



Emergency Management Innovation Project



Category:
Information Communications Technology Innovations

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Multiple Production Iterations

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Executive Summary

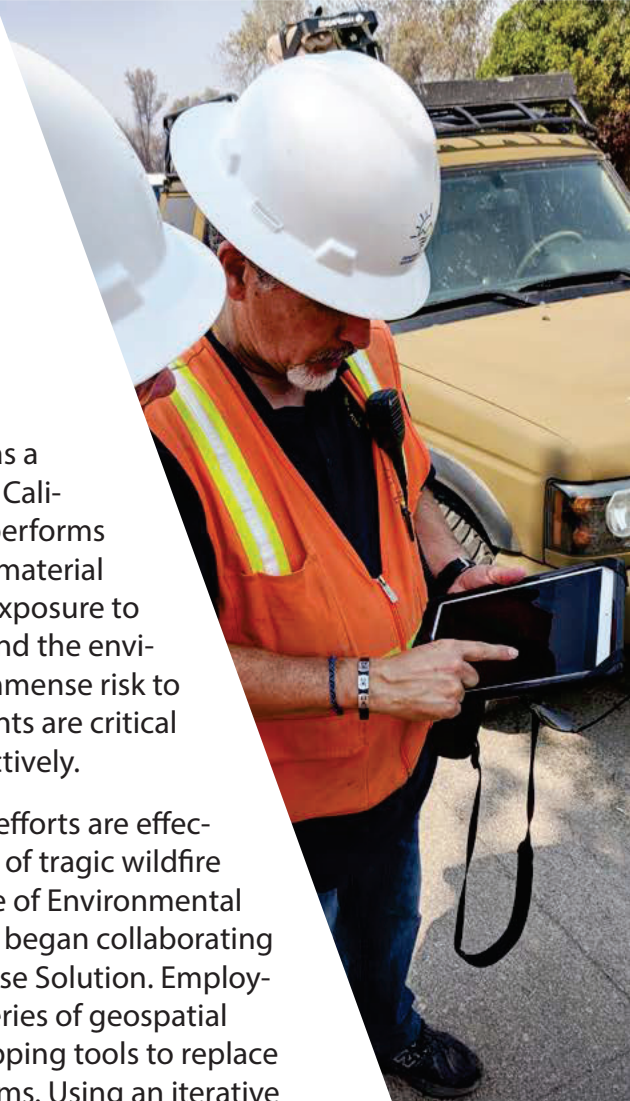
The California Department of Toxic Substances Control (DTSC) has a mission to protect the people, communities and environment of California from harmful chemicals. In support of this mission, DTSC performs household hazardous waste (HHW) assessments and hazardous material debris removal after major disasters such as wildfires to reduce exposure to hazardous waste and materials that can threaten public health and the environment. Improper disposal of hazardous waste also poses an immense risk to workers involved in restoration efforts, so DTSC's HHW assessments are critical to ensure that recovery efforts can be performed safely and effectively.

It's also important that the data collected during these recovery efforts are effectively managed and properly communicated. Faced with a series of tragic wildfire events that swept California beginning in late 2017, DTSC's Office of Environmental Information Management (OEIM) and Emergency Response Unit began collaborating to prototype, pilot, and deliver an innovative Emergency Response Solution. Employing an Agile systems development framework, OEIM created a series of geospatial dashboards, mobile field-ready applications and web-based mapping tools to replace its outdated, unwieldy paper-based checklists and inventory forms. Using an iterative approach powered by ESRI's ArcGIS Enterprise products, OEIM designed, configured, deployed, and continuously improved the tools we developed.

DTSC's Emergency Response Solution:

- Afforded efficiencies in HHW assessments and cleanup processes
- Improved data capture and quality
- Provided detailed operational data to field teams
- Allowed counties to effectively communicate with community members
- Empowered partner agencies to plan complementary recovery operations, and
- Provided streamlined access to information for public transparency

This Emergency Response Solution evolved and improved repeatedly, with each iteration advancing DTSC's workload management, data capture, information exchange, and geospatial mapping, ultimately resulting in faster emergency response HHW assessment and cleanup.



Concept

The California Department of Toxic Substances Control (DTSC) assists local, state, and federal agencies after wildfires, floods, and other major disasters in the removal of household hazardous waste (HHW) and other harmful substances. Contaminated debris—from automotive and household batteries, bulk pesticides, fertilizers, compressed gas cylinders, and pool chemicals to paints, thinners, aerosol cans, asbestos siding, pipe insulation, and consumer electronics—must be cleaned up and contained quickly to minimize the risks posed to human health, animals, and the environment.

DTSC's HHW inspection and removal is Phase 1. Property owners and local officials caught up in these disasters can't begin to remove other debris and clean up their damaged properties until Phase 1 is complete, so those people rely on DTSC's prompt and effective action to allow them to start to rebuild their lives, homes, and communities.

As California wildfires have become increasingly destructive in recent years, these HHW cleanups have added to the workload of DTSC's Emergency Response Unit (ERU), which was already burdened by constrained resources. The ERU had depended on a labor-intensive process using paper parcel maps, checklists, and inventory forms that were easily damaged by rain and wind. ERU staff who were often exhausted after a long day in the field had to spend their evening hours putting the information they'd developed into a format that other agencies involved in these emergency response, could use. The ERU staff also struggled to coordinate their daily schedules, and they lacked a consistent means of tracking property cleanup and completion status.

ERU turned to DTSC's Office of Environmental Information Management (OEIM) for help developing an Emergency Response Solution. Building on an analysis of ERU's HHW assessment and cleanup processes that was already underway, they identified areas where technology could be leveraged for further improvements. The team targeted three main areas:

- Data capture and transfer during removal efforts
- Phase 1 parcel status reports
- Public transparency

Internet of Things (IoT) Devices and Geospatial Data Collection Application

OEIM worked closely with ERU to analyze existing processes and understand procedural impediments and the challenges faced by field staff. The team quickly realized that ERU's paper-driven data collection could be done better with electronic forms, using an Agile methodology for solution design, development, and implementation. OEIM focused on IoT devices and geospatial solutions using ESRI's ArcGIS Enterprise products and mobile devices.

During the cleanup that followed the October 2017 Tubbs Fire in Northern California, ERU staff in the field entered data and tracked HHW removals using wireless, handheld devices equipped with ESRI's Collector for ArcGIS App. Just two months later, lessons learned in that pilot effort were put to

use after the Thomas Fire in Ventura County. OEIM continued to improve the data capture process by leveraging ESRI's Collector App, and provided teams with improved devices, rugged iPads, and 4G hot spots.

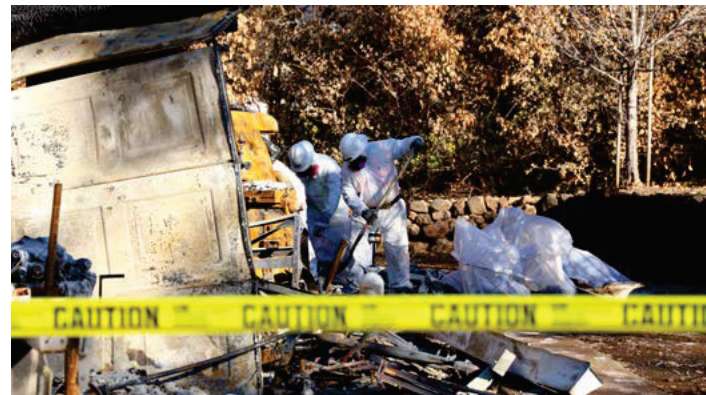
Improved Data Exchange, Partner Collaboration, Web Mapping, and Transparency

As California's deadly and destructive wildfires continued, communications between emergency response agencies become even more vital. OEIM has continued to pursue improvements in ERU's information collection and sharing. The next iteration of ERU's Emergency Response Solution involved developing data exchanges with other emergency response organizations. Partners that DTSC must keep apprised of progress in post-disaster cleanup can range from the county level to the state's Office of Emergency Services (CalOES), Department of Resources Recycling and Recovery (CalRecycle), and other agencies, and even up to the U.S. Environmental Protection Agency (U.S. EPA).

With ERSI's Collector App, OEIM was soon able to leverage data captured in the field and establish data exchanges with CalOES and CalRecycle. Detailed operational data feeds were shared to assist with recovery planning efforts, providing the time-sensitive information needed for coordinated emergency response and debris removal. OEIM also turned to ESRI's Application Programming Interface (API) framework to improve the timeliness of information shared with partner agencies and stakeholders.

The innovations continued, and recognition of their value broadened. OEIM leveraged ERSI's ArcGIS to provide ERU and local emergency responders with an [online map](#) of parcel-by-parcel HHW cleanup status, giving all involved a visual update on status and progress and greater efficiency in daily work assignments. The online mapping tool became an essential asset for the emergency team's operations.

Its value in public information and transparency and stakeholder engagement also quickly became evident, and the map was soon posted on DTSC's website. In addition, online data dashboards provided real-time parcel cleanup status information and critical operational information. The improved business process and innovative technology delivered by the DTSC team provided a new means to keep field crews, the public, and other organizations apprised of the work each day.



Above: Workers inspect a property for hazardous waste in Paradise, CA.

Below: DTSC field staff use a handheld device to record information.

Significance

The ecosystem of applications benefited several different stakeholders by allowing real-time access to data. The public was informed of operational information through live geospatial dashboards. Counties had direct access to underlying data that helped them resolve property access issues and communicate additional information to the property owners. Cloud-based standardized data storage facilitated communication with other state agencies through a centralized data hub operated by CalOES, enabling data-driven, transparent, and standardized messaging about the recovery efforts' progress. Agencies whose operations could benefit from DTSC's information were able to access real-time data through ESRI's API framework, and integrate the information into their own applications and processes.

Cloud-based sharing

The figure below illustrates the variety of users that are empowered by cloud-based Software as a Service (SaaS) technology.



Agile Applications Design and Delivery

Business partners were at first skeptical of OEIM's ability to deliver through the iterative application development approach, but Agile development practices helped build trust as valuable prototypes were delivered.

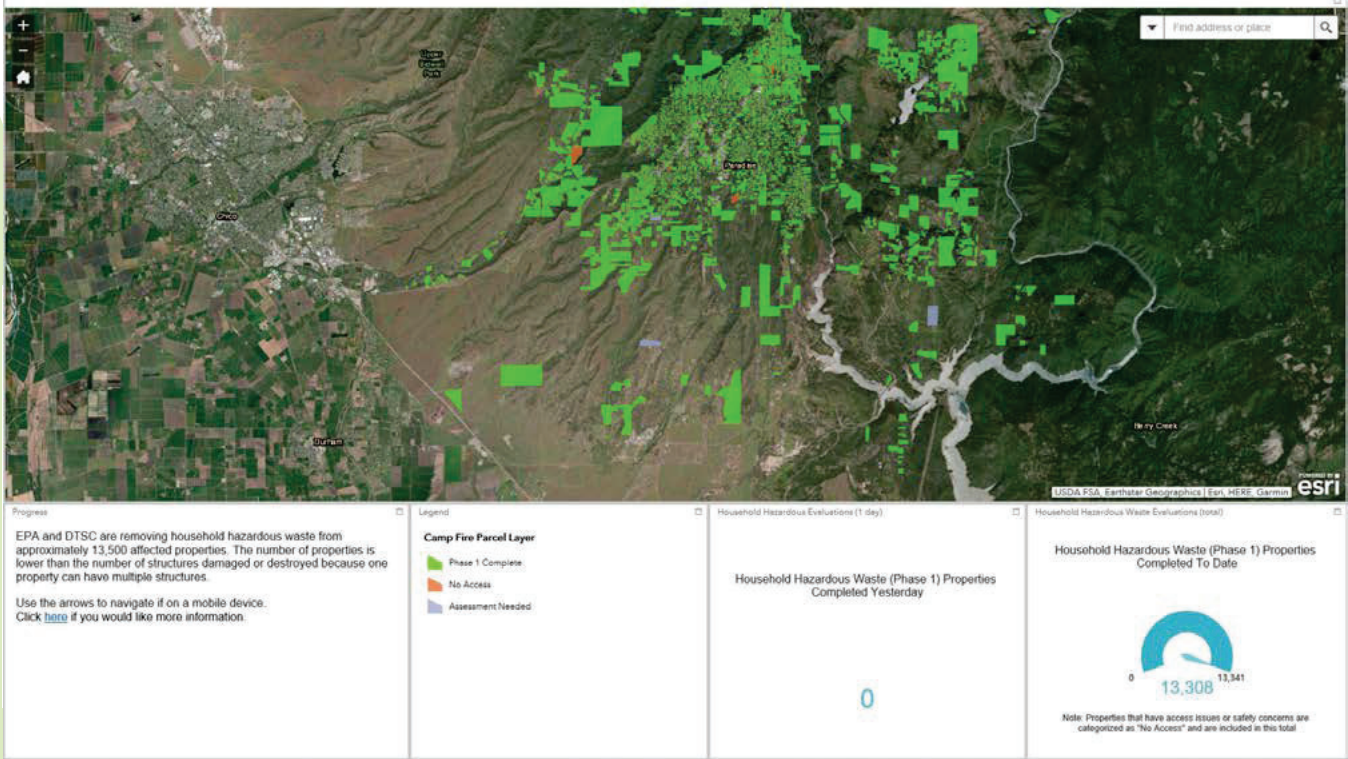
The iterative application development approach leveraged an Agile framework to better support its business and encourage IT professionals to work closely with their business partners to understand their needs and deliver value faster. To enable this approach, OEIM adopted a cloud-based architecture model using the ESRI mobile application stack. The SaaS model allowed easy modification of the Emergency Response Solution as conditions changed, and it provided a framework to enable data management best practices.

Increased Engagement with the Public

On several occasions, property owners encountered field staff on site because they had access to our information dashboard and were able to estimate when we would reach their property. This demonstrates the increased engagement the public has when useful information is easy to access.

Camp Fire Response

Butte County and Town of Paradise



[Butte County Camp Fire Dashboard](#)

County Empowerment

In one case, DTSC noticed that parcels still needing assessment after initial recovery efforts were not being communicated efficiently. We prototyped a map-based application to enable county officials to notify DTSC, allowing field staff to integrate the information immediately into their planning process, bypassing inefficient email and phone communications.

Empowered Government

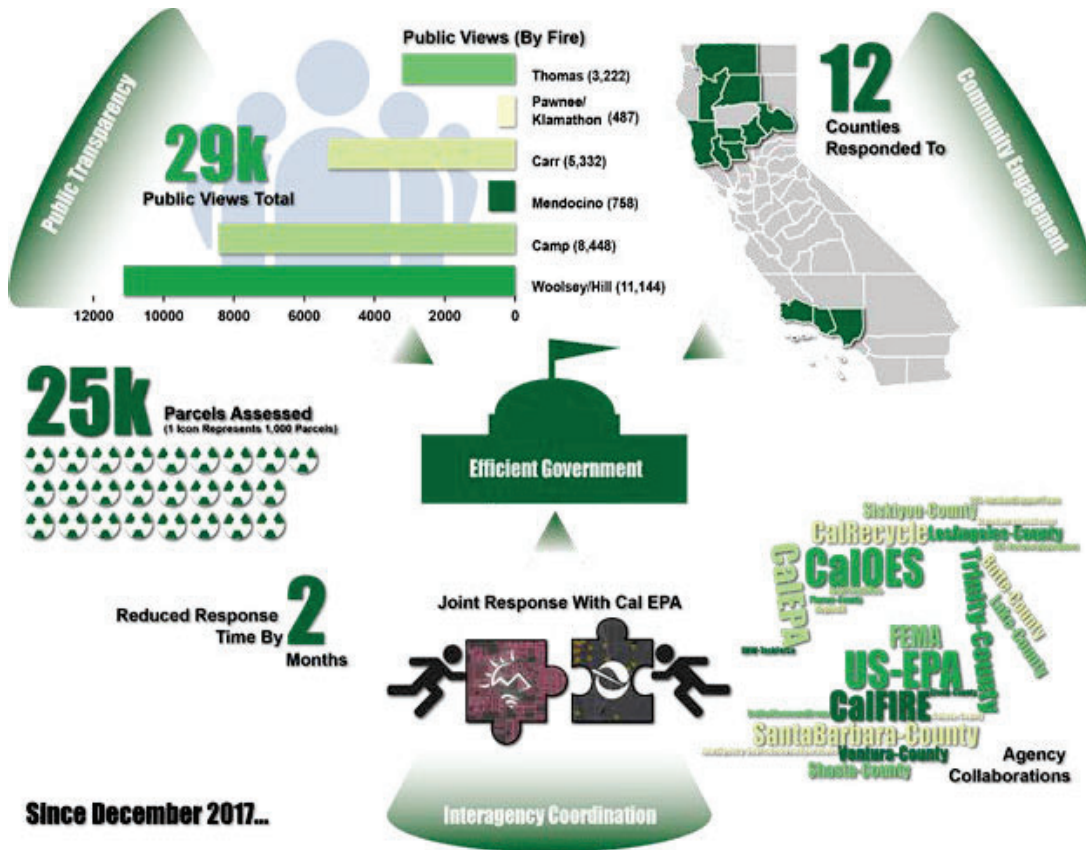
One key tenet of emergency response is to have enough resources at your disposal to handle the immediate situation without external assistance. DTSC relied heavily on the U.S. EPA's help as recently as the Thomas Fire cleanup; with the mobile application and improvements in our business process, though, we only needed the federal assistance for a week—and we were able to complete our assessment ahead of schedule. Similarly, counties call on DTSC for help in emergencies because they lack the capacity or expertise required. We try to enable our county partners to independently leverage these tools, and we freely share our methodology to assist them in their efforts. By empowering the local officials with the tools they need to do their job, they can quickly focus on handling other aspects of the emergency.

Impact

Over the last two years, DTSC has been mission-tasked for seven major wildfire responses, and we have accessed over 25,000 properties for assessment and removal of hazardous household materials and debris. Our Emergency Response Solution has been operational for a little over a year, and we have deployed an ecosystem of innovative products in that time, incrementally improved business processes and response time while empowering collaboration and transparency with state and local agencies and the public.

The results are evident even in the aftermath of the Camp Fire that broke out in November 2018—California’s deadliest and most destructive. Our efforts were projected to require nine to 12 months to complete, an aggressive target involving hundreds of workers and close coordination with U.S. EPA and the Butte County Environmental Health Department. ESRI’s ArcGIS Enterprise solutions helped us increase our efficiency and improve communication and data exchange with our partners. The result: Our crews completed their mission approximately two months ahead of schedule.

The figure below demonstrates the scope and magnitude of work accomplished by DTSC in that time.



Our adaptation of ESRI’s Collector App and the corresponding geospatial dashboard we developed have generated very positive feedback from the impacted communities. Since the implementation of this iterative Emergency Response Solution, we have improved our HHW cleanup efforts by approximately 20 percent. The information products that we have developed are now the standard that our partners and the public expect.