Pacific Northwest NATIONAL LABORATORY

TRAC

TRAC – Capturing Cleanup Progress at Environmental Management Sites

May 21, 2024

Christian Johnson
Senior Development Engineer

U.S. DEPARTMENT OF ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy

PNNL-SA-178953

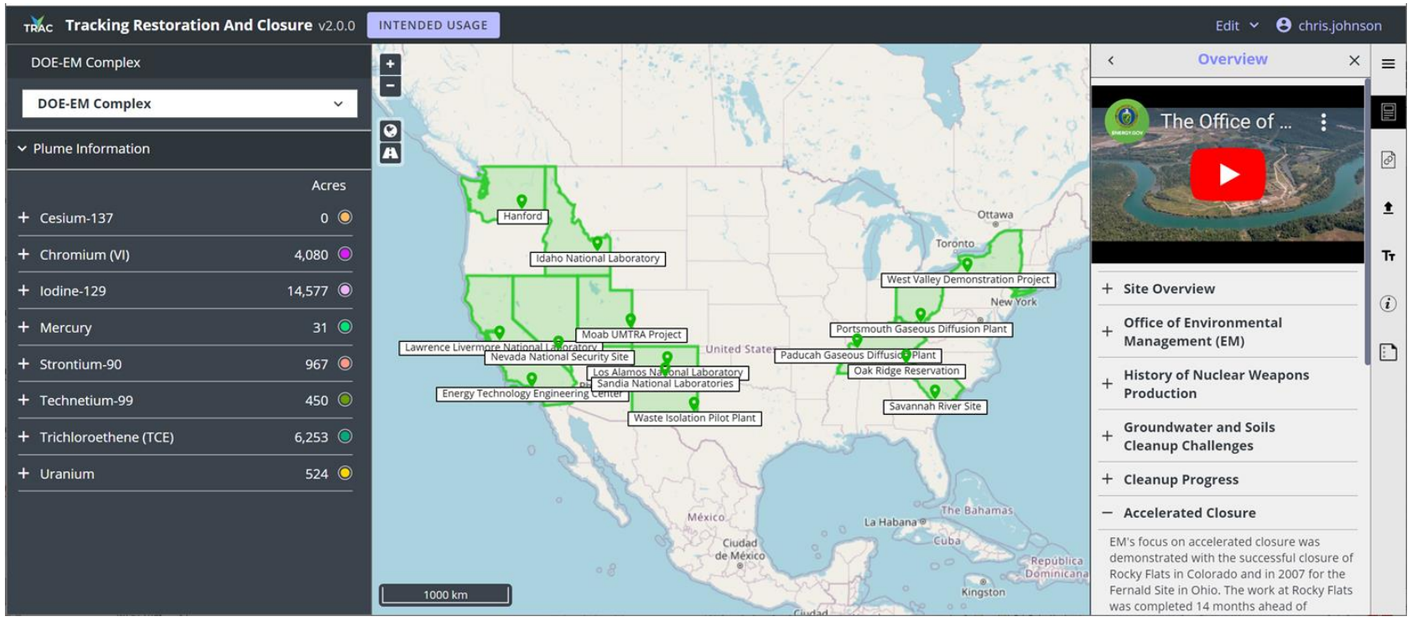
WM - 24308

Outline

- What is TRAC? Why is it needed?
- What does TRAC show?
- How is information managed in TRAC
- Future work
- Conclusions

Tracking Restoration and Closure (TRAC)

- Web-based application to communicate about status of groundwater contaminant plumes and progress toward closure
  - Consolidates narratives, metrics, and geospatial data
  - For U.S. Department of Energy (DOE) Office of Environmental Management (EM) sites
- Hosted on Amazon Web Services (AWS) cloud computing
  - Robust, flexible, and cost-effective framework
- TRAC version 2.0 released October 2023
  - Improved usability & features
  - Additional site data
- Part of DOE-EM groundwater closure strategy
  - Supports planning and decision-making about remaining plumes



Why is TRAC Needed?

- Provides dynamic online information resource for DOE-EM
  - Supports DOE-EM programs and mission
    - ✓ E.g., Groundwater closure strategy, Technology Development, Small Business Innovative Research, Minority Serving Institutions
- Provides a single endpoint for integrating and standardizing data between DOE-EM sites/organizations
  - Consistent framework for presenting progress towards site closure
- Facilitates effective communication
  - Between headquarters and DOE-EM sites
  - Between sites and stakeholders / regulators
  - Promotes sharing of technologies, successes, and lessons learned
- Mechanism for transparency and effective engagement with stakeholders
  - Complies with Programmatic Environmental Impact Statement Settlement Agreement

Transitioning from Manual Input for Groundwater Plume Book to TRAC

- Previously, sites sent data to DOE-EM headquarters as tabular information and printed materials
- Material was compiled into a static report by DOE-EM headquarters staff

US Department of Energy Groundwater Database Groundwater Master Report

Installation Name, State:	Idaho National Laboratory, ID		
Responsible DOE Office:	Office of Nuclear Energy		
Plume Name:	WAG-7		
Remediation Contractor:	CWI		
PBS Number: 30		Last Updated: 2012	

Contaminants

Halogenated VOCs/SVOCs Present? ☑ Yes ☐ No

VOC Name	Concentration (ppb)	Regulatory Driver
CCl4	5.43	☑ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No

Fuels Present? ☐ Yes ☑ No

Fuel Name	Concentration (ppb)	Regulatory Driver
		☐ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No

Metals Present? ☐ Yes ☑ No

Metal Name	Concentration (ppb)	Regulatory Driver
		☐ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No

Office of ENVIRONMENTAL MANAGEMENT

Office of Environmental Management

Idaho National Laboratory - WAG-1

JANUARY 1, 2014

Office of Environmental Management » Idaho National Laboratory - WAG-1

US DEPARTMENT OF ENERGY GROUNDWATER DATABASE GROUNDWATER MASTER REPORT

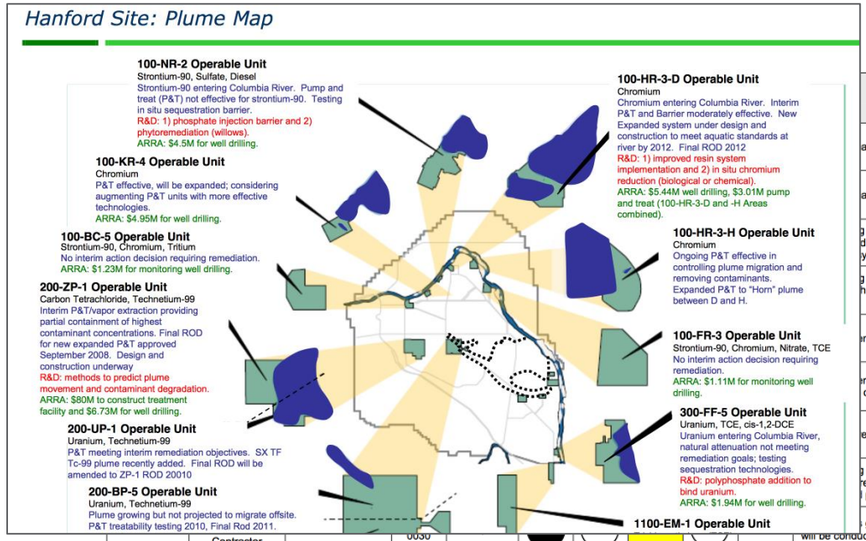
Installation Name, State:	Idaho National Laboratory, ID
Responsible DOE Office:	Office of Nuclear Energy
Plume Name:	WAG-1
Remediation Contractor:	CWI
PBS Number:	30
Report Last Updated:	2014

CONTAMINANTS

Halogenated VOCs/SVOCs Present?:	Yes

VOC NAME	CONCENTRATION (PPB)	REGULATORY DRIVER	CLEANUP REQUIREMENT
PCE	21	Yes	5
TCE	1272	Yes	5
VC	7	Yes	2
cis-1,2-DCE	181	Yes	100
trans-1,2-DCE	146	Yes	70

https://www.energy.gov/em/articles/idaho-national-laboratory-wag-1 1/4

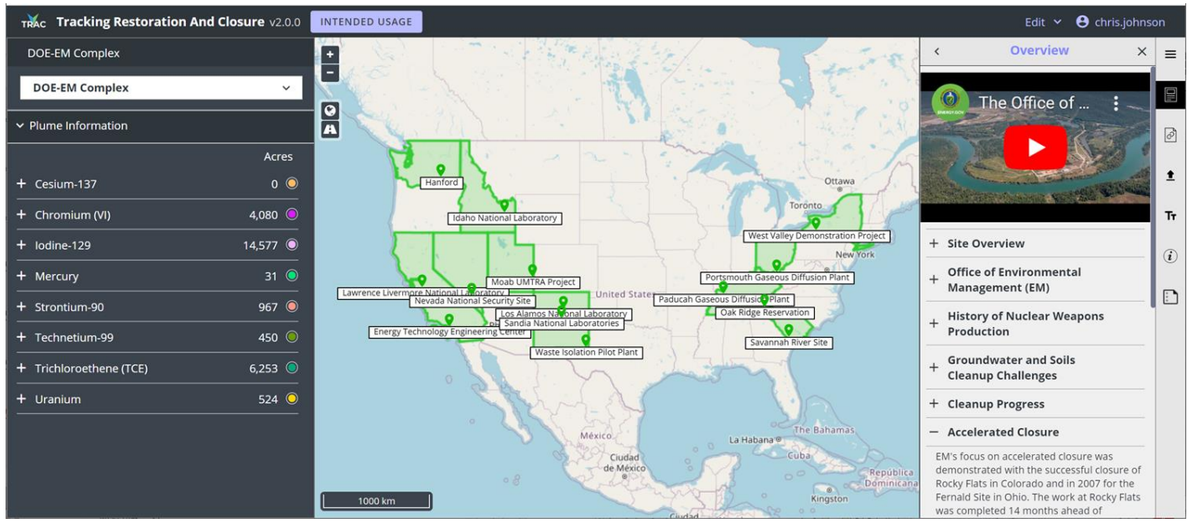


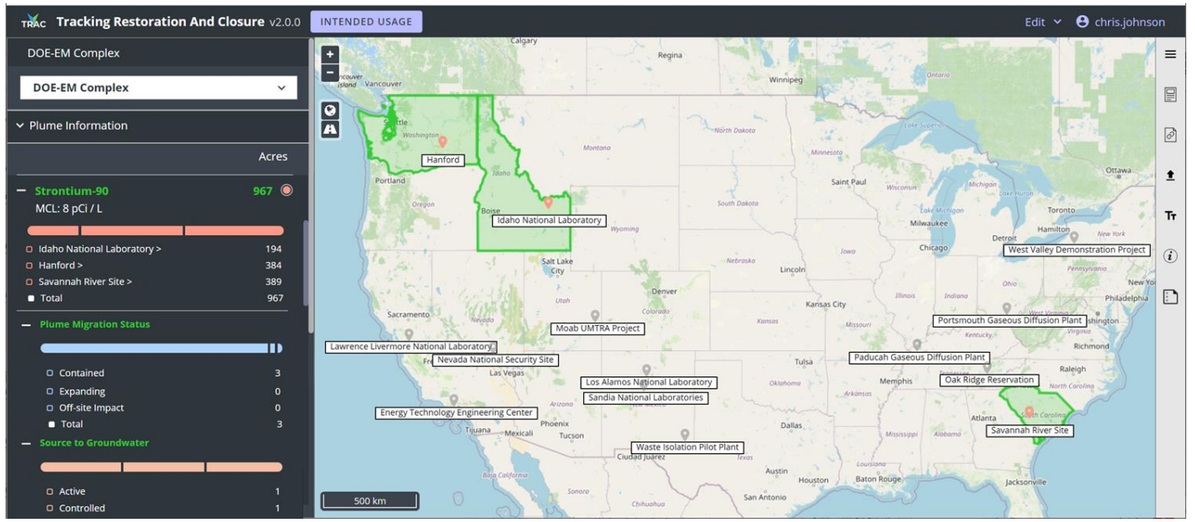
	Contractor		0030						will be conducted in 2010 and Final ROD will be issued in 2011
Hanford Site	Plateau Remediation Contractor	200-PO-1	RL-0030	I, Tritium			Red		Green	The plume has been shrinking in size naturally and no active remediation is expected. Migration of tritium into the Columbia River is currently only slightly above MCLs. A final ROD will be released in 2011.
Hanford Site	Plateau Remediation Contractor	200-UP-1	RL-0030	Tc, U			Green		Green	Interim P&T is operating and recent ESD has added Tc-99 plume at SX Tank Farm. UP-1 final ROD will be added to ZP-1 ROD
Hanford Site	Plateau Remediation Contractor	200-ZP-1	RL-0030	Car. Tet.			Yellow		Yellow	Interim P&T operations have provided partial containment of high concentration portion of plume at top of the aquifer. Final ROD for new expanded system approved September 2008. New P&T system under construction.
Hanford Site	Plateau Remediation Contractor	300-FF-5/ 300 Area U Plume	RL-0030	U			Red		Red	U is entering the Columbia River. The selected remedy, natural attenuation, did not work and the site is investigating other approaches.

Comments
atment required at this time.
atment required at this time.
g the Columbia River. P&T has been somewhat effective in controlling d removing Cr. Larger treatment facilities are being designed and installed ystem performance.
g the Columbia River. The selected remedy, an in situ barrier, has had hrough. Barrier mending and other alternative approaches being Large P&T system being constructed to work in conjunction with barrier.
n effective in controlling plume migration and removing Cr.
n effective. Expanded System has been constructed and is operating. develop alternative treatment methods to supplement P&T.
ed to be removed from wells.
g the Columbia River. P&T has stabilized plume migration but has not educed contaminant levels. The site is now testing apatite sequestration phytoremediation.
growing but not projected to migrate offsite. Treatability and pump tests

DOE-EM Complex Level Information

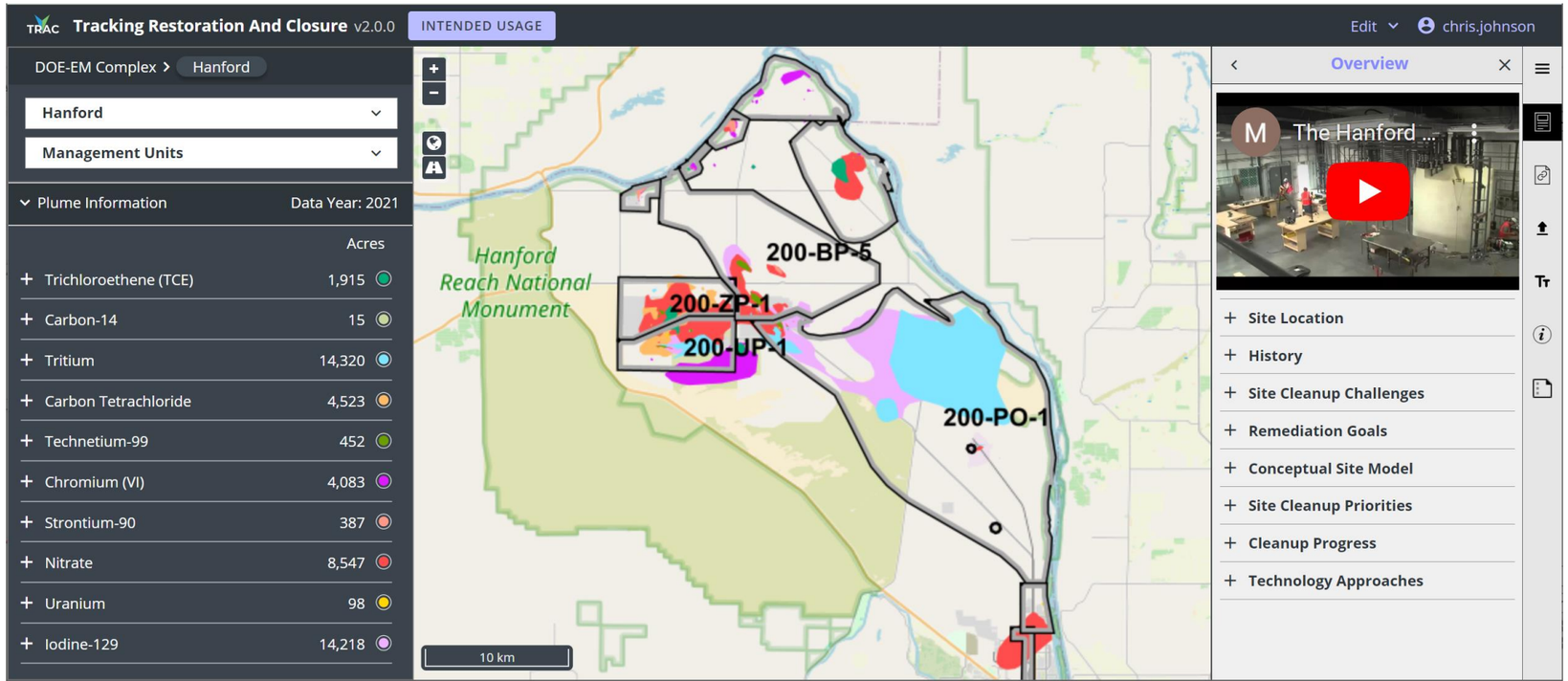
- Map overview of DOE-EM sites
- Focus on high-priority contaminants of concern
  - Which sites have the contaminant?
  - Total plume area and area by site
- Summary information on number of management units and status for:
  - Plume migration status
  - Source status
  - Regulatory status
  - Remediation technologies applied
  - Remedy implementation status





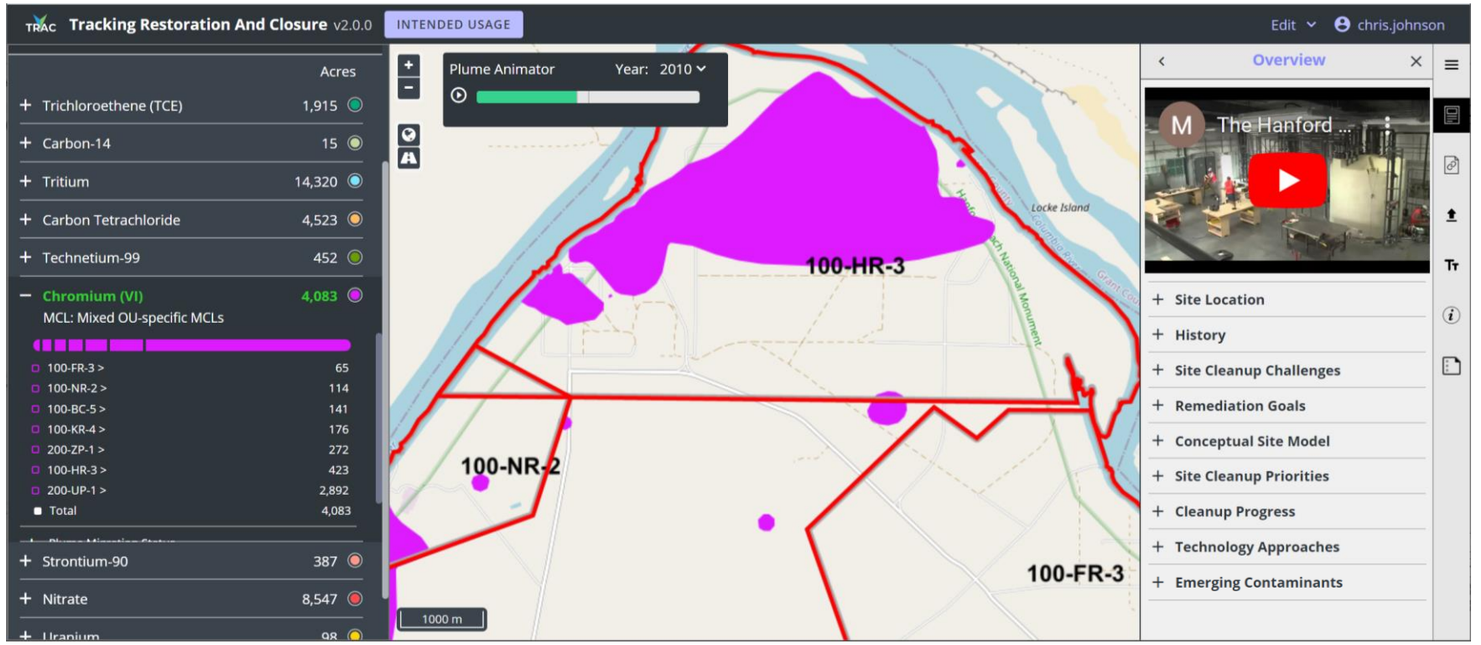
DOE-EM Site Level Information

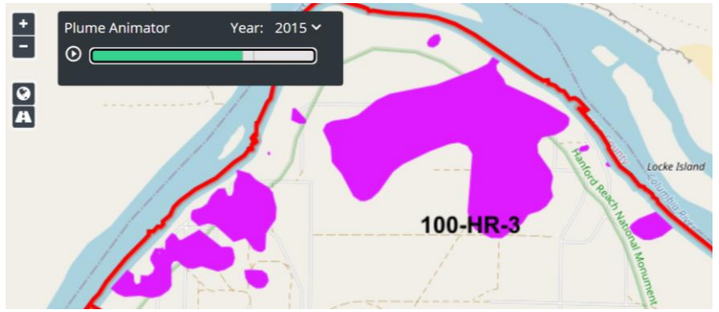
- Summary / rollup of metrics for all management units at the site
  - Plume area/status, regulatory status, and technology applied/implementation status
- Map view of geospatial footprints for all groundwater plumes
- Explanatory narratives
  - Site location & history
  - Remediation goals / priorities
  - Conceptual site model
  - Cleanup progress
  - Technology approaches
- Video and photographs

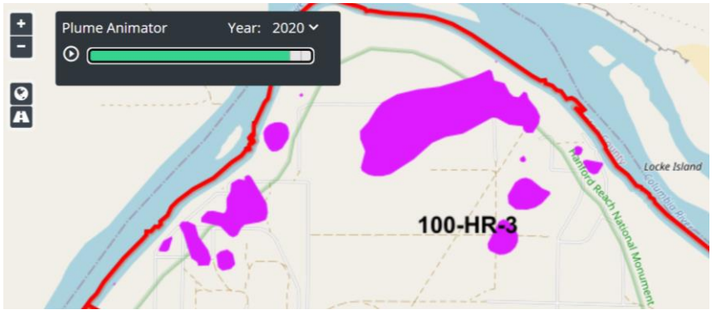


Site Plume Information and Plume Animator

- Plume footprint
  - Total acres
  - Acres for plume footprint by management unit
  - Highlight management units with contaminant
  - Different symbology for plumes at different depths
- Plume animator
  - Changes over time
  - May reflect changes in monitoring from year to year
  - Can show remedy impacts

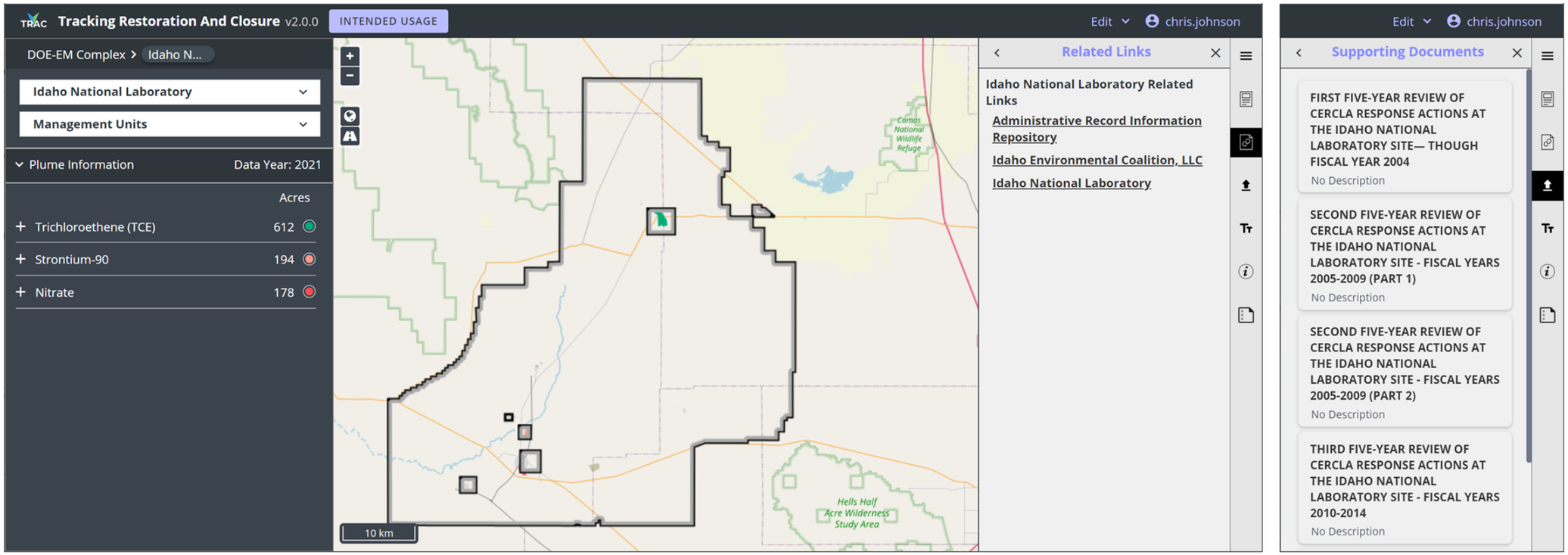






Related Links and Supporting Documents

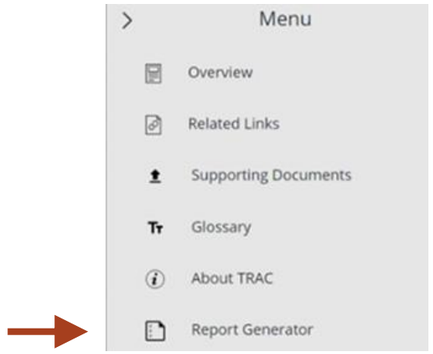
- Related links feature to point at additional resources
  - Websites, documents, online databases/tools, videos, etc.
- Supporting documents
  - Easy document access for users



Pacific Northwest NATIONAL LABORATORY

One-Page Factsheet

- Downloadable PDF file
  - Righthand side menu
- For EM site
  - Summary metrics for management units
  - Partial narrative content
    - ✓ Limited by space
- Useful for sharing, inclusion in a report, etc.



Moab UMTRA Project Site Data — DataYear: 2021

Plume Information

Contaminant	Area	Contaminant	Area
Ammonia	318.0	Uranium	427.0

Regulatory Information

Regulatory Cleanup Status		Cleanup Regulations	
ROD	1	Other	1
ROD Amendment	1		

Technology Information

Regulatory Cleanup Status		Cleanup Regulations	
Other	1	Treatment Plan Implemented	1

Contextual Information

Cleanup Progress
Interim groundwater action systems were installed starting in 2003 with a groundwater extraction system located along the Colorado Riverbank. This system was installed to remove contaminant mass from the groundwater and provide a source of water for dust control inside the Contamination Area. This system was updated over the past 20 years to currently extract groundwater from the base of the tailings pile. In addition, a freshwater injection system was installed along the riverbank to establish ...

Conceptual Site Model
Groundwater in the Moab region occurs in the unconsolidated Quaternary material deposited on the floor of Moab/Spanish Valley and in consolidated bedrock formations. Unconsolidated alluvial deposits overlie mostly the Paradox Formation at the site and comprise two distinct depositional facies: the Moab Wash alluvium and the basin-fill alluvium. The Moab Wash alluvium includes fine-grained sand, gravelly sand. The basin-fill alluvium is subdivided into two units; an upper unit (mostly Colorado Ri ...

History
Milling Operations. The Moab site began uranium milling operations in October 1956, and based on historical photographs the tailings pile was established once the mill operations were initiated. The mill was originally owned by the Uranium Reduction Company but was acquired by Atlas Corporation in 1962.In 974, Atlas made several modifications to its ore processing operations. The major modifications were construction of an acid-leach processing circuit to replace the one destroyed in a 1968 fire, ...

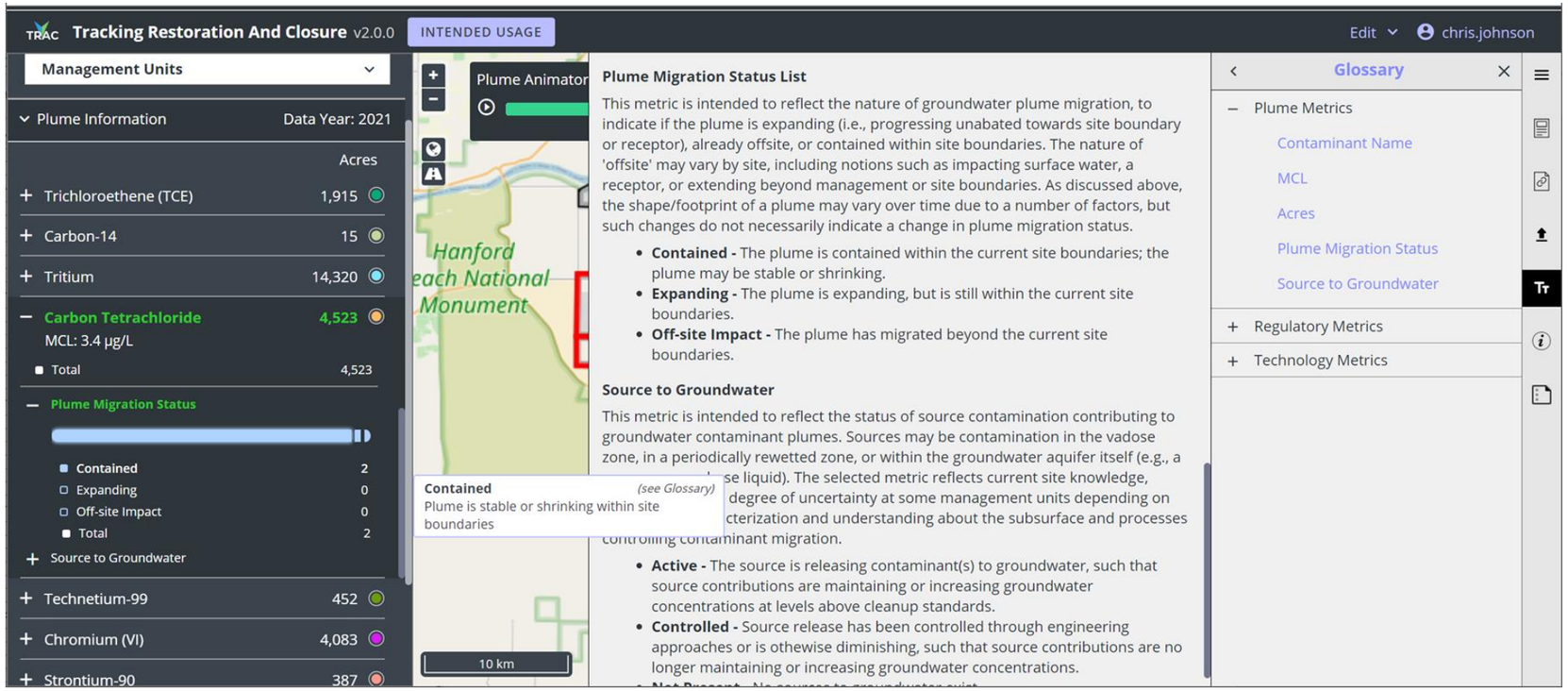
Remediation Goals
As directed by UMTRCA, EPA published 40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings." The standards in 40 CFR 192, Subparts A, B, and C, apply to the remediation and final disposition of contaminated materials, including groundwater, for Title I sites. Remediation of the Moab site must be in compliance with these standards. The Subpart A standards for control of residual radioactive materials apply to disposal of these materials at processing or ...

Site Cleanup Challenges
NRC has not approved a GCAP in many years, so the process and expectations currently have some uncertainty. DOE's objective is a final, approved GCAP by the completion of surface remediation activities, which may be as early as 2027.

Site Cleanup Priorities
The surface remediation of the tailings was initiated in April 2009. As of October 2023, 14 mil tons of the estimated 16 mil tons have been relocated to the Crescent Junction Disposal Cell.In conjunction with the surface remediation is groundwater remediation. Currently groundwater Interim Action has been removing contaminant mass and being protective of the Colorado River critical habitats. A final remediation strategy will be included in the site GCAP, which will be submitted to NRC in 2027.Am ...

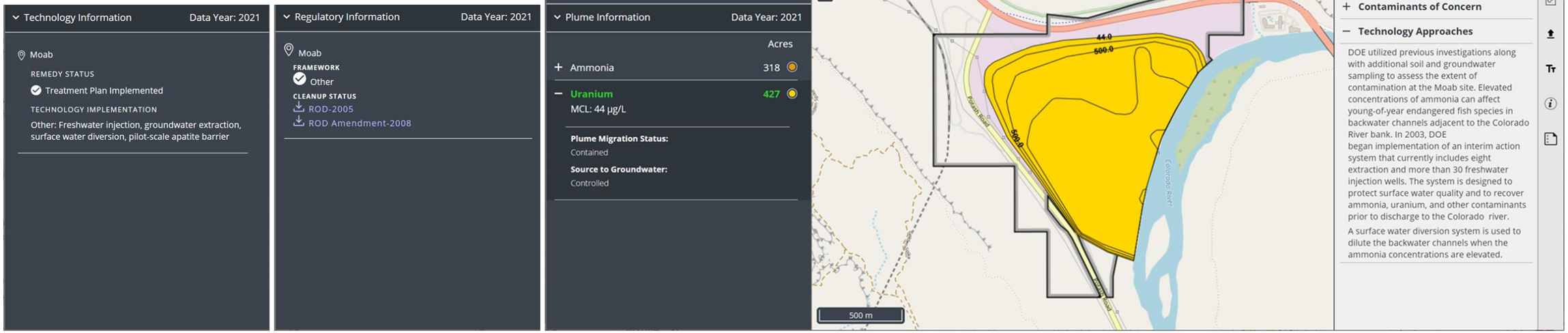
Glossary for Terminology

- Definitions of terms helps interpret the metric information in the left pane
  - For both general users and EM site editors/reviewers
- Also – tooltips on mouse hover over metric name in left pane
  - Brief definition and points to Glossary for details



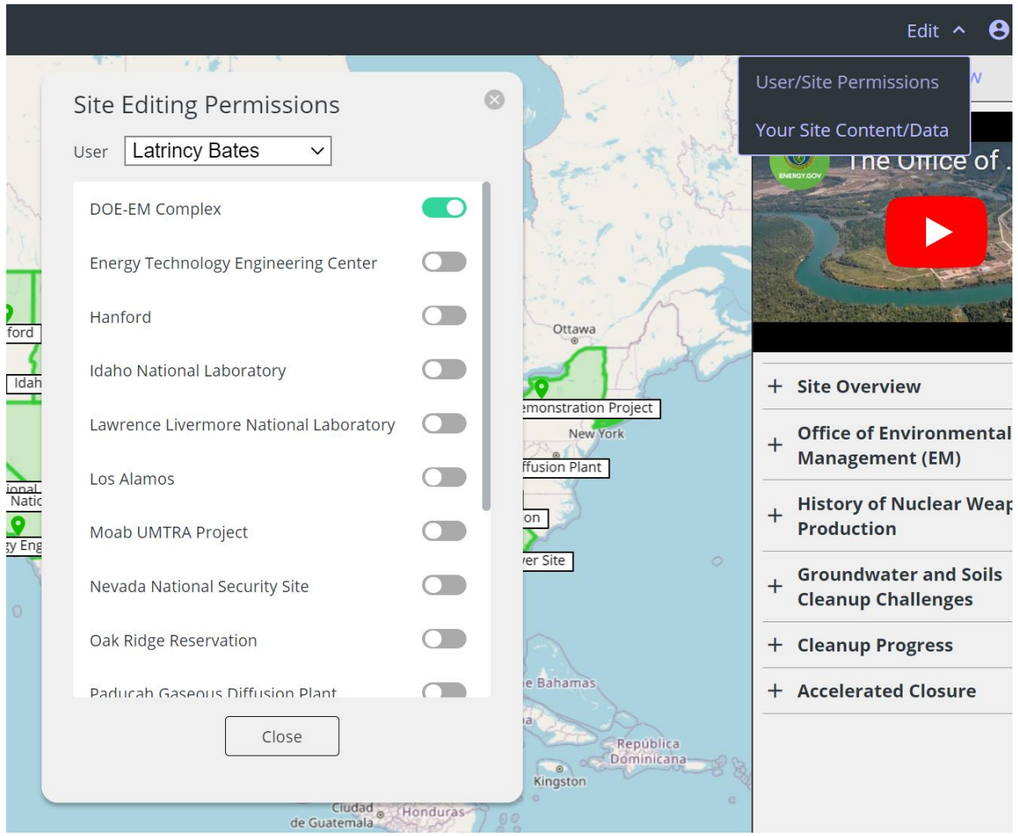
Management Unit Level Information

- Contaminant plumes by management unit
  - Plume footprint area, concentration contours, plume status, source status
- Regulatory framework and regulatory status
  - Links to regulatory documents
- Remediation technology applied and implementation status
  - Target contaminants, volume/mass treated



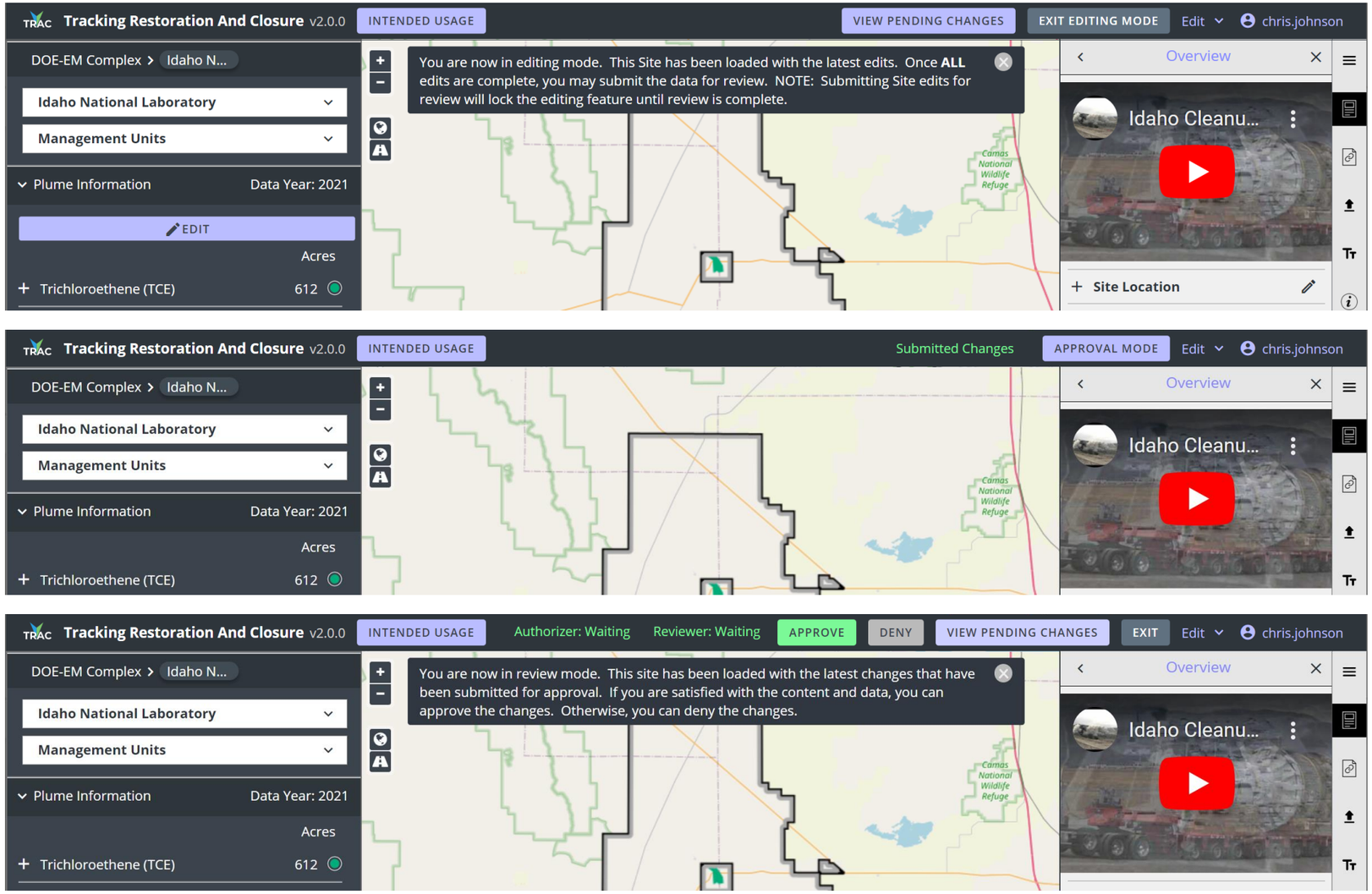
Collective Content Management

- Collaborative and effective workflow
- Site-specific and role-based editing
- Registered users can:
  - Edit content (narrative, metrics, file uploads) in draft mode
  - Review submitted draft content
  - Approve and publish content for public consumption
- Updates require minimal interaction for the TRAC website owner
  - Currently need to manually add GIS data files (updated plume maps)



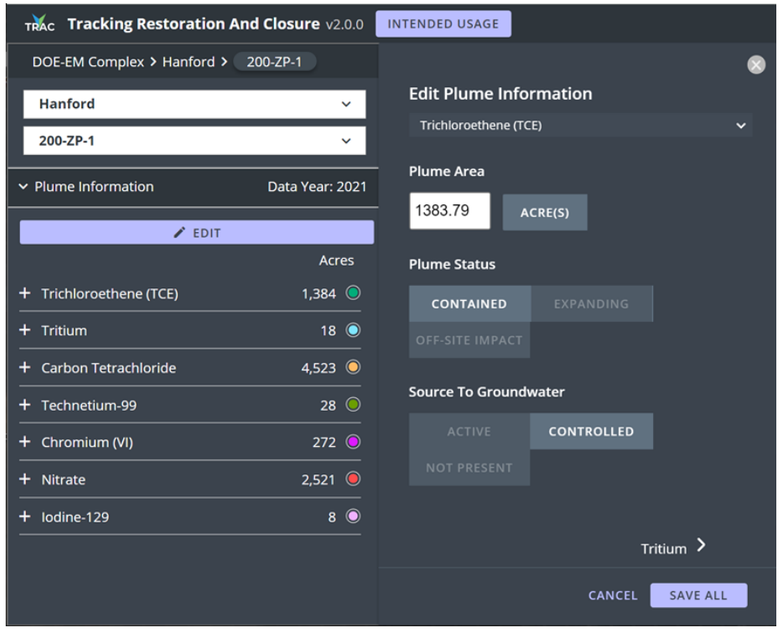
Editing / Submitting / Review / Approval

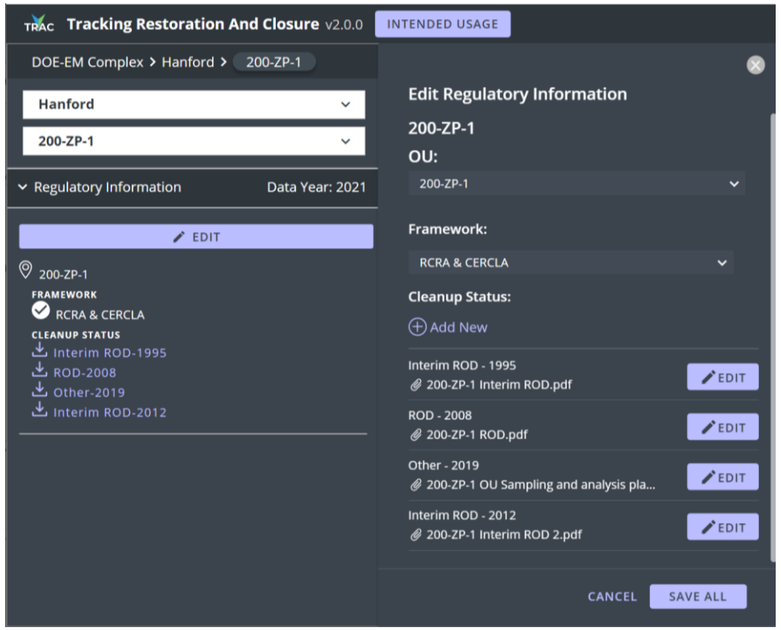
- ***Editor role*** – can make changes in edit/draft mode
- ***Submitter role*** – submit changes for review
- ***Reviewer role*** – review and approve/deny changes
- ***Authorizer role*** – final approval and publishing content

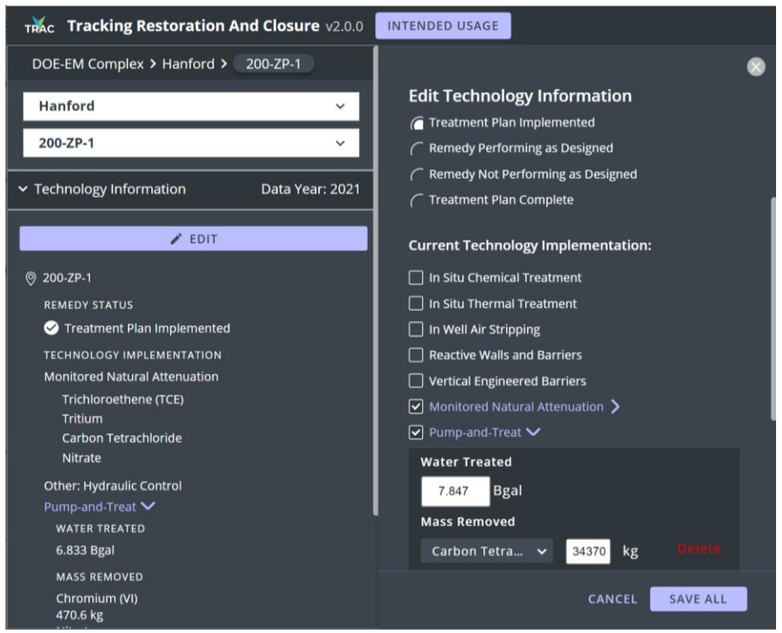


Editing Metrics at the Management Unit Level

- Plume
  - Enter an area value
  - Select appropriate status options
    - ✓Plume migration and source status option
- Regulatory
  - Select regulatory framework
  - Add documents reflecting regulatory status
- Technology
  - Select implementation status
  - Select technology(ies) and targeted contaminants
  - For P&T enter volume treated and mass removed

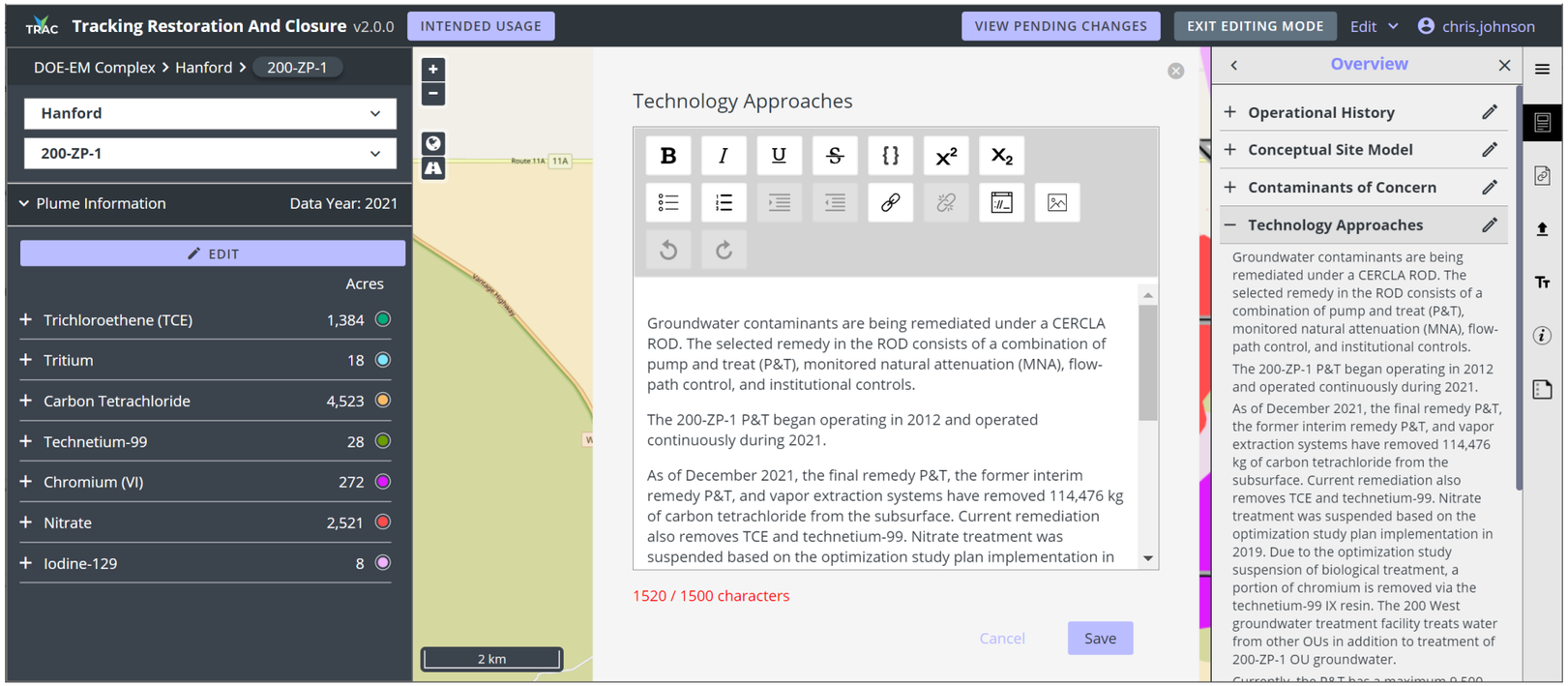






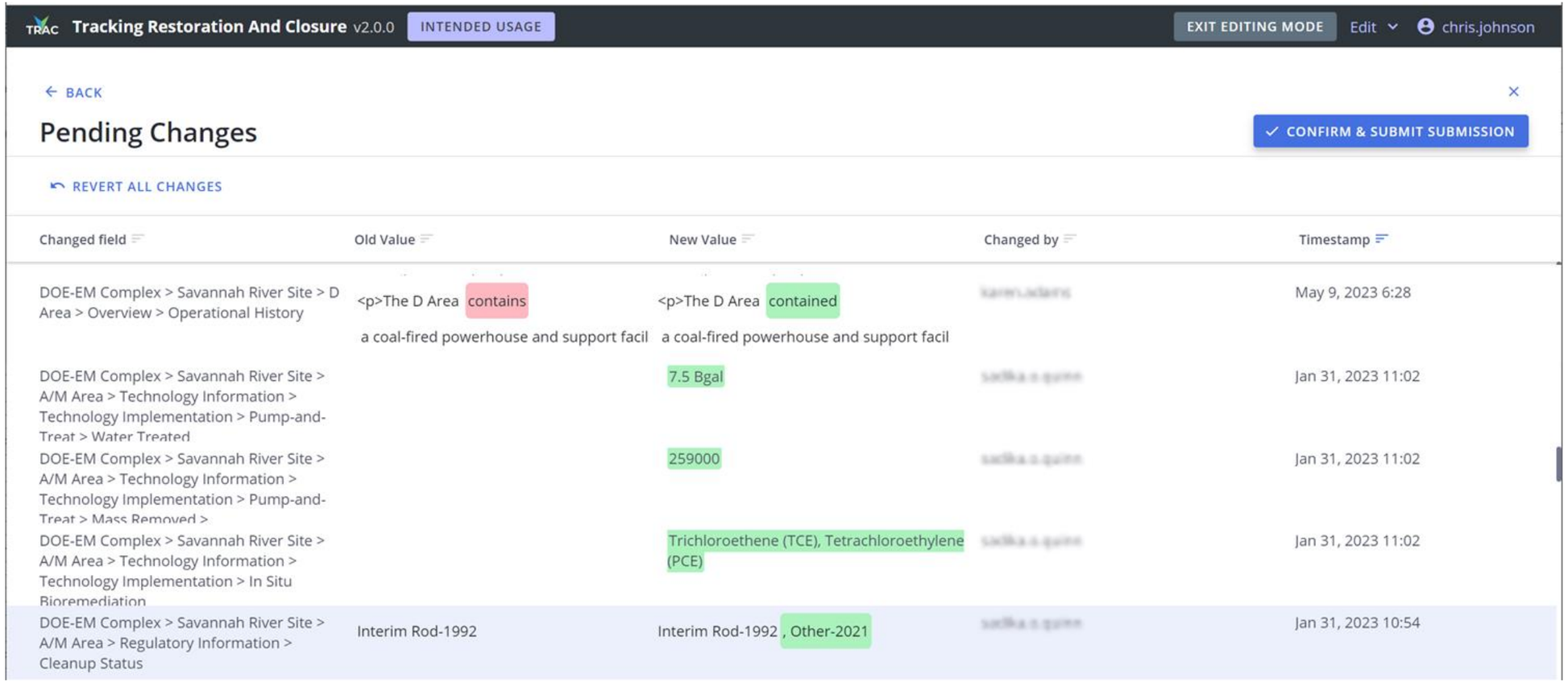
Editing Narratives

- Can add text and format it as desired
  - Font formatting
  - Numbered/bullet lists
- Can add hyperlinks
- Can add photos/images



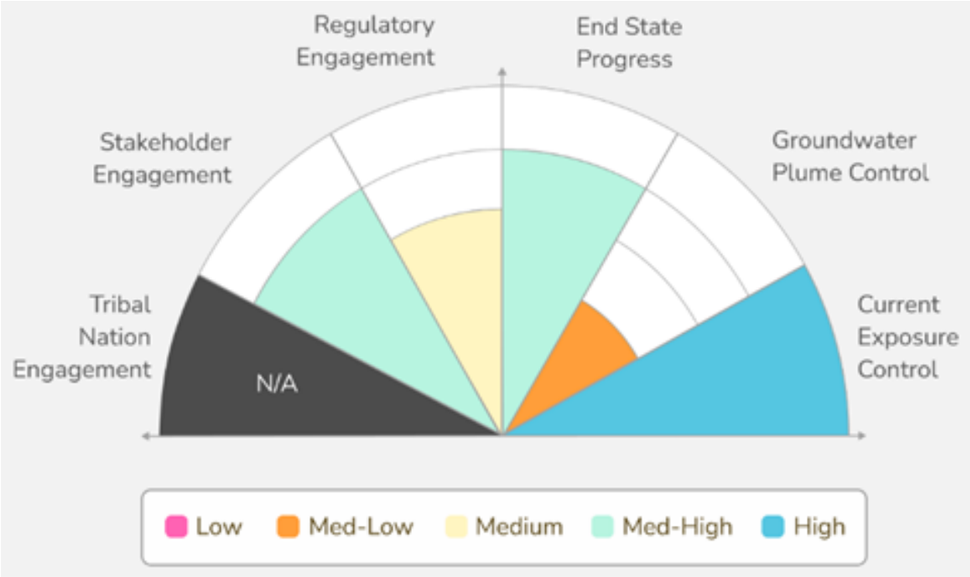
Pending Changes

- Pending changes screen lists edits compared to the prior version
- For submission of updates and for reviewing those updates



Future Work

- Incorporate end state metrics
  - Developed as part of the groundwater closure strategy
- Visualization of metrics over time
- Incorporate interactive, self-service GIS data file upload feature
- Content integration
  - Finish approvals (coming soon)
  - Finish adding Oak Ridge & LANL information
  - Add LLNL, NNSS, SNL, and WIPP as new sites
- Standing Operating Policies and Procedure
  - EM HQ will issue guidance for annual updates
- Version for tanks closure strategy
- Soil & disposal cell metrics



LLNL = Lawrence Livermore National Laboratory
NNSS = Nevada National Security Site
SNL = Sandia National Laboratories
WIPP = Waste Isolation Pilot Plant

Summary

- TRAC provides summary information for sites across the DOE-EM complex
- Can quickly identify
  - Which sites have a particular contaminant
  - Magnitude of the groundwater plume areas (how extensive is the problem)
  - Plume, regulatory, and remedy technology status
- Consistent set of summary metrics and explanatory information for all sites
- Facilitates communication on multiple levels (sites/headquarters, public)
- Provides information for DOE-EM to help make strategic decisions
  - Where are the issues?
  - Where to allocate resources?
- Part of the overall strategy for groundwater cleanup across the EM complex
  - Technical Targets / Site Interviews / Recommendations for groundwater closure strategy
  - ALTEMIS – Advanced Long-Term Environmental Monitoring Systems

Acknowlegements

- Co-Authors
  - Jennifer Fanning, Marcus Perry, Chloe Sow, Eric Engel, and Patrick Royer at the Pacific Northwest National Laboratory
  - Latrincy Bates and Grover Chamberlain (retired) at the Department of Energy Office of Environmental Management

- This work was funded by the DOE-EM Headquarters, who are gratefully acknowledged in this important endeavor to better track the progress of groundwater cleanup.
- Pacific Northwest National Laboratory is operated by Battelle Memorial Institute for the Department of Energy under Contract DE-AC05-76RL01830.

Thank You

https://trac.pnnl.gov

https://www.pnnl.gov/projects/trac

Contacts:

Christian Johnson, PNNL
cd.johnson@pnnl.gov

Latrincy Bates, DOE-EM
latrincy.bates@em.doe.gov

REMPLEX
CENTER FOR THE REMEDIATION OF COMPLEX SITES
@PNNL

remplex@pnnl.gov
https://www.pnnl.gov/projects/remplex

Technology Behind TRAC

- TRAC is a custom, single-page, web-based application
  - Modern, flexible framework
  - Web browser, dynamic content via AWS Lambda / AWS DynamoDB database
  - Database construction handles fusion of different data sets
- Hosted on Amazon Web Services (AWS)
  - Robust infrastructure – reliable, scalable, redundant
  - Lower maintenance costs associated with hosting
  - Server-side security updates by AWS
- Leverages AWS Cognito user management for role-based access
  - Curated, EM site-specific access and roles

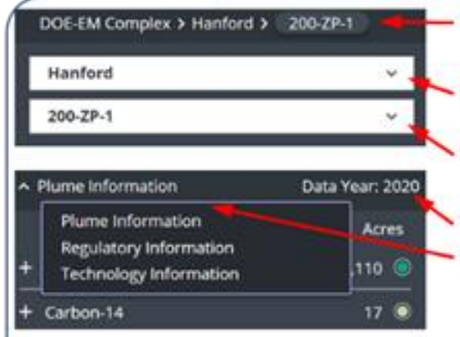
Amazon Lambda

Amazon DynamoDB

Amazon Cognito

Pacific Northwest
NATIONAL LABORATORY

Left Pane



- Navigation back up to higher levels
- Select EM Site or EM Complex
- Select a management unit
- Year(s) for site data
- Menu for plume, regulatory, or technology metrics

EM Complex or EM Site levels show totals: plume acres and number of management units for a category

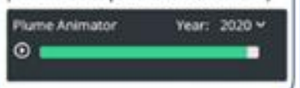
Bars show distribution across categories

Management unit level shows plume acres and regulatory/ technology summary information

Map

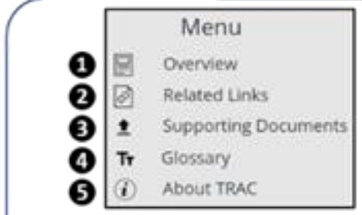
- Zoom controls (or use mouse wheel)
- Satellite map
- Street map

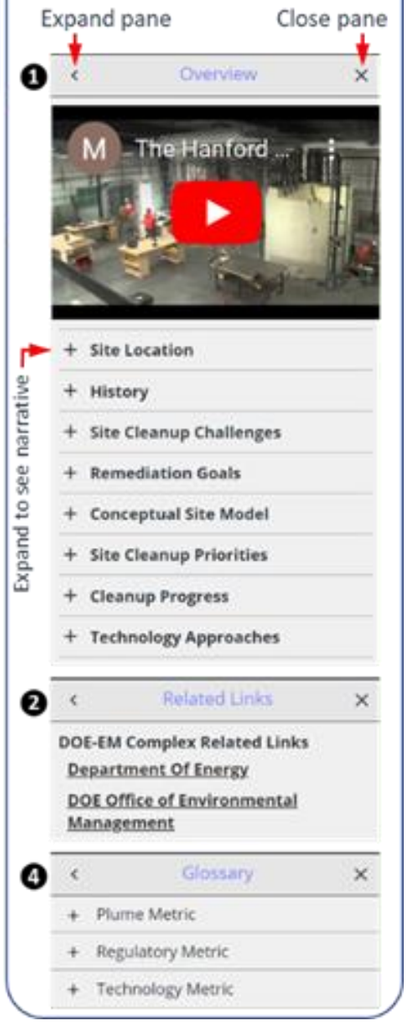
Plume animator (if multiple plume maps are available)



Top Right (header bar): Log in/out and feedback

Right Pane





Welcome to TRAC
(Tracking Restoration And Closure)

TRAC is focused on communicating cleanup status, technical challenges, and needs for site closure of U.S. Department of Energy Office of Environmental Management (DOE-EM) sites. TRAC facilitates open communication, strategy development, and long-term protection of human health and the environment. TRAC provides video, summary narrative (❶), geospatial visualization of groundwater plumes (in the Map), and metrics in the left pane (about plumes, regulatory status, and remediation technology implementation) for the DOE-EM complex, a particular DOE-EM site, or a management unit within a site.

Tips for using TRAC:

- Take a few seconds to familiarize yourself with TRAC functionality via the description here of elements available in the Left, Right, and Map panes.
- Make the **Glossary** ❹ your first stop to understand terminology of TRAC.
- TRAC provides summary information. The focus is not on specific numbers (which may be rounded values or sometimes have more significant digits than needed). Rather, the focus is on the magnitude/quantity, and, ultimately, how these numbers change over time as work progresses. For detailed information, numbers, and analysis, check out the **Related Links** ❷ and **Supporting Documents** ❸ for links to the annual report, 5-year report, online databases, or other resources.
- Recognize that status information will change over time; some aspects may be uncertain and will be refined over time as characterization or remedy operations provide more information.
- As more sites are included and DOE-EM prepares strategy for the coming decade, the metrics and categories used to describe status will evolve in TRAC to better track progress towards closure.