CREATION OF A NEW MOBILE INSPECTION AND MONITORING SYSTEM

2005 COMPUTERWORLD HONORS CASE STUDY

ENVIRONMENT, ENERGY & AGRICULTURE

BROWARD COUNTY REPLACED A PAPER-BASED INSPECTION ENVIRONMENTAL INSPECTION PROCESS WITH AN E-INSPECTION PROCESS. FIELD INSPECTIONS ARE NOW AUTOMATICALLY SCHEDULED AND COMPLETED USING ELECTRONIC MEDIA, MOBILE AND HOME-BASED OFFICES, AND THE INSPECTION DATABASE ELECTRONICALLY POPULATED IN NEAR REAL-TIME AND MADE AVAILABLE TO ALL EPD STAFF. **[20055317]**

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SUMMARY

The Broward County Environmental Protection Department (EPD) replaced a paper-based inspection process with an e-inspection process, whereby field inspections are now automatically scheduled and completed using electronic media, mobile and home-based offices, and the inspection database electronically populated in near real-time and made available to all EPD staff.

APPLICATION

CONTEXT

The Pollution Prevention and Remediation Division (PPRD) of the Broward County Environmental Protection Department (EPD) is a county-level regulatory organization in Broward County, Florida. PPRD has regulatory oversight over nine diverse programs covering approximately 7,000 facilities, ranging from underground storage tanks to solid waste facilities. A fundamental element of work for all the programs is field inspections.

To complete field inspections, while in the field inspectors would record the results of a given inspection on one of multiple types of field inspection forms (depending on the type of inspection), film photographs were taken, and site diagrams completed. Back in the office, film was delivered for development, the inspection results transferred to into a non-intuitive "green screen" database, and finally all records filed in a central filing room.

GOALS

The Broward County Board of County Commissioners established a goal to improve Broward County services through e-initiatives. With this goal as a mandate, PPRD planned the Mobile Inspection and Monitoring System around six goals.

1. Improve the quality of product delivered to the customer. Provide customers with an original quality copy of a standard inspection form with typed, easily readable notes and copies of any photographs and site diagrams created during the inspection.

2. Improve the efficiency of PPRD's inspection workflow, completing a higher number of inspections with greater quality and less variability. Provide automatic inspection scheduling. Automatically populate the inspection database. Eliminate inspector travel time to and from the office and down time related in film development and hand data entry.

3. Improve the availability of inspection information. Provide close to real-time availability of all inspections to all EPD staff such that the inspections, photographs, and site diagrams are easily and intuitively retrievable. Consolidate multiple database formats.

4. Improve inspection monitoring. Improve the tracking of inspection completion, enforcement resulting from inspections, and licensing of PPRD's regulated community.

5. Encourage staff to develop personal computer skills.

METHODS AND SCOPE

Software products supporting the e-inspection initiative included Computronix's POSSE/RANGER/STAGE/OUTRIDER suite of products, a type of middleware that overlays an Oracle database and used to develop EPD's new licensing and inspection database; Sybase's SQL Adaptive Server Anywhere product, a database management system that supports mobile computing and permits synchronization with the main POSSE database; and InfoMaker, a report writing tool; and a full suite of PC application software for inspector laptops. (These acquisitions and their subsequent configurations supported all of EPD's programs, not just PPRD.)
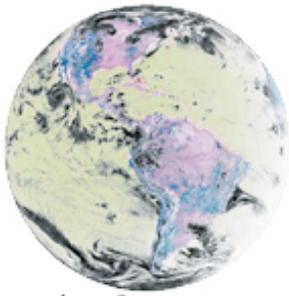
Hardware products supporting the e-inspection initiative included Panasonic CF-18 laptops, Pentax Optio S digital cameras, HP 450 mobile printers, and installation of DSL connections at all inspector's homes that permitted synchronization of the RANGER mobile databases with the EPD's main POSSE database.

EPD elected to limit the initial scope of the e-inspection initiative to two of PPRD's programs, including that program with the largest number of inspectors (nine) as the first to be moved onto the new POSSE system. (With the success of this initial implementation, EPD is currently working on implementing the e-inspection process for all EPD inspectors.) Using STAGE (POSSE's configuration tool), the workflow of both programs was configured to include one inspection process. Computronix personnel completed this initial configuration. Concurrent with this configuration, key EPD staff received training on POSSE, STAGE configuration, RANGER, and InfoMaker.

Once the first version of the POSSE database was configured, and with close support for key EPD staff, data conversion from the legacy system to POSSE was completed and the initial programs made to live approximately one year after Computronix was awarded the bid.

At this time, PPRD staff began the process of fully configuring the inspection process. It is this process that is passed between POSSE and RANGER (on the inspectors' laptops). Configuration work included development of all possible deficiencies of Broward County's code in check box format; text fields for comments; tabs to permit inspectors to create inventories of all hazardous materials at facilities being inspected; tabs for electronic photographs and site diagrams; tabs for completed inspection reports; the configuration of a licensing non-compliance notice, which automatically generated a field citation for customers when applicable; and a mechanism to capture customer signatures digitally, which eventually evolved to customers signing the CF-18 touch screens, capturing the signature as a bitmap, and configuring ranger reports to automatically incorporate the signature into the appropriate location on the report.

Occurring concurrently with the detailed configuration of the inspection process was in-house inspector training on the new system and hardware. In general, PPRD inspectors had only limited experience using computers. The training consisted of first teaching the inspectors to use the new hardware and software. Then, for a period of six months, inspectors were required to only access their schedules off the RANGER application on their laptops. This permitted sufficient time for inspector staff to familiarize themselves with the equipment and synchronization process without impacting inspection throughput.

After this six month initiation period, the inspection process was fully configured and inspectors were required to cease with paper inspections and complete all inspections electronically. Inspectors now enter all inspection results in the field, with heavy use of checkboxes as appropriate. Photographs are taken with digital cameras and imported onto the inspection process. Site diagrams are completed in PowerPoint and again imported onto the inspection process. Upon completion of the inspection, inspectors then generate an inspection report in PDF format, a copy of which is printed and given to the customer. Should a follow up inspection be required, the inspectors can automatically schedule that inspection. Upon completing the day's inspections, inspectors return to their homes and synchronize with the EPD POSSE database using their DSL connections. Once synced, all EPD staff has access to inspection results, including a copy of the inspection results actually provided to the customer. Finally, specific requests to inspectors can be communicated through the inspection process so that a given inspector, upon completing an inspection, has ready and convenient access to any specific facility information deemed relevant by management staff.

ACHIEVEMENTS
1. Average quality of inspections has increased (from 50% error free rate for one inspection type to 92% error free rate).
2. Average quantity of inspections has increased (from 2.5 inspections per inspector per day to 2.9).
3. The customer's receive a professionally formatted and legible inspection document.
4. The public can view a facility's inspection history over the WEB.
5. Multiple, static paper-based inspection forms have been replaced with one electronic, easily configurable inspection form.
6. Management staff can now access management and executive reports built on almost real time data (less than 24-hours old).
7. Desired changes in the inspection form format can be implemented immediately among all inspectors.
8. Alerts can be issued to all inspectors and prominently displayed on the inspection process to facility resolution of specific performance or field problems.
9. Inspection processes can be configured with mandatory fields (the inspection process cannot be completed until the field is completed), assisting in collection of specific information and helping to remind inspectors of specific inspection related tasks to be completed while in the field.
10. Inspections are now configured into the Licensing workflow, permitting all EPD staff to easily view the

inspection status of any facility, drilling down to the actual inspection report handed out on-site if so desired.

11. Within the boundaries of the initial implementation at EPD, all paper based inspections have been eliminated.

12. All film photography has been eliminated.

13. A significant first step to connecting field staff to all program areas within EPD has been completed.

14. To-date, at least three other Broward County Departments have adopted POSSE/RANGER, portending significant improvement in communication between these Departments and their field staff.

15. The State of Florida Bureau of Petroleum Storage Systems, who contributed to the development of Broward County's e-inspection initiative, has conceptually adopted the initiative and is currently developing their own similar system (labeled FIRST), to be deployed State-wide in support of Florida's storage tank inspection program.

16. Waste associated with outdated, preprinted inspection forms has been eliminated.

17. An electronic library of regulatory information, education brochures, and so forth has replaced the need to maintain a separate paper based library of these materials and eliminated the waste of disposing of outdated materials.

18. All field staff have developed a considerable PC skill set.

BENEFITS

• Has your project helped those it was designed to help?

Public. The public now receives inspection results in a legible, professional format and the public can access inspection results on-line.

Inspectors. Inspectors now have only one inspection form that has been configured to facilitate ease of completion, regardless the type of inspection they are completing. All pertinent regulatory cites for any given regulatory deficiency are related to that deficiency, assisting the inspector in identifying the specific regulatory language supporting a given deficiency. Inspectors are no longer required to transport numerous copies of brochures and educational pamphlets. Instead, these materials are provided in an electronic library conveniently hyperlinked to the appropriate area on the electronic inspection form. Inspectors are no longer required to wade through reams of green bar to identify their scheduled inspections. Instead, the inspection schedule is conveniently made available on a single electronic list, storable by a number of variables. Rather than hand-write inspection notes, often difficult to complete legibly in field conditions, inspectors can now type all comments.

EPD Staff. EPD staff can now access all inspection results from their desktops, no longer making requests to the file room and waiting until files are pulled. EPD staff can review the inspection history and on-going status for any facility from their desktops. EPD staff, regardless what program they may belong to, can communicate alerts and other information to inspection staff via the inspection process. EPD staff can view all site photographs and diagrams from their desktops.

Management. Management has immediate and easy access to knowledge-based reports drawn directly from the inspection database with data no more than 24-hours old. Management can easily assign inspections from their desktops, communicating those reassignments to field staff each time the staff synchronizes their laptops.

• In your opinion, how has it affected them? Mostly positive. Customers remark on the quality of the inspection report (some indicating it was the first time they could understand everything on the document). Customers are able to view licensing status and inspection results on the WEB. Inspectors were able to adapt to a challenge, observe improvement in their output, and be part of a progressive project. EPD staff were able to improving their tracking of inspections, significantly improve the QA/QC of those inspections, integrate the workflow of their individual programs with the inspector via the inspection process, accessible to both field and office staff. Management is now easily able to access management and executive reports, assisting in the allocation of limited inspector resources. The primary negative affect is unavailability to keep up with demand of all staff to improve the system through reconfiguration.

• What new advantage or opportunity does your project provide to people? Besides those discussed in items 1 and 2 above, the e-inspection and POSSE, provide EPD with a mechanism to connect all Divisions within EPD on a single database. As the general interface to POSSE for any Division is built with the same building blocks (primarily, different kinds of tabs), a user in one Division can readily navigate the details any other Division's information. (For example, Biological Resources can easily assess the status of a PPRD license or inspection, and so forth.) Additionally, any one Division can build into the main POSSE database workflow that automatically crosses functional lines. (For example, if an inspector notes a potential contamination issue, the Cleanup program can automatically be notified.) The success of the program to-date has resulted in POSSE being adopted by at least three other Broward County departments with additional implementations anticipated. Also, the State of Florida Bureau of Petroleum Storage Tank Systems has reviewed the e-inspection process and is currently devising their own similar system, which they have named FIRST, to be used State-wide for their storage tank inspection program.

• Has your project fundamentally changed how tasks are performed? All tasks are now recorded as steps within a workflow created within POSSE jobs. For example, the issuance of a hazardous material license

includes a number of steps which are completed by staff in various divisions within the Department. Within POSSE, a hazardous material license job was created, consisting of all the steps – or, in POSSE language, processes -- to complete that job. Each process is a task that is automatically assigned to the appropriate staff. Each day, staff can check their to-do lists to review all outstanding tasks. Supervisors, by accessing tasks in a variety of different ways, can ascertain work completed by any staff person within a given time frame, that current workload status of staff, and a variety of other performance measures. Additionally, since staff are constantly reminded of tasks to be done via their to-do lists, work does not get lost or forgotten about. Finally, in general the handling of tasks by POSSE tends to push work through the entire system (someone is always being reminded of the next task to be completed on a particular job), rather than staff having to mine the database system to assess upcoming tasks and their general workload.

• How might that change unfold? This issue is discussed in some detail in the general comments, above.

• Does your work define new challenges for society? If so, please describe what you believe they may be. The intent of the mobile inspection and monitoring system is to resolve existing societal challenges rather than introduce new ones. The system affects two such challenges. First, it is a more efficient and effective means of collecting environmental data – thus, a more responsible stewardship of public funds. Second, the system improves public access to knowledge about the environmental status of properties in Broward County – assisting members of the public in identifying environmental risks associated with a given property, aiding in routine societal transactions like property transfers and drinking water protection.

Project provides for better environmental protection through the use of effective, efficient, consolidated and common systems.

IMPORTANCE

Information technology was a critical factor in every aspect of the project right from the beginning of development.

Our agency's office is in Fort Lauderdale, Florida while our POSSE vendor, Computronix is in Edmonton, Canada. While they worked on-site during some of the initial development, much of the work was done remotely. The ability to connect to remote locations over internet VPN connections and to transfer files via FTP allowed for remote development. This activity continues today as new programs are brought into POSSE.

Information technology has given us the ability to do remote inspections in the field using Ranger. The configurability of POSSE and Ranger allows POSSE data pertinent to inspections to be selectively uploaded to Ranger. Uploads of this selected data can be full or incremental, eliminating unnecessary sync times. Through secure VPN connections to our POSSE database, inspectors work from home, which benefits EPD and the inspector:

• Benefits to the inspector:
? Eliminates travel time to and from the office
? Work independently
• Benefits to EPD
? Eliminates EPD provision of county office (vehicle is office)
? Reduced mileage on county vehicles
? Electronic inspections created in field do not require filing
? Electronic inspections created in field replace paper hand-written inspections do not require separate data-entry
? Electronic inspections can be viewed concurrently by POSSE users from their desktops

The rapid application development aspects of POSSE and Ranger, their ability integrate InfoMaker reports and both products' ability to integrate photos and various file formats allowed the mobile inspection team manager to create custom inspections, to include:

• Inspection reports contains either county or state logos, depending on the type of inspection, contact signatures, inspection photos and detailed comments
• A complete inspection report is provided to the facility contact at the time of the inspection and also saved as a PDF and upon syncing, moved into the primary database, allowing all EPD staff to view inspection data to the detail of the actual inspection customer deliverable
• Inspection jobs are automatically generated, assigned and tracked based on procedures created by management staff
• Electronic inspection reports prompt the inspector for key information, reducing the potential for inspector oversights
• Found deficiencies automatically triggers a field enforcement notice, reducing rework and staff time back in the office

ORIGINALITY

The development of the mobile inspection program has resulted in a number of speaking requests at state and national conferences. To date, no similar system, developed to the extent of Broward County's mobile inspection program, has been located. In terms of the maturity of such a mobile inspection system, the program appears to be if not original, at least rare.

A second original aspect of the project is that applications are developed by users in a rapid application development environment. Applications evolve as business processes dictate and are developed by managers directly responsible for program management and implementation. It is not uncommon that such development occurs with software tools such as Excel spreadsheets or other similar PC software applications. However, with the mobile inspection program, this user development is occurring within a sophisticated, relational database environment shared by all users within the Environmental Protection Department.

SUCCESS

The project has achieved its original goal of handling remote inspections integrated with a licensing and enforcement program. Further it has exceeded expectations by becoming the standard for other licensing and permitting programs throughout EPD and at other Broward County Departments. Its success is also demonstrated by the Broward County Board of County Commissioners recognizing POSSE/RANGER as a sole source provider for inspection, licensing, and permitting software within Broward County – in the public sector world a significant accomplishment.

Specific elements of the success of the program, which generally took 18 months to implement fully, include an increase in the average inspections per day per inspector of approximately 30%, a significantly improved customer deliverable, almost real-time availability of inspector results to all EPD personnel via the POSSE/RANGER system and to the public via the WEB, improved inventory of hazardous materials in Broward County, reduction in paper of film photography waste, and reduced need for inspectors to travel Broward County roads (inspectors remain in their zones, typically close to their homes, instead of having to travel back and forth to the office each day).

Plans for the future include converting the remainder of EPD inspectors to the mobile inspection program with inspections configuring to meet their programs' specific needs, use of wireless connectivity to replace the inspectors DSL connections (edge card technology is currently being piloted), and finally the integration of GIS with POSSE through use of POSSE Map Objects, objects designed to work with GIS layers.

DIFFICULTY

Generally, conceptual approval of the mobile inspection program was readily given by senior management, in no small part because the program was consistent with the Broward County Board of County Commissioner's goal of improving customer service through e-government initiatives. Also, all the advantages that have been discussed throughout this application were obvious (more inspections occurring because inspectors did not have to travel from the office to the field everyday, replacement of hand written inspection forms with work processed forms, and so forth) and appealed to management.

The largest difficulty of the program was and continues to be personnel resource to complete configuration work, both tweaking existing configuration and implementing new configuration. The strategy from the inception of the program was to phase in POSSE/RANGER a Division or two at a time, depending heavily on Computronix for initial configuration work. Concurrent with the first implementation, configuration training was provided to several of EPD's and Broward County's Office of Information Technology staff. The plan was that as early Divisions came on-line, Computronix could mentor EPD and OIT staff, and as more of EPD's Division's came on-line, the responsibility for configuration would slowly transition to EPD and OIT staff.

In reality, many of EPD personnel receiving the training did not progress to become competent configuration staff. In part this was because of the substantial time required to become skilled in configuration. In part, it was because some of the staff trained simply did not do well in the configuration environment. Certain EPD staff did develop a significant skill level and those Divisions with that staff developed POSSE/RANGER implementations faster and with more functionality than did those Divisions without staff with developed configuration skills.

In any case, as more of EPD's business was transferred to POSSE/RANGER and EPD's experience with the program developed, the demand for configuration skills dramatically increased. Even with trained EPD staff, trained OIT staff, and an on-going mentoring contract that provides one Computronix staff on-site, the biggest

challenge on POSSE/RANGER continues to be finding the resources necessary to meet the ever growing demand for configuration work.