

EarthSoft and ALS Provide Advanced Integration of EDMS and LIMS for bp



A Complete Digital Workflow Case Study

– By Ruth Callaghan, Alek Hage (EarthSoft); Phillip Kennedy, Lee Western (ALS); and Linda Chapman (bp)



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EarthSoft and ALS have collaborated for years to assist shared clients and the environmental management sector in general to improve environmental data management processes and practices. This case study elaborates on the data challenges faced by bp and the environmental industry, and the digital workflow implemented by EarthSoft and ALS to solve these challenges.

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The EQUIS leader for bp referred to the EarthSoft and ALS work as “a **game-changer**” for large corporate digital lab deliverable programs.



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The Challenge

Many environmental laboratories and consultants have manual workflows to collect and manage environmental sample data. These workflows are often not completely digital, with gaps requiring manual steps to digitize the data and capture the data in a Laboratory Information Management System (LIMS) and/or Environmental Data Management System (EDMS). With a variety of LIMS and EDMS choices available in the marketplace, there did not appear to be enough of a market to fund the necessary effort to completely integrate the software between a given LIMS and EDMS to realize the benefits. The manual workflows and system gaps remained in place for years and even though multiple organizations designed solutions, these solutions were never finished and brought to market or commercialized. Since the same situation existed across the environmental industry, organizations did not rush to bring automated workflows and digital integration to market.

And so therefore, in 2023, an estimated 95% of Chains of Custody (CoC) records in Australia are still paper based. (We do not consider a PDF file of a hard-copy COC to be digital data.) Some regulatory agencies require the creation and use of paper based COCs; however, these requirements do not preclude use of digital COCs.

Due to the increase in the volume of available data we have witnessed over time and a growing dependency on our data-driven culture, organizations are transforming business processes to continue market success. Environmental data are increasingly recognized as a business asset that must be managed and governed. Common drivers to increase data governance include:

- **Business Agility** – Make data-driven decisions and recommendations faster with increased efficiency and accuracy.
- **Lower Costs / Operational Efficiency** – Streamline workflows and automate data-related business processes.
- **Risk Management / Compliance and Security** – Define data standards, policies, and processes with clear roles and responsibilities to ensure compliance with internal and external policies and regulations.
- **Improve Data Quality** – Ensure data are accurate, complete, timely, relevant for a given use, and consistent with all requirements.
- **Sustainability** of the organization's data investments.

Data governance calls for implementation of automated workflows wherever possible to achieve business goals. Integration of an EDMS and a LIMS in an environmental data workflow brings multiple, significant benefits including improved data quality and increased productivity. If CoCs are created electronically (eCoCs), then software can generate, check, secure, audit, certify, and “unpack” the eCoCs to load into a LIMS or EDMS. This significantly improves quality and productivity, without additional staff.

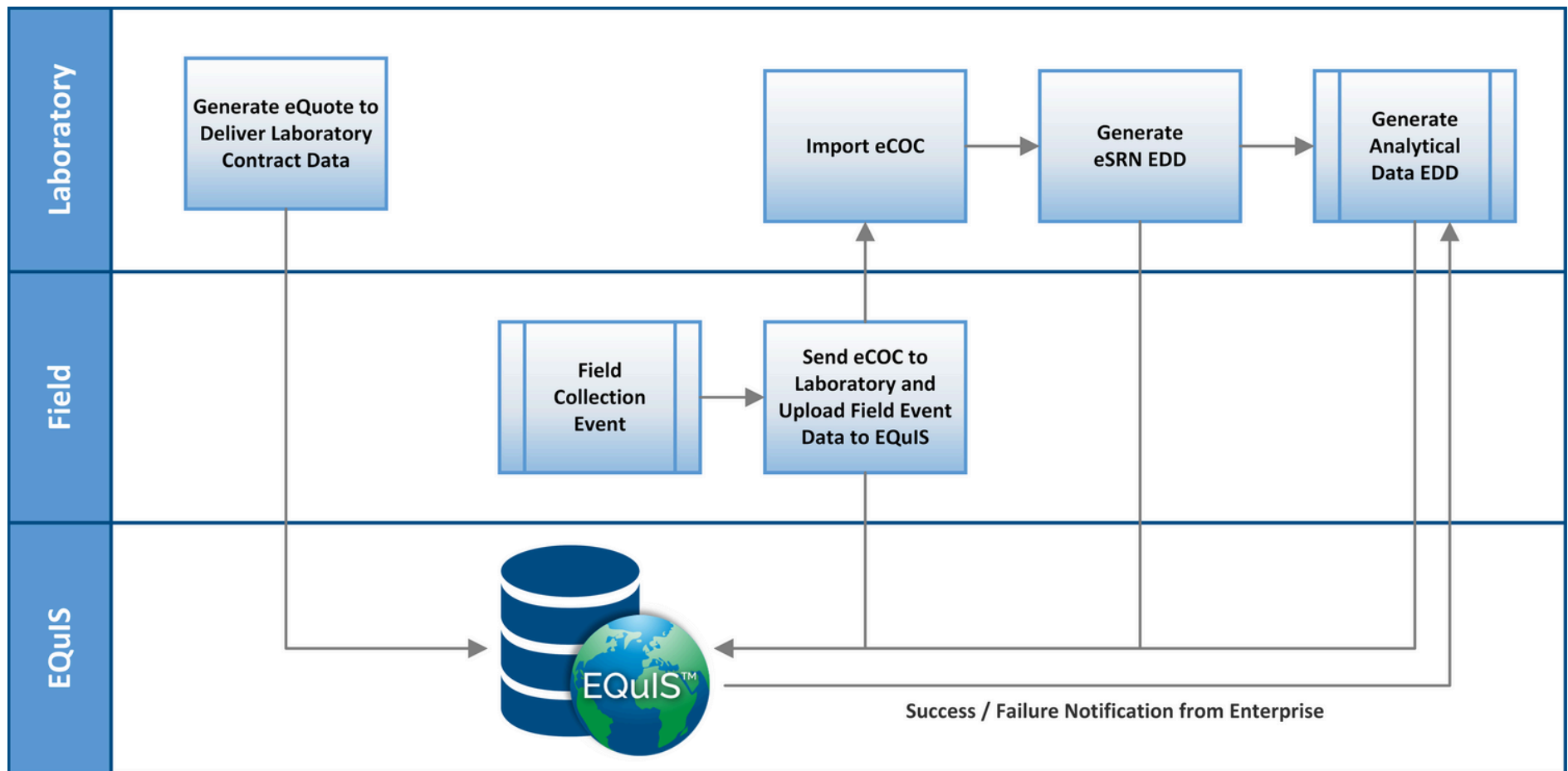
Questions like
“Is this sample ID a l or 1?
O or 0? 5 or S?”
would be problems of the
past if manual, handwritten
COCs are replaced or
supplemented with eCOCs.

The Solution – A Complete Digital Workflow

EarthSoft and ALS commenced discussions several years ago to make the analytical sampling workflow fully digital and collaborated to successfully integrate the data between ALS’ Global Environmental LIMS (GEL) and EarthSoft’s EQUIS™ environmental data management software. With each exchange of data between systems, data are checked to ensure system requirements are met.

Several electronic touch points occur in an analytical workflow between a sampling company that uses EQUIS and an environmental laboratory.

Figure 1. EQUIS Digital Workflow



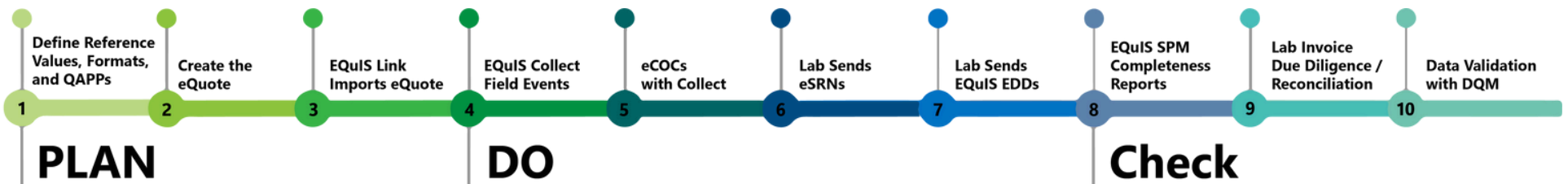
- The **eQuote**: After project analytical requirements are communicated to the laboratory, the laboratory generates an electronic quote (eQuote). The eQuote contains the list of methods, analytes, units, containers, and method groups. These data are then uploaded to EQUIS and used for sample planning purposes using the EQUIS Sample Planning Module (SPM).
- The **eCOC**: After collection of samples in the field, an electronic Chain of Custody record is generated using EQUIS Collect and submitted to the laboratory for upload to their LIMS. Digital data transactions are checked and confirmed prior to the receipt of the physical samples.
EQUIS digital eCoCs offer a single commercially available format that is laboratory agnostic. The eCoCs are pre-populated prior to personnel going out in the field and are digitally transmitted to EQUIS and/or the project laboratory after sample collection is completed. Where regulations allow, paper versions of the eCOC are eliminated.
- The **eSRN**: After receipt of the samples at the laboratory, the laboratory generates an electronic sample receipt notification (eSRN) that lists the samples received, analysis registered, and documents any receipt issues. The eSRN is uploaded to EQUIS and a report generated comparing the data from the eCOC.
- The **EDD**: Following sample preparation and analysis, the laboratory creates an electronic data deliverable (EDD) and submits this file to EQUIS. EQUIS checks this EDD for correctness and provides detailed information on the EDD.

The digital workflow discussed above highlights the digital exchanges occurring between a sampling company and a laboratory, which are part of a bigger 10-step analytical data workflow (see Figure 2). Workflows are designed to increase productivity and efficiencies. Organizations will have workflows based upon their own business goals. The high-level analytical data workflow in Figure 2 is based upon the data governance principles of availability and quality.

Principle of **Availability** – Data need to be available at the right time or frequency and in the prescribed format to all authorized EQUIS users as efficiently as possible and without disruption.

Principle of **Quality** – Standards and controls maintain the quality of the information, and governance processes and tools assure that data are fit for use.

Figure 2. EQUIS Analytical Data Workflow



The Plan, Do, Check, and Act Project Model

The EQulS analytical data workflow components can be grouped into Plan-Do-Check steps. Once these steps are completed for a project, an organization has actionable information for better decisions. The following describes the steps of the EQulS analytical data workflow in Figure 2.

The Plan Steps

- 1) Define EQulS Reference Values, Formats, and QAPPs** – The digital workflow assumes that reference values and EQulS format requirements have been discussed and agreed upon between the field consultant and the laboratory. Configuration of the Data Qualification Module (DQM) and Quality Assurance Project Plan (QAPP) should be completed prior to receipt of the analytical data and evaluation of the data using DQM.
- 2) Create the eQuote** – This step is the first of the electronic touch points. After project analytical requirements are communicated to the laboratory, the laboratory generates an eQuote. The eQuote contains the list of methods, analytes, units, containers, method groups, and cost information. These data are uploaded to EQulS and used for sample planning purposes with the EQulS Sample Planning Module.
- 3) EQulS Link Imports eQuotes and Creates Lab Contract** – Upon receipt of the eQuote from the laboratory, EQulS Link imports the eQuote files using the eQuote Format and automatically creates the Sample Planning Module Lab Contract based upon the data contained in the eQuote.

The Do Steps

- 4) Field Data and Sample Collection** – The field events are scheduled using EQulS SPM. Field samplers go to the field, collect the samples and the required field data using EQulS Collect software.
- 5) Creation of Electronic Chain-of-Custody Records with Collect** – This is the second of the electronic touch points. After collection of samples in the field, an electronic Chain of Custody record can be generated using EQulS Collect and submitted to the laboratory for upload to their LIMS.
- 6) Laboratory Sends Electronic Sample Receipt Notification** – This is the third of the electronic touch points. After receipt of the samples at the laboratory, the laboratory generates an electronic sample receipt notification (eSRN) listing the received samples, documenting any receipt issues. Sampling personnel can schedule resampling activities with EQulS SPM or take other needed actions based on any reported SRN issues.
- 7) Laboratory Sends EQulS EDDs** – This is the last of the electronic touch points. The laboratory submits the analytical electronic data deliverables (EDDs) to EQulS in the specified EQulS format.

The Plan, Do, Check, and Act Project Model (Continued)

The Check Steps

- 8) **EQUS Sample Planning Module Completeness Reports** – Once the field and analytical data have been uploaded to EQUS, a Completeness Report can be run to determine if any of the planned samples and activities are incomplete based upon the sampling and analysis plan in SPM. Investigations about any missing data may be required.
- 9) **Laboratory Invoice Due Diligence / Reconciliation** – A report compares the cost information in the laboratory contract in the Sample Planning Module to the cost information in the invoice once the laboratory has submitted their invoice data using the eSRN format. Project personnel can discuss any differences with the laboratory from any discrepancies.
- 10) **Data Validation with Data Qualification Module** – After receipt of analytical data, the data can be validated using the Data Qualification Module (DQM) to determine the usability of the reported analytical results as defined and configured in the project DQM QAPP.

After submittal and successful upload of the analytical EDD into EQUS, additional EQUS functionality can be used to report, visualize, and assess the reported data. Metrics can be generated to review if business and data governance goals were met.

An example metrics dashboard is provided for illustrative purposes only.

Figure 3. Sample Collection Metrics by Company



Digital Workflow Demonstrations

EarthSoft and ALS recently demonstrated an entirely digital sample workflow, from project planning to sample collection to analytical testing to reporting, with the EQiS and GEL software. The demonstration was conducted with bp, a large energy client in Australia, who confirmed that the digital workflow using EQiS and GEL offered significant, measurable cost savings. bp referred to the demonstrated benefits of the digital workflow as a “gamechanger.” This workflow offers substantial productivity gains while significantly and simultaneously increasing data quality.

Many of the **lessons learned** from the digital workflow demonstration were related to training and change management issues. In response to the issues encountered, the client reports:

- New users can usually submit correct eCOCs after watching a series of eight 7-minute videos.
- Most users correctly submitted data the very first time after the training.
- About 70 project managers were trained and it was deemed easy to learn.
- EQiS helps track labs and field crews, and therefore, improve performance in real time.
- A new way to use the EQiS Sample Planning Module to generate ad hoc sampling plans on-the-fly was developed.

A second demonstration of the digital workflow using EQiS and GEL is underway with a large mining client in Canada. We expect several clients will modify their workflows for the benefits gained by the integration.

While the individual components of the workflow are not new, the complete workflow integration delivers substantial new innovation and is the result of significant effort. The benefits of digital integration and workflow automation between LIMS and EDMS are substantial. EarthSoft will commercialize the work, initially cooperating with our Business Partners.

The benefits of the integrated workflow are substantial. EarthSoft has a Business Partner Program for Laboratories and invites other environmental laboratories to collaborate on creating similar workflows.

Benefits

Benefits reported by bp include:

- Use of the workflow decreased time in the field from ~4 hours per trip to ~2 hours per trip.
- Fridays were previously consumed with extensive data transcription tasks, which have been eliminated.
- eCoCs submitted within minutes of each other from site locations that are an hour apart are immediately questioned for confirmation.
- Sampling location IDs are always correct (e.g., there is only one MW3, and it is never called MW03, MW-3, or anything else).
- Reference values are all correct, with no errors.



Efficiencies



Quality

About the Authors



Ruth Callaghan is a Certified Environmental Analytical Chemist (CEAC) with more than 30 years of environmental analytical chemistry, quality assurance, and third-party data validation experience. Her technical competencies pertain to regulatory compliance with respect to data quality, developing data quality programs, developing analytical methods, data validation, data governance, and implementing the EQiS Data Qualification Module.

Alek Hage is a Professional Engineer, an EQiS Product Owner, and Vice-President of EarthSoft Canada, Inc. Alek has more than 20 years of experience working with public and private sector organizations to implement appropriate Information Technology solutions for environmental and geotechnical data management.



right solutions.
right partner.

Phillip Kennedy is an experienced operations and management professional working at ALS for over 25 years. He has extensive experience across 'digital' supporting the first global implementation of EQiS eCOC and eSRN in 2012. Recently, Phillip has collaborated with EarthSoft to improve uptake of digital tools. Phillip supports challenging integrations with clients transitioning to environmental data management systems.

Lee Western has been with ALS for over 25 years and held operational and technology roles across several divisions. Lee's digital journey began in 2006 working as a Support Analyst at ALS Software Development, progressing to Application Training, Software Testing, and Business Analysis. More recently, Lee has transitioned to a client facing role supporting client digital integrations to EDMS to maximize the value proposition of clients' digital strategy. Lee understands the importance of data governance and is a local leader in data management across Asia Pacific.

ALS discussed the digital workflow in their EnviroMail newsletters in [Australia](#) and in [Canada](#).



Linda Chapman has worked for bp for over 20 years in roles in both AsPac and the UK. Through her primary roles supporting environmental remediation teams and suppliers, Linda has developed a deep understanding of bp projects and data management processes. More recently, she has used her experience to roll out and lead the delivery of innovative digital and information management tools for bp in the AsPac region. Linda has a passion for knowledge management and ensuring that the digital systems and tools we embrace have strong data governance in place, are secure, and fit for purpose.

**Own the Workflow,
Make Better Decisions**

To learn more about how EQiS digital workflow solutions, contact one of our representatives today. Please write info@earthsoft.com or visit www.earthsoft.com for further information.

