



COMPLIANCE WITH E-REPORTING RULE

Category: Digital Experience: Agency/Program Solutions
State: Arizona
Project Dates: July 2021 – December 2025
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Executive Summary

To modernize Clean Water Act reporting in alignment with federal mandates, the Arizona Department of Environmental Quality (ADEQ) launched a strategic enterprise e-reporting initiative, successfully transitioning compliance workflows across more than 10 applications from a fragmented, paper-based ecosystem into a centralized digital platform. Leveraging a hybrid project management approach—combining rigid Waterfall governance for fiscal and deadline accountability with flexible Agile development waves and user-focused Kaizen events—we built a secure, cloud-scalable architecture featuring an intuitive "TurboTax-style" questionnaire interface. Despite facing critical technical and regulatory challenges, including severe federal CROMERR service latencies, complex mutable data mapping across 1,200 parameters, and external government shutdowns that threatened the December 21, 2025, compliance milestone, the project successfully insulated local businesses from backend instability. By replacing manual workflows with automated validations, pre-populated data fields, and proactive reminders, the platform has achieved an unprecedented 90% reduction in licensing cycle times and a 70% increase in on-time compliance rates, positioning Arizona as a top-performing state nationally for electronic reporting while maximizing long-term operational efficiency and environmental protection.

IDEA

The Problem & Opportunity – In October 2015, the U.S. Environmental Protection Agency (EPA) established the National Pollutant Discharge Elimination System (NPDES) Electronic Reporting Rule to modernize Clean Water Act reporting by shifting from a paper-based system to a digital one.

As a state regulatory agency, ADEQ is tasked with enforcing these mandates while upholding its mission to protect public health and the environment. However, environmental regulations are inherently complex, and navigating compliance can be a daunting, resource-intensive burden for local businesses. This challenge presents a distinct opportunity: by developing a centralized, intuitive e-reporting platform, we can transform a complex regulatory hurdle into a streamlined digital experience. The opportunity lies in bridging the gap between stringent federal compliance and user-friendly state enforcement.

Why It Matters – This project matters because it directly impacts both economic vitality and environmental preservation. For businesses, a streamlined system alleviates regulatory friction, reduces administrative overhead, and minimizes submission errors. For ADEQ, migrating away from manual, paper-based workflows drives significant cost and resource savings while maximizing operational efficiency. Ultimately, timely and accurate digital data transmission enhances environmental transparency, allowing the agency to detect, analyze, and respond to environmental risks faster and more effectively.

What Makes It Different – What sets this project apart is its comprehensive strategy to overcome deeply rooted technical, operational, and regulatory friction points. Rather than simply launching a superficial web form, this initiative directly tackled systemic architectural and cross-agency barriers, including:

- **Critical Performance & Stability Mitigation:** Enterprise e-reporting requires absolute system resilience. However, during development and production, the platform had to absorb severe external service instabilities. Specifically, significant slowness in the EPA's CROMERR service (particularly the SignAndStoreCor and downloadSignature services) saw response times occasionally exceed 255 seconds, triggering application timeouts and production failures. Furthermore, recurring external outages—such as JDBC connection issues, EPA Node instability interrupting data transfers for programs

like Biosolids, and unexpected "502 Bad Gateway" errors—frequently threatened to block customers from certifying account requests or submitting permits. The project team engineered robust error-handling protocols to buffer these volatile service drops.

- **Massive Data Integration & Mapping Complexity:** Mapping data accurately to federal systems is a monumental data-engineering task. The NPDES e-Reporting project required analyzing approximately 1,200 unique data points across 14 distinct permit types to ensure perfect structural alignment with the EPA's backend database design. Additionally, the team encountered complex **Mutable Data Conflicts** within the FEAR (Formal Enforcement) module. Because the "Enforcement Type" field is highly mutable within the database, mapping these dynamic actions to static EPA codes risked creating "phantom" or inaccurate historical records—a challenge requiring sophisticated database architecture to resolve.
- **Upstream Version Overhauls:** The system had to remain highly adaptable to upstream technological shifts. Upgrading internal components to maintain strict alignment with the EPA/Windsor OpenNode2 version 5.14 required exhaustive table analysis and deep architectural rewrites to our internal data structures.
- **Navigating Inter-Agency Communication & Regulatory Hurdles:** Technical delivery was frequently stalled by external communication gaps. The team regularly faced delayed technical support and extended feedback loops from federal partners, often waiting weeks for root-cause analyses on critical service degradations. Proactive outage notifications were virtually non-existent, forcing ADEQ to rely on live user complaints to diagnose federal service downs. These technical roadblocks, compounded by unpredictable EPA staff furloughs during federal government shutdowns, actively threatened compliance timelines, creating a scenario where ADEQ had to proactively manage and mitigate an anticipated miss of the December 21, 2025, ICIS-NPDES e-Reporting milestone.

What Makes It Universal – While this system is tailored to Arizona's ecosystem, the underlying architecture addresses a universal challenge. As an environmental agency, we struggle with the exact same friction points: balancing strict federal EPA mandates, retiring obsolete legacy systems, and easing the compliance burden on local economies. By successfully overcoming these technical hurdles, ADEQ's e-reporting system establishes a scalable, replicable blueprint for digital state governance and environmental modernization nationwide.

IMPLEMENTATION

Project Implementation & Methodology – Strategic Framework: Lean, Agile, and Customer-Centric.

To modernize and streamline the collection and sharing of environmental data, ADEQ launched the e-Reporting project as a core strategic initiative. The mandate required shifting from paper-based forms to electronic submissions for all permit information and compliance reports across more than 10 plus distinct applications. To achieve this, we embraced an **agile methodology** coupled with **lean management principles**. This iterative approach allowed the development teams to adapt swiftly to shifting regulations, deliver continuous incremental value, and minimize development costs.

The implementation began by "leaning out" decades-old legacy workflows. By collaborating directly with end-users, we integrated the "Voice of the Customer" into the system architecture. This results-driven

management strategy broke down traditional government silos, transforming ADEQ into a single, cohesive enterprise focused on the digital user experience.

User-Centric Design and Features – To ensure high adoption rates and remove regulatory complexity, we adopted a simplified, intuitive design from inception. Key features of this customer-facing framework include:

- **A "TurboTax-Style" Interface:** Complex environmental regulations are broken down into intuitive, sequential question-and-answer prompts, simplifying the legal interpretation for businesses.
- **Global Design Standards:** A uniform look, feel, color palette, and layout across all 10 plus applications ensure seamless navigation and efficient platform utility.
- **Contextual "Tool Tips":** Embedded on-screen guidance provides real-time clarity on data requirements, drastically reducing submission errors.
- **Smart Data Pre-Population:** The system intelligently recalls previously reported information to minimize repetitive data entry time for businesses.
- **Dynamic Validation:** Required fields prevent incomplete submissions, eliminating the historic administrative burden of chasing down missing paper data.
- **Integrated Mapping Tools:** A built-in GIS map feature allows users to easily and accurately pinpoint geographic locations.

The Phase-Based Development Lifecycle – To execute this massive digital transition efficiently, we utilized a structured, phased lifecycle across all applications, heavily involving stakeholders—including subject matter experts, IT professionals, legal teams, executive leadership, and end-users—at every stage: **Phase I:** Requirements, Analysis & Lean Discovery; **Phase II:** Architectural Design; **Phase III:** Construction & Prototyping; **Phase IV:** Integration & Environment Testing; **Phase V:** Quality Assurance & Debugging; **Phase VI:** User Acceptance Testing (UAT); **Phase VII:** Production Implementation; **Phase VIII:** Continuous Maintenance & Support.

Enterprise Alignment & Strategic Roadmap

The Enterprise View: Strategic Fit – The e-Reporting project is not an isolated IT upgrade; it is a foundational pillar of ADEQ's broader **Enterprise Architecture (EA) strategy**. Historically, regulatory data lived in decentralized, program-specific silos (e.g., separate databases for air, water, and waste). This project breaks down those silos, aligning government operations into a single, unified enterprise. By consolidating permitting and compliance reporting from over 10 disparate applications into a shared platform, we established a "single source of truth." This centralized data ecosystem allows the agency to make predictive, data-driven environmental decisions while drastically lowering the long-term cost of IT maintenance across the entire department.

The Strategic Roadmap – The journey from concept to fruition was executed across a multi-year horizon, transitioning from tactical alignment to enterprise scaling:

1. **Discovery & Process Alignment:** Leaning out legacy processes, hosting Kaizen events, and standardizing cross-program data requirements.
2. **Core Framework Development:** Building the foundational "TurboTax-style" user interface and establishing security protocols.

3. **Application Migration (Phased Waves):** Grouping the 10 plus compliance applications into logical development waves, starting with water programs (NPDES) and scaling across other agency divisions.
4. **Enterprise Integration:** Connecting the modern frontend to rigid legacy databases via secure data exchange pipelines.
5. **Continuous Optimization:** Transitioning into an Agile maintenance lifecycle driven by ongoing user feedback and regulatory shifts.

Project Management & Governance Approach – This initiative utilized a Hybrid Project Management framework designed to balance strict state accountability with development flexibility. Predictive Governance (Waterfall Framework) was used to manage fixed financial budgets and ensure strict adherence to federal EPA deadlines and Adaptive Execution (Agile/Scrum Framework) was used to allow the agency to rapidly pivot when environmental regulations shifted, build continuous prototypes, and gather immediate user feedback.

Project Assessment & Success Metrics – To ensure accountability, the project’s success is continuously evaluated against predefined Key Performance Indicators (KPIs):

<u>Success Category</u>	<u>Metric / Target</u>	<u>What Success Looks Like</u>
User Adoption	>95% Digital Adoption	Elimination of paper submissions for targeted forms within 12 months of launch.
Data Quality	100% Critical Field Completion	Zero missing critical data points, achieved via automated validation rules.
Operational Efficiency	Substantial Cycle-Time Reduction	Decreasing the time for report submission enterprise report to be submitted.
Fiscal Responsibility	Reduced Development Costs	Reusing standard components.

Stakeholder Management & Change Plan

Key Stakeholder Profiles – The success of the e-Reporting system relied on the strategic alignment of five core groups:

- **Executive Leadership:** Championed the initiative, secured state funding, and aligned the project with ADEQ’s overarching public health mission.
- **Subject Matter Experts (SMEs) & Legal Teams:** Ensured the digital forms strictly adhered to complex Clean Water Act and state statutes.
- **IT Professionals & Technical Leads:** Engineered the system architecture, managed legacy database integrations, and enforced cybersecurity compliance.
- **The Business Community (End Users):** Provided the critical "Voice of the Customer" to ensure the application was genuinely usable and reduced administrative friction.

Buy-In, Awareness, and Adoption Strategy – Securing cross-organizational buy-in required a deliberate, multi-channelled Change Management plan, specifically engineered to maintain stakeholder confidence even when external technical barriers arose.

Phase 1: Awareness (Building the Case & Managing Expectations) – *Internal Action:* Executive leadership hosted agency-wide communications emphasizing the strategic pivot toward a unified digital enterprise. Critically, leadership used this phase to prepare technical and program staff for known external dependencies, such as EPA node instabilities and systemic CROMERR timeouts. *External Action:* ADEQ published proactive compliance alerts and digital newsletters informing the business community of the upcoming transition. When federal system outages or "502 Bad Gateway" errors impacted the user experience, we used targeted, transparent communications to insulate the agency's reputation and reassure users that technical fixes were being aggressively pursued.

Phase 2: Buy-In (The Voice of the Customer amid Regulatory Delays) – *The Kaizen Catalyst:* By inviting business owners and compliance officers into week-long Kaizen design workshops, stakeholders became co-creators of the software. When federal bottlenecks or government shutdowns delayed the final ICIS-NPDES rollout past its original December 21, 2025, milestone, the psychological buy-in established during these workshops kept local businesses partnered with, rather than alienated by, the agency.

Phase 3: Adoption (Targeted Marketing & Training) – *The Tool-Kit Campaign:* ADEQ launched a targeted marketing campaign featuring brief "How-To" video tutorials, interactive webinars, and step-by-step user guides. *On-Screen Assistance:* Marketing the system's "Tool Tips" and "Pre-Population" capabilities incentivized hesitant users by proving the digital path was faster than paper.

Resource Allocation & Technical Architecture

Resource Requirements – Executing an enterprise modernization project of this scale required a balanced allocation of capital, human talent, and time. **Financial Resources:** Capital budget allocated for software licenses, secure cloud hosting infrastructure, specialized external IT consulting, and dedicated funding for stakeholder engagement workshops. **Human Resources:** A multidisciplinary project matrix comprising dedicated Scrum Masters, Frontend/Backend Developers, QA Analysts, Business Analysts, ADEQ Program SMEs, and a Change Management Lead. **Time Capital:** Dedicated discovery sprints prior to development, followed by a phased, multi-year rollout schedule to prevent operational disruption to active business compliance cycles.

Technical Architecture – Rather than focusing on specific programming languages, the architecture of the e-Reporting platform is defined by its **business capabilities**. It was engineered with three core principles in mind. **Service-Oriented & Modular Architecture:** *Why it matters:* By building modular, reusable system components (such as a standardized login portal, a universal GIS mapping tool, and a single payment processing gateway), we can launch any new compliance application in a fraction of the time and cost. **Secure API-Driven Interoperability:** *Why it matters:* Instead of undergoing an incredibly risky and expensive replacement of decades-old legacy databases, the team built secure API wrappers around them. This allows modern web apps to "talk" to legacy systems in real-time, ensuring seamless data exchange while preserving historical state data. **Cloud-Scalable Infrastructure:** *Why it matters:* Environmental reporting is highly cyclical, experiencing massive traffic spikes right before major federal deadlines. A scalable cloud infrastructure ensures the system automatically scales up to handle heavy user loads without crashing, guaranteeing a reliable, frustration-free experience for businesses when they need it most.

IMPACT

The Story of Transformation: Connecting Results to Business Rationale – The ultimate measure of the e-Reporting project's success is its tangible impact on Arizona's economic vitality and environmental health—especially when measured against the stark technical challenges it had to conquer. By transforming a fragmented, paper-heavy process into an automated, self-service digital enterprise, ADEQ successfully insulated local businesses from a highly volatile federal tech stack. Before this initiative, businesses were at the mercy of complex manual workflows, mapping friction across 1,200 distinct data points, and unpredictable external system timeouts. Today, that environment has been completely stabilized for the end-user. While the backend development team continuously navigates upstream version upgrades (such as OpenNode2 v5.14) and absorbs massive latency spikes from federal sign-and-store services, the frontend interface remains seamless, intuitive, and highly performant for Arizona citizens. The system's 24/7 availability allows businesses to obtain permits in minutes, side-stepping historic legacy dependencies and transforming how both the state and local industry navigate environmental compliance.

By the Numbers: Proven Quantitative and Qualitative Value – Our shift to digital governance is backed by definitive data that underscores a massive return on investment (ROI):

- **90% Reduction in Cycle Time:** The total elapsed time for a business to move from initial application submittal to final license issuance has been slashed by over **90%**.
- **70% Increase in Compliance Rates:** Automated, timely alerts and dynamic reminders have driven a **70%** surge in on-time, accurate compliance report submissions.
- **National Leadership:** Because of this framework, **Arizona is now recognized as one of the top states in the nation** to successfully meet the EPA's electronic compliance report submission standards.
- **Operational Reallocation:** Internal staff have been completely unburdened from manual data entry. Personnel are now strategically focused on high-value data analysis, environmental risk mitigation, and proactive enforcement. Non-compliance is immediately flagged and addressed by the system, directly accelerating our core mission to protect public health.

The Road Ahead: Future Vision & Long-Term Value – To protect the state's initial investment, we established a permanent, proactive Operations and Maintenance (O&M) framework. The platform will not be allowed to stagnate into a legacy system of its own. A dedicated product team will manage a continuous maintenance schedule, releasing regular software patches to patch security vulnerabilities, optimize user interfaces based on direct behavioral data, and adjust to shifting state and federal statutory requirements. As new environmental programs require digitalization, developers will reuse the core universal architecture (e.g., login portals, GIS mapping tool, validation engine), exponentially lowering the development cost of future application modules.

Why the Project is Worthy of Investment – The e-Reporting platform represents the highest and best use of modernization funds. It has proven that strategic IT investments can simultaneously champion economic growth and enhance environmental protection.

The upfront financial and human resources have yielded a highly scalable enterprise tool that drives down the long-term cost of government operations, safeguards natural resources through fast, data-driven interventions, and injects time and capital back into Arizona's business ecosystem. Ongoing investment in this platform ensures that ADEQ remains an agile, modern, and resilient regulatory agency for decades to come.