes. Other AI technologies such as neural nets, fuzzy logic,

genetic algorithms, etc., have worked for some problems where "guessing" an answer is adequate (or the best that can be done). However, for problem-solving tasks that are well understood and documented, nothing beats rule-based expert systems. And now, Web-enabled expert systems allow 24-hour access and interactivity with automated online knowledge.

Regulatory compliance is ideal for online deployment via **Exsys Corvid**® expert systems. Most regulations are written in a form that easily converts to rules, and are stated in terms of "If … Then…" statements. However, there is an important and fundamental difference between just providing the user with the If/Then statements as "information", and putting the same If/Then statements in an expert system.

The difference is the Exsys Corvid "Inference Engine". This is the "brain" of the expert system that interprets, analyzes, sorts and makes sense of the various rules, rather than relying on the user to do this. The inference engine determines what rules are relevant to the problem being solved, what facts are needed to determine if those rules are true, and how to derive or ask those facts. If the needed facts are available from other rules, the inference engine will automatically use those rules, allowing even complex problems to be broken into small maintainable pieces.

The user is only asked relevant, focused questions that relate to their situation. Since the inference engine looks at all the rules, no relevant regulations are overlooked, but no unnecessary questions are asked of the user.

At the end of the session, the user is presented with an answer or recommendation based on their specific input and the rules in the system. The user never needs to see, read or understand the rules (regulations) - that is done by the inference engine and allows "knowledge" rather than "information" to be delivered. The user is given their answer in the fastest and easiest way - similar to a quick conversation with a top expert.

Exsys Corvid software development tools capture the logic of decision-making rules in an easy to follow intuitive way, and present systems to end users in attractive and interactive interfaces. Systems can be delivered over the Web, using Java runtime programs that are portable across operating systems – or they can be downloaded as stand-alone applications. These deployment options bring a huge advantage to disseminating expert systems. Now a system can be fielded on a Web page and made available 24/7, around the world – even on mobile devices! Updates need only be made to one location on the server, and all users will be running the latest version. If a regulation changes, the relevant rules are easily modified and propagated throughout the system, and the change is provided to everyone running the system - without requiring notification, reeducation or retraining.

Proven Results

OSHA, SBA, Homeland Security, EPA, USDA, FHA, the Military and many other agencies recognize the usefulness and practicality of using Exsys Corvid expert systems to deliver regulatory advisory knowledge to businesses and users via the Web. In addition, various state, local, Indian tribal organizations and government agencies worldwide have fielded regulatory expert systems. They are also widely in use for regulatory purposes in many industries to assist companies in complying with government and internal policies.

OSHA has very successfully used expert systems for many years to help companies understand and comply with OSHA regulations. (See www.osha.gov/dts/osta/oshasoft/index.html and scroll down to the "Expert Advisors" section). OSHA's Permit Required Spaces Advisor alone

has saved businesses more than $100 million per year in consultants and attorney fees.

> "OSHA has 11 expert systems on its Web site. In 18 months there were 70,000 downloads. This represents 70,000 users that did not have to read complex regulations. Hundreds of thousands of questions were automatically answered, rather than trying to get an answer from OSHA. And an unknown number of safety problems were detected and fixed, preventing injuries and perhaps saving lives."
>
> **Federal Computer Week**
>
> "Industry and military users have reported that the Asbestos Advisor has been used by up to 80,000 businesses in the first year it was put on the Internet. The Asbestos Advisor was honored with the NPR Hammer Award."
>
> **"Best IT Practices in the Federal Government"**

Seeing the large number of systems already in use, government agencies and industry do not view this approach as high risk or "cutting edge". The systems created by OSHA and other agencies received high praise from Congress and the Secretary of Labor, and they were awarded the prestigious NPR Hammer Award presented by former Vice President Al Gore's Best IT Practices in the Federal Government – A Joint Project of the Chief Information Officers Council and the Industry Advisory Council.

Expert systems in general and OSHA's systems in particular were singled out for praise in William Eggers book, **Government 2.0" – Using Technology to Improve Education, Cut Red Tape, Reduce Gridlock and Enhance Democracy**. - "Thanks to the software they can forgo the costs of hiring compliance consultants. Businesses would have to spend up to $4,000 for a written equivalent of the reports that the [expert system] advisors generate in minutes. OSHA estimates savings to small businesses from the Hazard Awareness Advisor alone amount to around $272 million over five years."

" I was horrified that we as a huge regulatory agency weren't able to do the first duties of a regulatory agency: Provide easily understandable information to business about what they needed to do to comply and then help them comply,' states now retired Roland Droitsch, Labor's Deputy Assistant Secretary. The expert systems solve this problem in a way that can be even better than talking to a 'live' customer services representative on the phone. Why? Because expert systems can tailor information to the particular circumstances and characteristics of the firm…they always give consistent answers…and are available 24/7."

Using expert systems has become the clear choice for delivery of knowledge.

> "Any individual with access to the Internet can find free and accurate information about employment laws affecting them with the simple click of a mouse. The elaws Advisors are a valuable set of tools for America's 21st century workforce. They have the power to provide instant information to anyone at anytime."
>
> **Secretary of Labor**

Implementation

Building a regulatory compliance expert system is conceptually very simple. Just convert the individual steps in a regulation to the If/Then rule form of the expert system, and let the Exsys Corvid inference engine process the rules to ask focused questions and present recommendations.

Building a regulatory compliance expert system is conceptually very simple. Just convert the individual steps in a regulation to the If/Then rule form of the expert system, and let the Exsys Corvid inference engine process the rules to ask focused questions and present recommendations. That is always the core of the logic in a regulatory system and many systems really are that easy to build.

However, regulations are often not written in exactly the correct form, have procedural operations that are not based on logical operations, or have complex interface requirements. This requires some skill in building the system and integrating it into a Web site. Exsys offers several options to assist in system development – from determining best approaches, knowledge engineering, interface design, online training and integration. Several discounted packages are available including a very popular Pilot Project/Prototype Package designed to get a system(s) built and deployed in a very time/cost efficient manner.

Many regulations have associated forms and documentation that must be filled out. An additional, substantial benefit of the knowledge automation approach is that the system can ask all the needed questions and options, and generate a completed form in PDF format ready to be printed, signed and filed. These systems can even run within emails.

This Advisor by HUD helps present the requirements of the Lead Safe Housing Rule (LSHR). By analyzing your responses it generates a report of project-specific requirements that can be saved on your computer in a word-processing program or printed for a file. It also provides links to related resources including a glossary, related regulations, guidance, and sample forms used by many programs and field staff to implement the LSHR's requirements. HUD field staff are better able to provide accurate and consistent guidance to HUD grantees and program participants, and to monitor their lead-related activities.

To run this system go to:
http://www.exsyssoftware.com/HUDLBP/HUDLBP.html

Several specific systems will be examined in detail below illustrating many of the issues in building various types of regulatory systems.

OSHA's Compliance Advisors

In 1993, the Occupational Health and Safety Administration (OSHA) began developing Expert Advisors, a series of expert systems based on Exsys software. The Advisors address health and safety issues in areas such as asbestos and fire safety. Impetus for the initial product originated from the Small Business Administration's Office of Chief Advocacy, which urged OSHA to find new ways to help small businesses in interpreting government regulations. OSHA has worked with trade associations, unions and government agencies to respond to suggestions for expert systems in a variety of fields.

> **Delivering High Value**
> Typically hiring an outside consultant to perform the analysis performed by the Hazard Awareness Advisor could cost businesses thousands. Instead, businesses can now get authoritative, OSHA advice for free. The savings to US business on the Hazard Awareness Advisor alone is estimated at $272 million over 5 years. With additional savings and benefits from the other OSHA advisors.

Users of the Advisors answer questions about their work place, practices, materials and other topics. Advisors determine the hazards that are present and the OSHA regulations that apply. In addition, the Advisors can generate legally sufficient plans of action for implementing appropriate procedures and handle administrative tasks such as preparing required letters. Some advisors are on very specific items such as the regulations regarding asbestos or working in confined spaces. Others cover a very wide range of compliance issues in one system, and allow a complete survey of OSHA requirements across many business practices.

When OSHA started building these systems, the expert system approach was considered rather avant-garde and they had to address the question of "why use an expert system tool rather than programming the decision tree?" "A key reason," says Ed Stern, OSHA's driving force behind their Advisors, "is that an expert system shell allows us to lay out the logic of the regulations so anyone can see it clearly (without having to learn programming code). When we issue an Advisor, we need to get approval from a range of people, from technical staff to lawyers. Without a clear presentation of the underlying rules on which the system is based, it would be virtually impossible to get concurrence from the various parties.

In addition, an expert system tool allows the subject matter experts, rather than programmers, to control the development of the product and to change it. The series has attained the hoped-for goals by capturing the knowledge of the most experienced staff even after they have changed positions. (This way) we have not lost their insights and understanding of the regulations." The OSHA Expert Advisors program was a recent finalist in the Innovations in American Government Awards, which is recognized as one of the most prestigious public-service awards programs in the country.

SBA Emergency Response Self Appraisal

Federal agencies have an Executive Order mandating that certain essential functions must be maintained in all situations, including natural or man-made disasters and any form of attack. Continuation of Operation (COOP) plans provide the details of how organizations will respond to such situations. In order for these plans to be effective, the agency must have many things in place to provide for the data, communication, personnel and infrastructure needed to maintain operations.

The US Small Business Administration (SBA) recognized the need to provide on-line surveys and assistance to its many field offices to help them determine their preparedness for a disaster. While there are many government documents on COOP preparedness, these are long, complex and difficult to use. The nature of the SBA field office structure is that they have many small offices spread across the country with limited staff. While the many SBA offices had COOP

responsibilities, very few had COOP experts that could make sure all the needed steps were in place – and learning after-the-fact that they had not been ready, was not an option. In addition, multiple senior managers in each organization had individual COOP responsibilities that they had to individually assess.
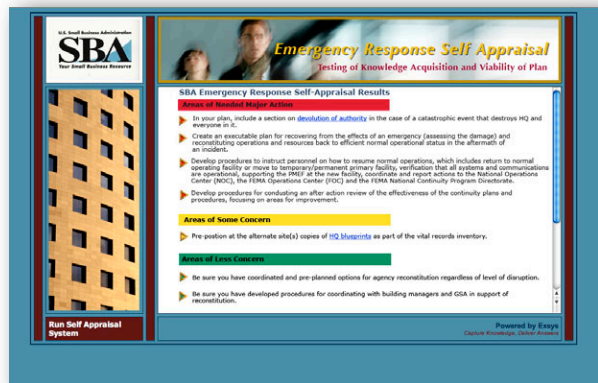
To solve this, SBA developed a COOP expert system using Exsys Corvid to provide advice on how well an organization had met their COOP responsibilities and steps they should take to be prepared. Exsys Corvid made it easy to field this online as an intelligent questionnaire, asking only relevant questions per the individual's situation. System access is via any web browser just by going to the correct URL. The system provides situation specific advice tailored to the individual organization, along with links to other relevant online SBA COOP resources.

The online interaction with the Corvid system matches the interaction someone would have discussing their COOP preparedness with a SBA COOP expert. This is because the system rules are based on the expert COOP knowledge of Jim Van Wert, SBA's COOP authority. The rules in the system match the approach Jim uses in assessing an organization's preparedness. The implementation of the rules and system user interface was developed by Exsys Inc, and fielded with Exsys Corvid Servlet Runtime to provide a complex HTML based interface that could be run on both PCs and mobile devices including iPhones and iPads. The online system allows the staff in all the SBA filed offices to quickly, easily check that they have met their mandated responsibilities and proactively take any required actions.

## California State Water Resources Control Board Environmental Compliance

The Board requires that all funded monitoring projects have acceptable Quality Assurance Project Plans (QAPPs) based on U.S. EPA's format and criteria. To meet this requirement, the California EPA used Exsys Corvid® to develop an environmental monitoring knowledge automation system for its Surface Water Ambient Monitoring Program (SWAMP).

The SWAMP Advisor system assists grant applicants through the process of writing an acceptable QAPP. The system is capable of addressing multiple lines of inquiry (or problem statements/objectives). Many monitoring projects have more than one line of inquiry. For example, they may plan to monitor water characteristics such as pH, turbidity, temperature, etc. using real-time field measurements; and also collect water samples for analysis of pesticides, PCBs, metals, or E. coli, etc. for laboratory analyses.

Each line of inquiry requires different Measurement Quality Objectives (MQOs) and uses very different sampling and analytical techniques with completely different performance criteria. The SWAMP Advisor "cycles through" applicable elements of a QAPP and analyzes them individually. There is no limit to the number of lines of inquiry that a project may have and still be addressed by the SWAMP Advisor.

The system provides 3 levels of capability: (1) a top/executive level with brief answers, (2) an educational level with in-depth information, and (3) a research level with links to other documents, slide shows, forms, and Internet sites. The system can also use Vocal Explanations. A tab is provided to indicate that an audio explanation is available for the specific segment of the system. The advantage is that sometimes verbal explanations are better and more effective than providing the same information that has to be read. This reduces some explanations that may require lots of text. The user's browser loads the audio file, and then a program such as QuickTime or RealPlayer will play the audio file.

One significant feature in the performance of the SWAMP Advisor is Corvid's ability to write a project-specific QAPP of up to 24 chapters. The draft QAPP sections are sent from California EPA's server to the user's personal computer in a rich text format. This allows easy editing by the user who can then save the final document in MS Word format.
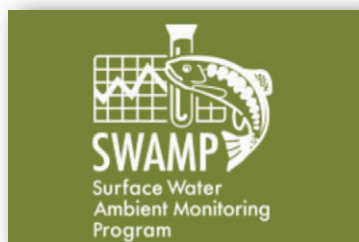
 Using Exsys Corvid, the SWAMP Advisor was constructed so that the information can be easily modified or customized to fit other state's requirements and objectives. Thus other states and/or organizations can leverage time and experience from the California system. Rather than "re-inventing the wheel," they can utilize resources wisely to customize similar advisors.

The software has been shown to write superior QAPPs that will save organizations the time and expense of making extensive edits and re-evaluating unacceptable QAPPs, while at the same time ensuring that all of EPA's and the organization's criteria are adequately addressed.

I-9 Employment Eligibility Verification Form Wizard

The SBA's I-9 Eligibility Verification system was created to help companies fill out an I-9 form for foreign workers. This is a form that verifies that each worker has the correct documents and credentials to work in the US, and that the company has this information on file. This seems like a simple problem and one that should be able to be handled without an expert system. The form is not long or complicated and has reasonably clear instructions. However, it applies to millions of workers and, in practice, many errors are made in understanding and filling out the form.

One of the goals of the system was to produce a completed I-9 form in PDF format that could be printed, signed and filed. Generating a form is not a logical decision, but rather a procedural operation. Purely procedural functions can be

done using an expert system inference engine, but they are not the normal mode of operation, which is more oriented toward logical processes. However, within the procedural operations were logical ones. For example, the correct documentation must be supplied and verified. In some cases, combinations of items are required. If the documentation is not correct, the employee needs to produce an alternative. In addition, before the system even starts to fill out a form, a determination has to be made if the form is necessary. This is based on if the worker is an "employee" or "contractor". For many workers this is a straightforward determination, but that is not always the case and the Exsys Corvid system can lead the employer through the steps to make the determination.

In addition, the I-9 system makes a special point of providing a detailed explanation of its steps. Most questions have an explanation box that educates the user about that part of the regulation. This can be used to help the user understand the questions, or better understand why this fact is important in the system. Since the explanation is associated with the question, it is only displayed if the logic of the system requires the question to be asked.

Using an Exsys Corvid expert system for the procedural steps allowed the logical portions and explanations to be easily added. Using other approaches, such as HTML forms and Java script, while perhaps suitable for the procedural part, would not have allowed the logical portions to be added easily and seamlessly. In the end, the

Exsys Corvid expert system approach was the best option to handle the overall problem. As with the Visa Classification system, the fact that the system rules can be easily read simplified the review and approval process.

Even though the process of filling out the I-9 is not difficult and could be solved with "information", delivering it via an Exsys Corvid expert system makes it far easier and more foolproof. The employer does not have to follow written instructions - which have proven to be prone to errors, misunderstanding or just ignored. Employers simply open a Web page, answers a few questions, and the completed form is printed out – all that's needed is a signature. Building this system was more complicated than the Visa system, but this was largely due to the procedural operations clarification by the expert, and the need to build a completed I-9 form in PDF format. The system was still built quickly and at low cost. It would have cost as much, or more, to build a Web-based solution using non-expert system techniques, which might have provided the procedural completion of the I-9 form, but without logical validation or analysis of the need for the form in the first place.

Nestle Foods Corporation Pension Fund Advisor

Nestle Foods developed a knowledge automation system which provides information on an employee's pension fund status. The corporation made certain modifications to the original pension fund plans to bring it into conformance with new standards. Understandably, these changes created a considerable amount of confusion for the participants as well as additional work for the personnel departments fielding questions from all concerned.

This knowledge automation system is not intended to be the official pension "calculator", but rather a means of giving participants the ability to conduct private sessions with a pension fund expert advisor and ask "What-Ifs". By providing

access to this system by all of the personnel departments, a participant may become far more confident in personal financial planning decisions and the personnel department may focus on other pressing issues.

They have also built Smart Questionnaires, which produce customized contracts to meet environmental compliance. The system results deliver PDF reports ready for completion and signatures.

Sandia National Laboratory - Interactive Technology Distribution System (ITDS), Materials and Process Characterization Questionnaire (MPC)

An Innovations in American Government Award Winner, the ITDS/MPC is an expert system designed to perform environment, safety and health (ES&H) regulatory compliance assessments of manufacturing processes. Users respond to a series of questions posed by the knowledgebase. Based on user input, the MPC result is a listing of applicable regulatory references, some brief explanation, and a relative priority ranking of issues identified. This output may be general to very specific depending on the user input. The MPC is distributed to users on disk, and upon completion, users return data files for uploading into the Interactive Technology Distribution System, ITDS database. The ITDS contains more detailed information about materials and processes. The interaction of the MPC (containing the user profile) and the ITDS results in a far more comprehensive analysis of the users' compliance condition including references and resources to correct compliance deficits. Solutions currently offered by the ITDS include process and material alternatives, compliance program templates, pollution prevention and waste minimization strategies, safe operating procedures, and material attributes such as physical properties. The ITDS is used to monitor user profiles over time to report the impact of changing and new ES&H regulations.

The expert system differs from commercially available regulatory databases in several important ways. It is designed for users not familiar with ES&H regulatory compliance issues linked to materials and processes. The user is not asked to make any determination of "hazard".

Individuals not familiar with ES&H regulations very often use subjective criteria when making a "hazard" determination. The MPC/ITDS makes hazard determinations for the user based on expert regulatory criteria. These features help ensure that relevant regulatory compliance issues are considered and addressed by each individual user. Getting from materials and processes to regulatory compliance issues frequently requires some professional judgment and interpretation. This expertise and analysis ability is contained in the system.

The ITDS/MPC is both a Performance System and a Model. As a Performance System, the ITDS/MPC teaches the user about regulatory compliance issues. The MPC may be used to model changes in regulatory compliance issues with changes or additions of new materials and processes. The ITDS/MPC is a tool to assist the user in determining compliance requirements, prioritizing those issues and solving compliance problems. It is a training tool, which teaches the user to think in terms of their regulatory compliance obligations. This tool may not address all detailed facility or process specific compliance issues, but will train the user on when and how to seek more information as appropriate. This tool will be most useful to organizations without access to Environmental, Safety and Health professionals. The ITDS operates in a Windows environment, and may be networked for broad access within an organization.

Conclusion

Knowledge automation technology is a proven and highly effective way to implement compliance regulations in a way that vastly simplifies the process of compliance and helps to insure that all requirements are met correctly and fully. The systems can provide anything from simple advice to fully completed forms and documentation.

It is much better to deliver knowledge rather than just information. It takes less time and expense to build an Exsys Corvid expert system that delivers knowledge, than to build an effective Web-based "Information only" system, which will actually deliver adequate information.

There are many proven benefits to using this technology:

- Exsys Corvid expert systems have a high R.O.I. - both in terms of improving user efficiency and reducing errors. Regulatory compliance expert systems provide the public with the answers they need to comply with the law and help to implement the policies that underlie the regulations.

- Using Exsys Corvid expert systems, both internally and externally, allows new or changed regulations to be rapidly disseminated without re-training.

- Using Exsys Corvid expert systems allows the public to get the answers they need in the fastest most effective way.

- Once a system is fielded it is available 24/7, has minimal maintenance costs and is highly scalable.

If you build them, they will come. The public and your employees want answers - not data. Once they find a Web site that can quickly and reliably answer their questions, they will use it.

Contact Exsys today to discuss your Compliance Knowledge Automation initiatives. We'd be happy to set up a web conference to build a live demo of the system you have in mind.