

Using Data Visualization Tools to Analyze and Improve PNNL Operational Performance



DOE 2010 ISM Champions Workshop

PNNL Presenters:

- **Christopher Larmey**
- **Rob Cuello**

PNNL Technical Support:

- **Scott Dowson**
- **Penny Gouge**



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Presenter Biography

Christopher Larmey, PNNL Assurance Systems

▶ Work Experience

- 20 yrs at PNNL: assurance, performance analysis, analytics, strategic planning, assessment, issue management, quality, systems development, process improvement, software
- 8 yrs in aircraft and communications industries: systems engineering and quality

▶ Education

- M.S., Applied Mathematics, University of Arizona
- B.S., Engineering Mathematics, University of Arizona

▶ Current Projects

- Analytics: data visualization, data mining, predictive modeling



Presenter Biography

Rob Cuello, Energy & Environment Directorate

▶ Work Experience

- 29 yrs at PNNL: research operations, performance management, planning and assessment, requirement management, quality management, and biomass gasification research.

▶ Education

- B.S., Zoology, Washington State University, Pullman

▶ Current Projects

- Research operational performance: assessment and analysis



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Presentation Outline

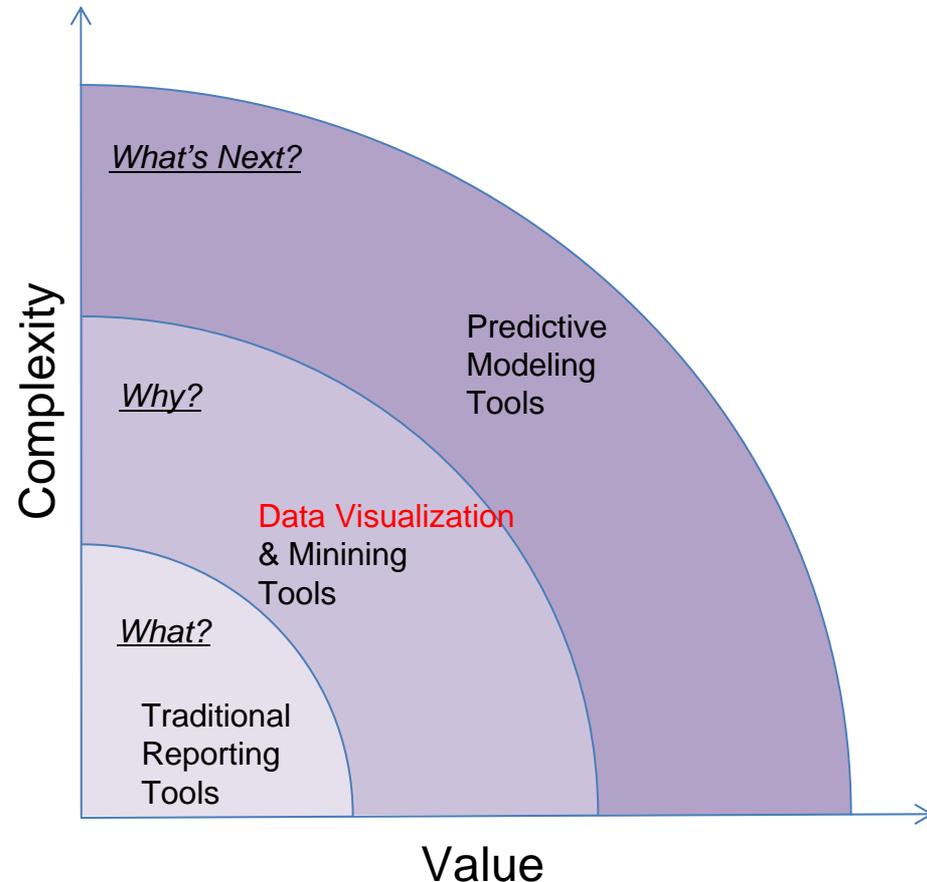
- ▶ Introduction
- ▶ Performance Analysis Tool Suite
- ▶ Overview of Data Visualization Tools
- ▶ Video: Example Use of Data Visualization Tools
- ▶ Ongoing Effort
- ▶ Questions

*“**Information** is the reduction of uncertainty.
Noise is anything that is not information or
impedes getting information.”*

Dr. Claude Shannon, Bell Laboratories

Performance Analysis Tool Suite

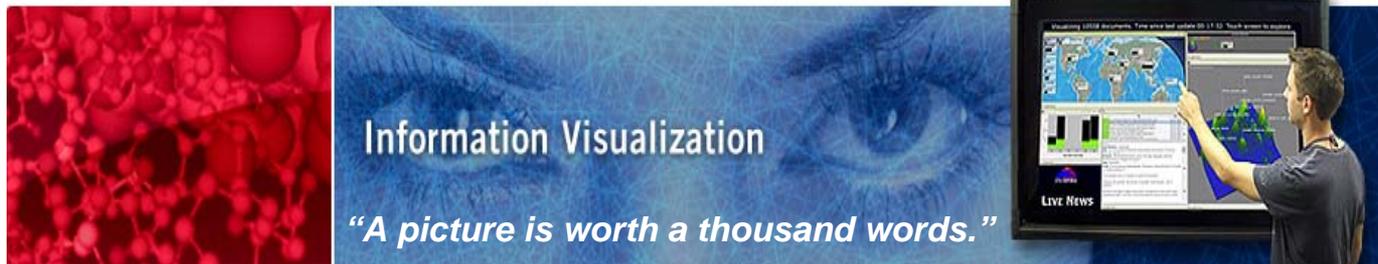
- ▶ **Traditional Tools**, including critiques, causal analysis, trending, and expert summaries of operational performance, help reactively identify what happened and why
- ▶ **Data Visualization Tools** visually analyze integrated data sets to help proactively convert overwhelming amounts of stove-piped data into actionable information
- ▶ **Predictive Modeling Tools** create statistical models, which identify factors that drive performance, and use those factors to predict future performance



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Overview of Data Visualization Tools

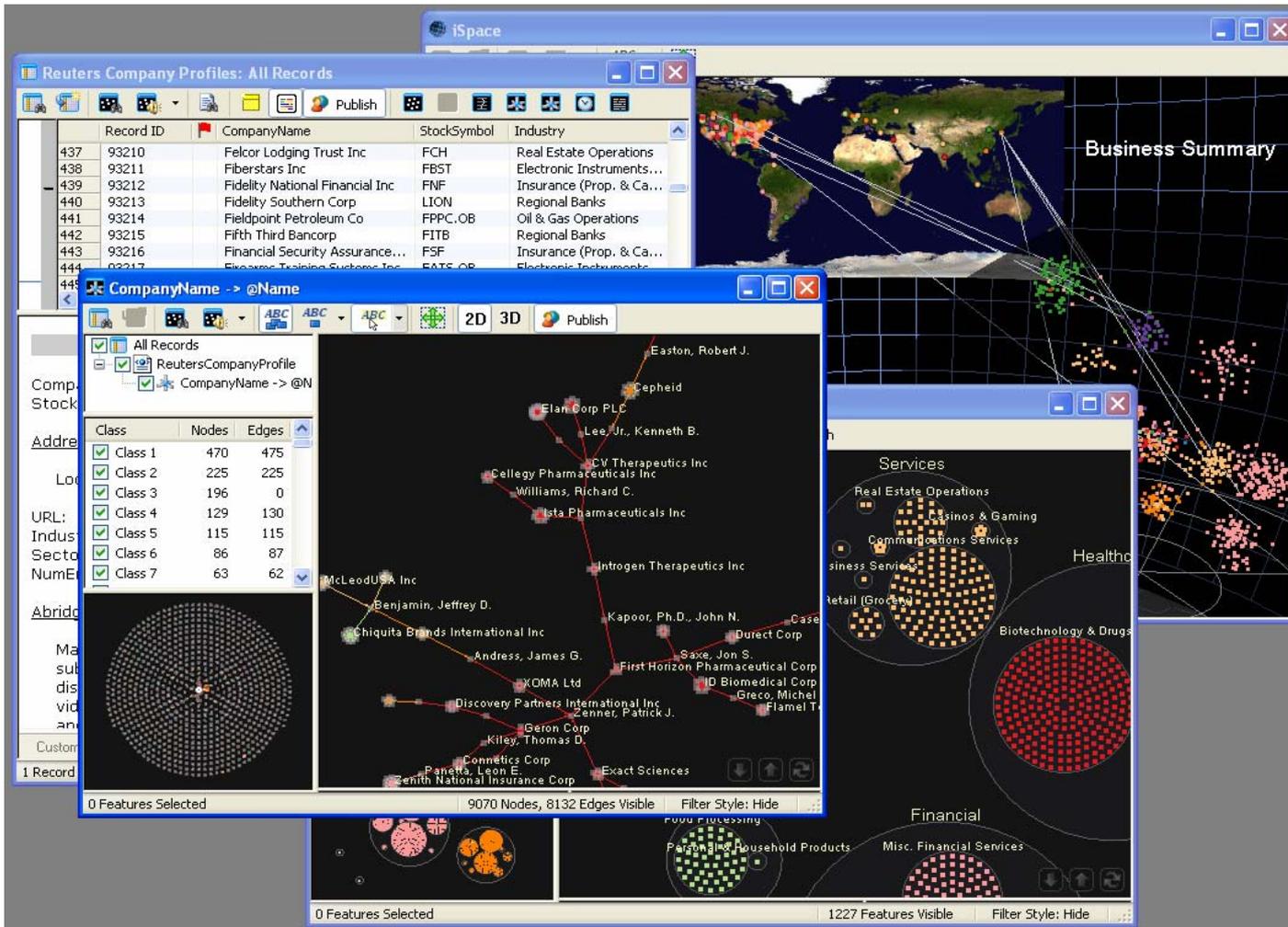
- ▶ Have been effectively used in fields as varied as law enforcement, nuclear non-proliferation, and intelligence
 - Help turn overwhelming amounts of data into “actionable” information
 - Provide simplified, integrated views of complex data
 - Help get beyond “what” to “why”
 - Can be tailored to support all levels of management
- ▶ These sophisticated tools developed by research projects at a national laboratory can also be used to improve the Laboratory’s operational performance



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Video: Example Use of Data Visualization Tools



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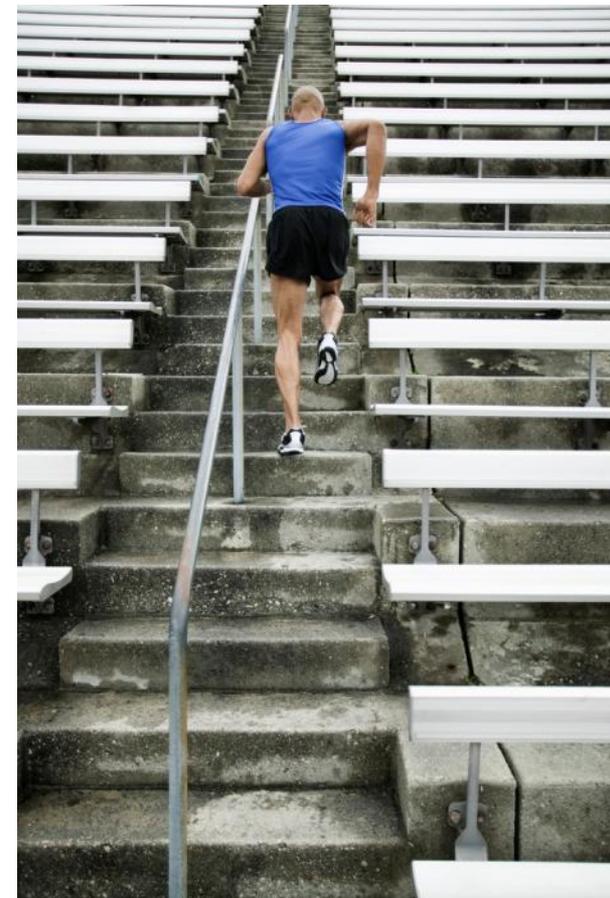
Click the black box to play the demo.

Use of Data Visualization Tools at PNNL

- ▶ Help focus assessment efforts
 - High risk areas and activities
 - Outside standard controls
 - Where performance is not meeting expectations
- ▶ Help coordinate and leverage all assurance activities
 - Quickly identify gaps/issues and take appropriate actions
 - Deliver tailored, actionable views of data to manager desktops
- ▶ Result in
 - More effective deployment of expert specialists
 - Reduced assessments
 - Less work interruption
 - An assessment portfolio that is right-sized and provides leadership assurance of performance

Ongoing Effort

- ▶ Expanding current use of data visualization tools
- ▶ Expanding web-enabled capabilities to provide information to managers' desktops
- ▶ Applying visualization tools to other types of operational data such as project, capability management and financial
- ▶ Continuing to develop data-mining and predictive modeling capabilities



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Questions?

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**For a live demonstration of data visualization tools,
please come see us at the Poster Session!**

Backup Slides

Included in case the video showing example use of data visualization tools does not operate properly

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PNNL Challenge

- ▶ PNNL manages about 2,000 active projects and performs about 10,000 assessments/inspections each year.
- ▶ PNNL is looking for analysis tools to help:
 - Be more efficient and effective in performing these activities.
 - Better understand PNNL's current assurance portfolio, including gaps and redundancy.
 - Better target high-risk areas where work outside standard operating conditions is being performed.
 - Better deploy expert support based on risks.
 - Achieve a right-sized assurance portfolio, given the hazards and risks within the Laboratory.

Large, Complex Data Sets are Difficult to Use

Record ID	Assess Date	Building	Room	SA Role	LVL2	LVL3
24232	3/31/2010	XYZ	1419	S&H Rep	XYZ100	XYZ120
24828	3/31/2010	XYZ	1419	Elec Safety Rep	XYZ100	XYZ120
24929	3/31/2010	XYZ	1518	S&H Rep	XYZ100	XYZ120
25086	1/22/2010; 4/27/2010	XYZ	1510	CSM	XYZ100	XYZ120
25264	2/16/2010; 3/31/2010; 5/14/2010	XYZ	1527	CSM;S&H Rep	XYZ100	XYZ120
25610	1/22/2010; 4/27/2010	XYZ	1510	CSM	XYZ100	XYZ120
25683	12/11/2009 ;3/31/2010	XYZ	1518	Manager;S&H Rep	XYZ100	XYZ120
26806	3/31/2010	XYZ	1419	S&H Rep	XYZ100	XYZ120
27141		XYZ	1419		XYZ100	XYZ120
27432	3/31/2010	XYZ	1510	Elec Safety Rep	XYZ100	XYZ120
27580	3/31/2010	XYZ	1518	S&H Rep	XYZ100	XYZ120
27840	3/31/2010	XYZ	1518	S&H Rep	XYZ100	XYZ120
27909	4/27/2010	XYZ	1518	CSM	XYZ100	XYZ120
28325	3/31/2010	XYZ	1419	S&H Rep	XYZ100	XYZ120
28732	3/31/2010	XYZ	1518	Elec Safety Rep	XYZ100	XYZ120
28755	3/31/2010	XYZ	1518	S&H Rep	XYZ100	XYZ120
28778	2/16/2010	XYZ	1527	CSM	XYZ100	XYZ120
29065	3/31/2010	XYZ	1419	Elec Safety Rep	XYZ100	XYZ120
29137	3/31/2010; 4/27/2010	XYZ	1518	S&H Rep;Env Comp Rep;CSM	XYZ100	XYZ120
29236	3/31/2010; 4/27/2010	XYZ	1419	S&H Rep;CSM	XYZ100	XYZ120
29248	3/31/2010	XYZ	1518	Elec Safety Rep	XYZ100	XYZ120
29375	3/31/2010; 4/27/2010	XYZ	1419	Elec Safety Rep;CSM	XYZ100	XYZ120
29783	3/31/2010; 4/27/2010	XYZ	1419	S&H Rep;Env Comp Rep;CSM	XYZ100	XYZ120
29930	3/31/2010	XYZ	1510	Elec Safety Rep	XYZ100	XYZ120
30049	2/16/2010; 3/31/2010	XYZ	1527	CSM;S&H Rep	XYZ100	XYZ120
30057	1/22/2010; 3/31/2010	XYZ	1510	CSM;S&H Rep;Env Comp Rep	XYZ100	XYZ120

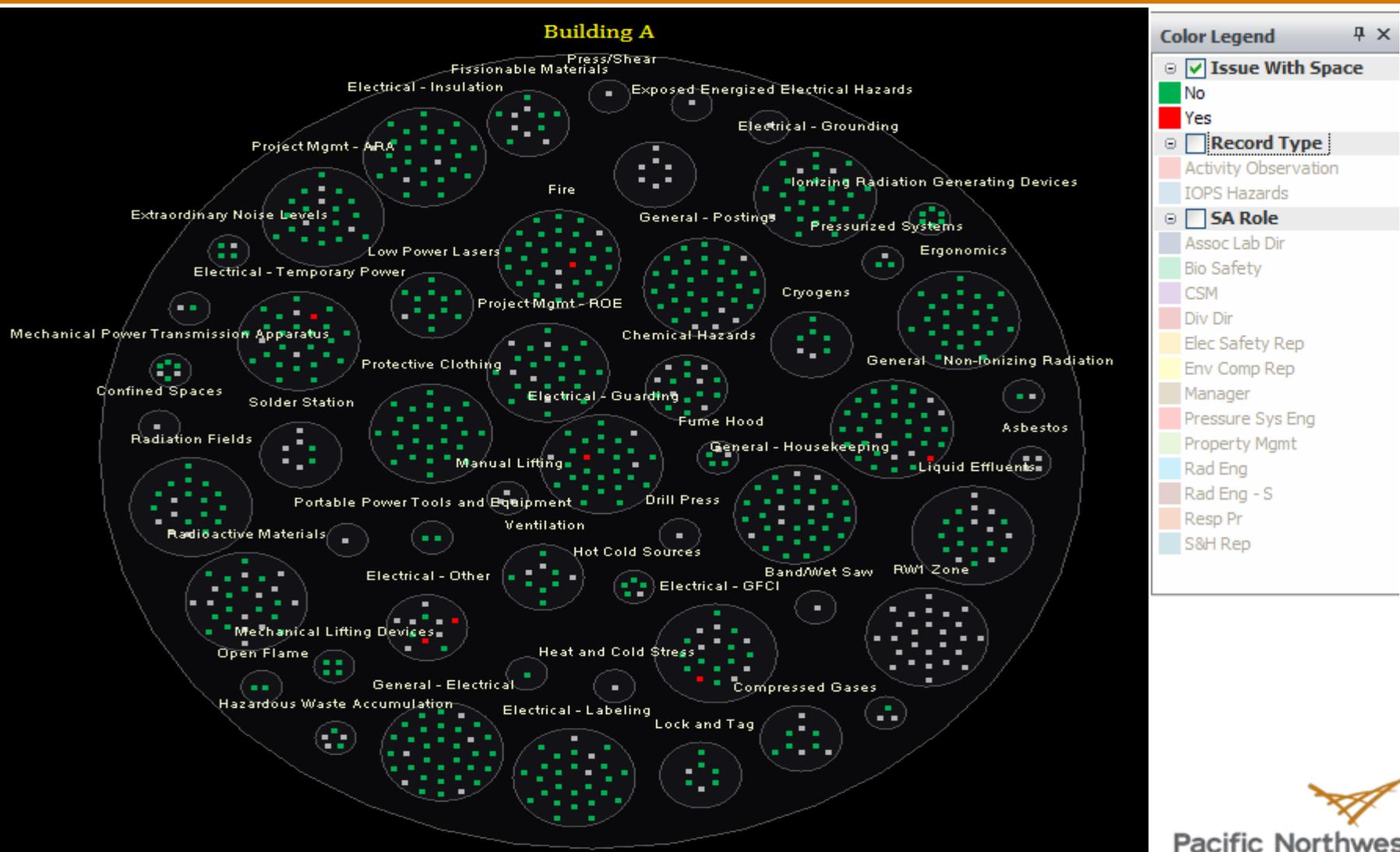


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Visual Representation is Easier to Understand

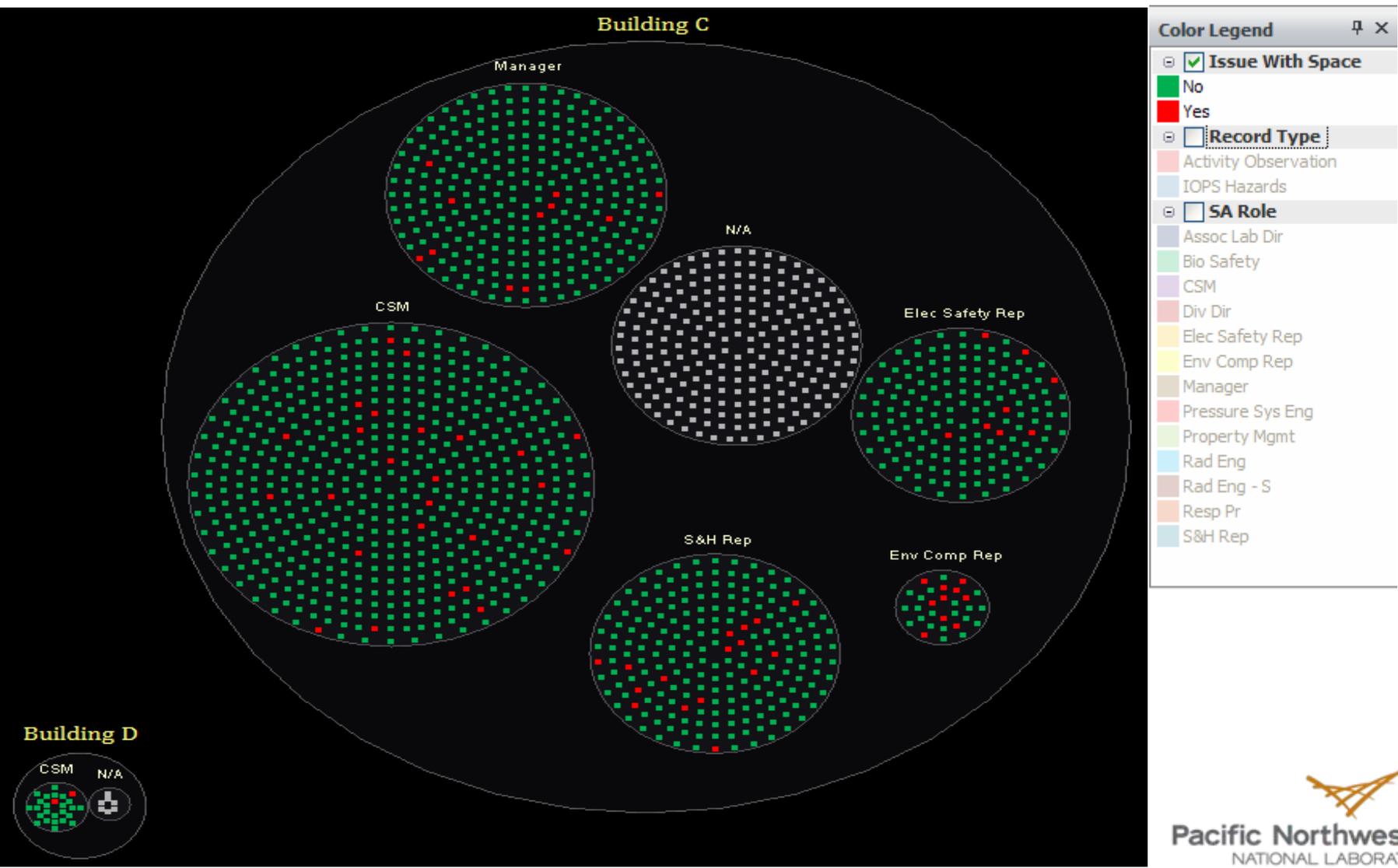


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Multiple Views Provide Additional Insight

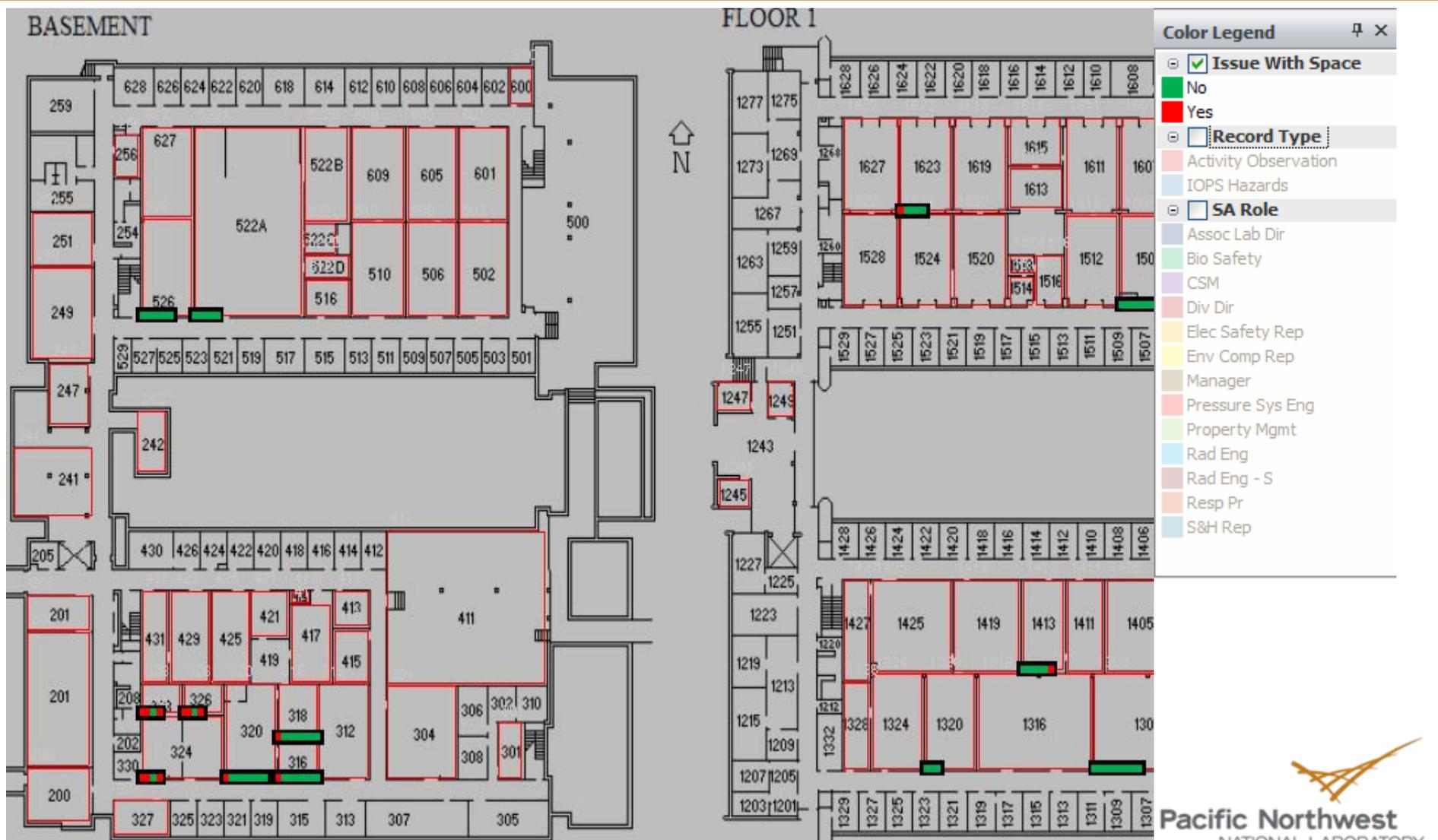


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Data Overlaid on Maps Provides Spatial View



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Drill-Down into Detailed Data When Needed

Building: **Issue Found:** No
Room: 1510 **Department Code:**
Hazard: Fixed Power Tools and Equipment **Department ID:**
Evaluation Date: 1/22/2010 **Last Assessment:** 1/22/2010

Number of Assessments: 2

Assessment ID: 37613 **Issue Found:** No
Assessment Date: 1/22/2010 **Assessor:**
Department Code: **Assessor ID:**
Department ID: **Assessor Role:** CSM
Question ID: 780 **Check List:** Fixed Power Tools and Equipment
Acceptable: Yes **Life Cycle:** Equipment Life Cycle

Is each machine provided with a positive means of deactivating and locking out the power source?

Assessment ID: 37614 **Issue Found:** No
Assessment Date: 1/22/2010 **Assessor:**
Department Code: **Assessor ID:**
Department ID: **Assessor Role:** CSM
Question ID: 780 **Check List:** Fixed Power Tools and Equipment
Acceptable: Yes **Life Cycle:** Equipment Life Cycle

Is each machine provided with a positive means of deactivating and locking out the power source?



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