



Application for 2018 University of California Larry L. Sautter Award
for Innovation in Information Technology

Project Title **Chemical Inventory
Administrator Solution**

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The Problem

Chemical inventory administrators on each University of California campus are responsible for a variety of federal, state and local regulations and corresponding reports. These include the California

Environmental Reporting System (CERS- this allows the upload of the chemical inventory with California fire code classifications to the state for Community Right to Know Act compliance), the Chemical Facility Anti-Terrorism Standards (CFATS) and Maximum Allowable Quantities (MAQ) of Hazardous Materials described in the California Fire Code (CFC – based on the International Code). Having reliable, up-to-date information regarding the chemicals in each facility on each campus is key to producing accurate reports, maintaining a safe campus environment and reaching regulatory compliance.

For the past several years, UC campuses have used a program called CIS (Chemical Inventory System) to track their inventories and manage compliance. Although CIS possessed the ability to generate many reports, there were still many challenges with the system that inhibited usability and efficiency. For example, CIS required that a Chemical Abstracts Service (CAS) number be associated with each chemical when entering a chemical into an inventory. Not every chemical has an associated CAS number, so oftentimes the lab worker entering the data would enter in dummy information in order to proceed with the inventory. Later, when preparing the annual CERS report, it became necessary to go through each line of the CIS data and manually rectify the incorrect data. One administrator described the laborious process of going through the nearly 700-page report to catch data issues such as a dummy CAS that would be rejected by the state's upload site. For the CFATS report, typically run monthly, the CIS program was very slow to generate the report and also did not provide enough information for the administrators to easily track down false positives when they appeared, costing time and resources. In addition to these and other challenges, CIS did not have the ability to generate MAQ information for a given control area, leading campus fire marshals and their delegates to use time consuming and outdated methods to monitor compliance.

The Chemical Inventory Administrator Solution

The development of a solution for streamlined, accurate chemical data reporting began with the creation of the Chemicals application. In 2016, Risk and Safety Solutions released a secure cloud-based chemical inventory management tool to allow easy tracking and maintenance of containers. Chemicals has been developed with extensive input and feedback from the researchers who will use it the most, helping to ensure the inventory remains accurate and up to date when it comes time for compliance reporting. Chemicals is being used at all 10 UC campuses, where it is in various degrees of implementation. The UC contract with CIS expires in 2018, and most campuses intend to switch completely to Chemicals by that time.

Information about substances is stored in a Master Library, including data necessary for reporting. For CERS and MAQ reports, it was necessary to band chemicals by hazard class based on their physical characteristics. This was done by incorporating the Fire Code definitions for each hazard into our software so that everything in the library could be automatically assigned to the appropriate category. Both container information from the inventory and chemical information from our library feed in to our reports. They are:

- The Chemicals Dashboard: This robust tool for analysis and ad-hoc reporting displays data (refreshed nightly) on a variety of information, including quantity, location, and size of chemical containers. Users can search for specific chemicals on a campus by building, by hazard class, by owner, and so on. This information can then be exported to Excel for record keeping or further manipulation. Permissions can be granted at a campus or system-wide level, allowing

administrators and directors to have access to this wealth of information to accomplish any number of business needs.

- CERS Report Dashboard: This dashboard collects and displays all the data that is required in CERS reporting in accordance with the designated template. Submitting the completed template to CERS is very simple as the report was designed to be accepted directly with no further manipulation. All users have to do is download it from our dashboard and upload it to the state-run site. This dashboard also provides information necessary for local Certified Unified Program Agency (CUPA) reporting.
- CFATS: This report provides administrators with information on the type, location, and quantity of Chemicals of Interest at all buildings on their campus. The report clearly shows where buildings are nearing or exceeding designated thresholds by coloring the cells in yellow or red, respectively. It is very simple to drill down into the information to see who the owner of the material is when ground-truthing is necessary, overcoming one of the challenges with the older CIS program.
- MAQ: This report provides campus Fire Marshals with a real-time view of hazard-banded chemicals in a set “control area” (a collection of rooms in a building that is managed by the Fire Marshal). They have the ability to set control areas in a building, then the associated container information is pulled from Chemicals and displayed in the report. Calculating the MAQ is complex and requires a detailed understanding of many different tables found within the CFC. Fire marshals at each campus would previously have to find their own way of calculating these numbers using tools that were not integrated with their campus’s inventory, but with our integrated solution, all of the work is done for them once their control areas are set up.

It's important to note that not only do these solutions greatly reduce the administrative burden of collecting and producing this information, they also provide never before available insight into the hazards and locations of chemicals on each UC campus. The resulting reduction in compliance and reputational risks extend to the whole university, benefitting EH&S administrators, Department Safety Coordinators and chemical users.

And, because these solutions pull information from the UC Risk and Safety Solutions Chemicals app, any campus using Chemicals could use the tools or have similar solutions customized for the needs of their campus or hospital.

Technology Used

Chemicals is a multi-part application consisting of a mobile application and a desktop web client. The desktop is built with HTML5, SASS, Material Design, and Angular on the front end, while the mobile app uses the Ionic framework. Control Area and Facilities, which are used to manage locations for Chemicals reporting, are built with React. Chemical's backend is written with NodeJS and Express with MongoDB as the database, uses Elasticsearch for searching and aggregation and RDKit for substructure searching. Both applications utilize a stateless authentication strategy, with multiple instances of the server behind a load balancer. The Dashboards are developed using Power BI, the leading self- service Business Intelligence platform from Microsoft.