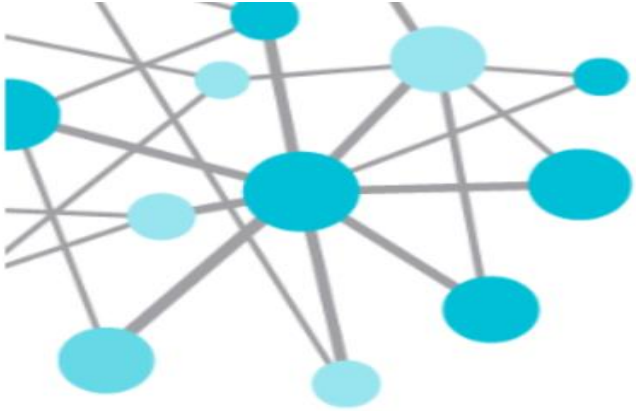


OSIsoft. T&D USERS GROUP 2014

The Power of Data

ALBANY SEP 10-12 NEW YORK

DECISION READY IN REAL-TIME

Presented by **Matt Tolbirt (PG&E), Kevin Bellflower (PG&E), Mike Nettler (PG&E), Greg Dumas (DST Controls)**

About PG&E Electric Transmission

Electricity and Gas

- Northern and Central California
- 15 million people
- 70,000-sq-mile service area
- 140,000 circuit miles
- All-time Peak 22,544MW (07/25/06)

Substations

Transmission 142

Transmission

(Circuit Miles)

500 kV	1,330
230 kV	5,420
115 kV	6,230
60/70 kV	5,660
Total	18,640

We Serve 1 in 20 Americans

Honoring Innovation

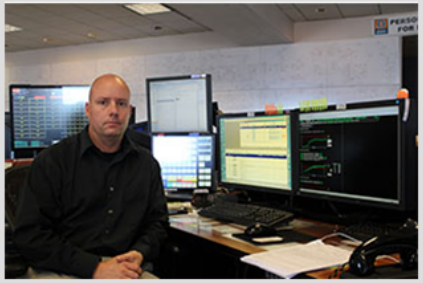
Electric Operations Systems Dispatchers are Rewarded for Innovation

By Alex Jespersen-Wheat | April 25, 2013

Mike Nettler knows that the saying, "if it ain't broke, don't fix it" doesn't hold true at PG&E. In fact, it's quite the opposite.

Here, employees are rewarded for speaking up about processes that are working, but could be made even better. For example, Mike—a Senior Systems Dispatcher in Electric Operations—has been working over the past year-and-a-half to develop a new process for monitoring power flow limits during outages.

PG&E's Transmission and Distribution System has over 141,000 circuit miles, and on average, 63 pieces of transmission equipment are taken out of service each day. In order to provide our customers with safe, uninterrupted service, our operating transmission lines must reliably carry more power even if nearby equipment is removed from service.



Senior Systems Dispatcher Mike Nettler helped develop a new tool to monitor power flow limits during outages. He and his colleague will be inducted into PG&E's Inventor Hall of Fame. (Photos by Alex Jespersen-Wheat)

This is where systems dispatchers like Mike and his co-worker **Kevin Bellflower** come in. Their role is to monitor the entire electric transmission system and ensure that power flow increases don't exceed the allowable limit for each line.

Previously, systems dispatchers would need to create monitoring and alarming programs for new power flow limits whenever an outage occurred. The

I Need To... + Show

A Message from Nick

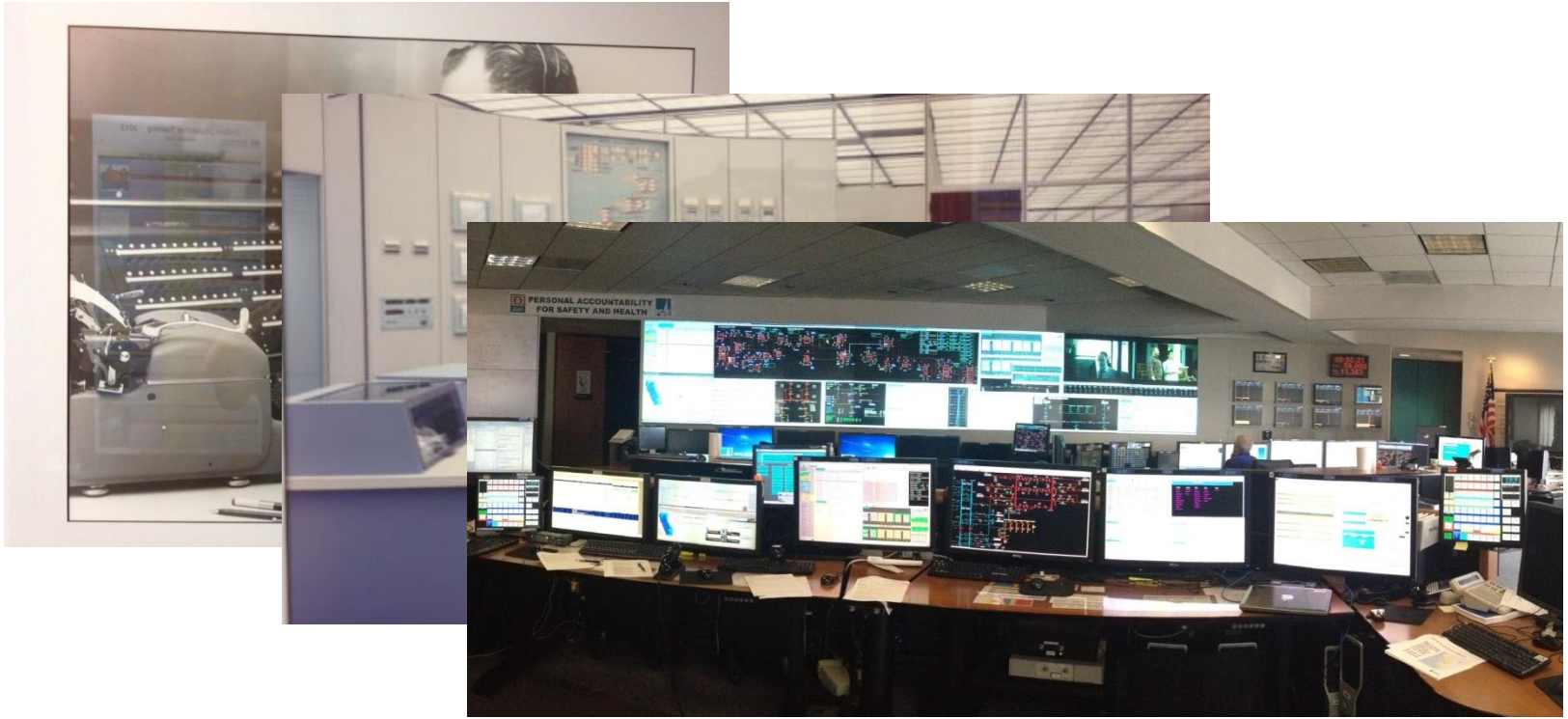
March 7, 2013

Great companies do the right thing. The "right thing" for PG&E means we have no priority more important than ensuring public and employee safety as we deliver reliable and affordable natural gas and electricity to millions of Californians.

Read More >

Previous Messages from Nick >

Control Room Evolution



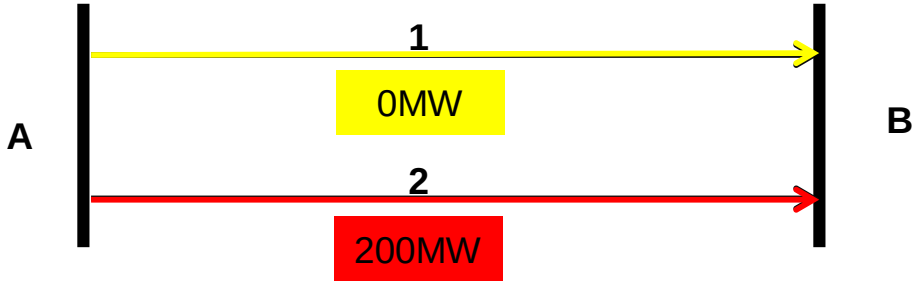
Constant Maintenance

Equipment Out of Service:

- 2012 approx. **23,000** equipment maintenance outages.
- Average of **63** per day
- **Every** scheduled outage requires an Engineering study to determine if adjacent equipment is **At Risk**
- System Dispatch routinely monitors **20 to 40** flow limits per day for overloads
- We already use >**50 Tools/Programs**

Equipment “At Risk”

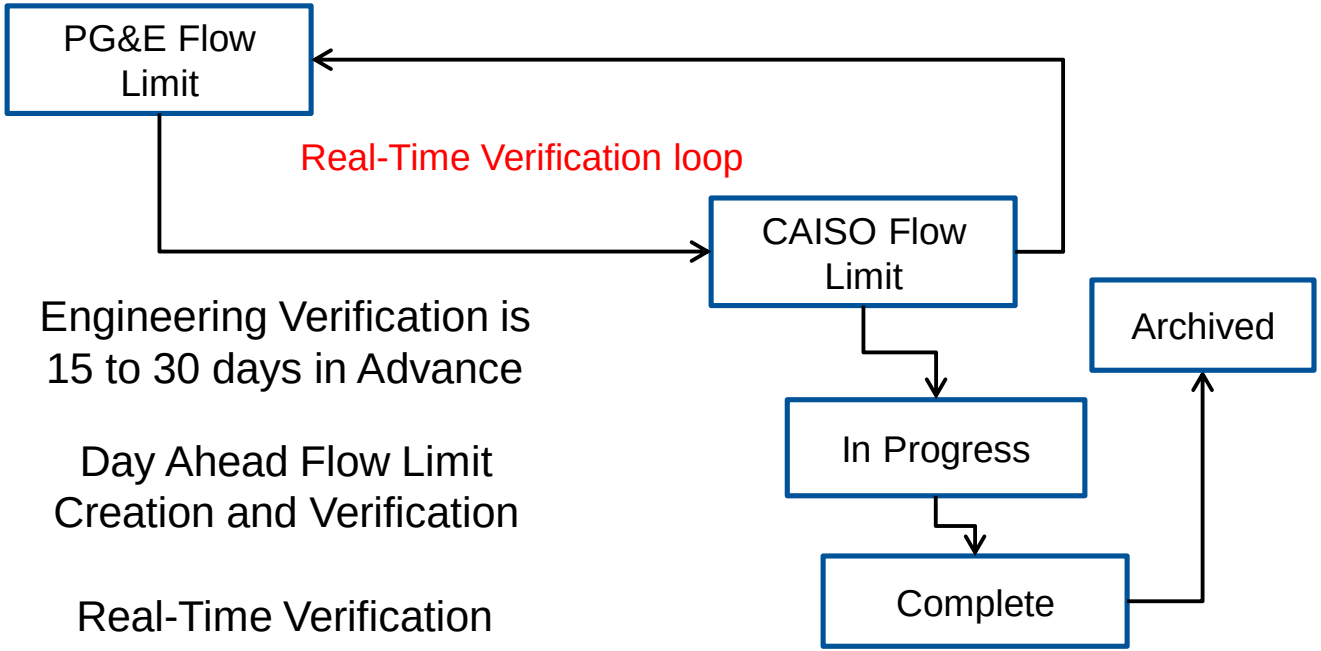
Constant Maintenance means that adjacent equipment is being placed “At Risk” of Overload.



It Doesn’t stop at Equipment “At Risk”

Super Bowl Power Disturbance

Coordinating with CAISO



Engineering Verification is 15 to 30 days in Advance

Day Ahead Flow Limit Creation and Verification

Real-Time Verification

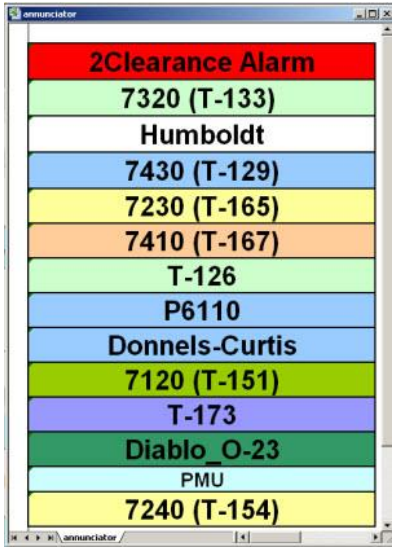
Today's Process

Spreadsheet

Tesla-Tracy 115kV line & Ellis 115kV Tap sect Cleared		TE	194628	9/11
Pre-Clearance Requirements - Flow Limit #1				
0.65 * Tesla-Tracy 115kV line (-> @ Tracy)		10		
0.84 * Tesla-Shulte #2-115kV line (-> @ Tesla)		-5		
Tesla-Shulte #1-115kV line (-> @ Tesla)		-6		Limit
	Total	-1	MW	178
Pre-Clearance Requirements - Flow Limit #2				
0.59 * Tesla-Tracy 115kV line (-> @ Tracy)		9		
0.72 * Schulte-Lammers 115kV line (-> @ Schulte)		47		
Schulte-Manteca 115kV line (-> @ Schulte)		40		Limit
	Total	97	MW	219
Real Time Requirement - Flow Limit #1				
0.84 * Tesla-Shulte #2-115kV line (-> @ Tesla)		-5		
Tesla-Shulte #1-115kV line (-> @ Tesla)		-6		Limit
	Total	-11	MW	178
		47		
		40		Limit
	Total	88	MW	219

Room for error

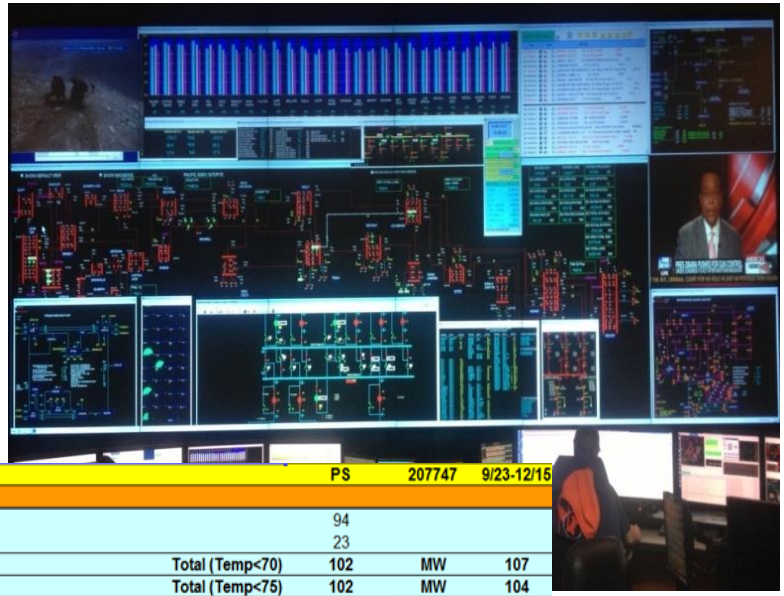
Generic Non-Audible Alarms



Additional Challenges

Static Limits for Dynamic Variables:

- ***Temperature***
- ***Weather***
- ***Time of Day***
- ***Or other exceptional condition***



Pittsburg-San Mateo 230kV line cleared		PS		207747	9/23-12/15
Real-Time Requirement - Flow Limit #1					
Newark-Ames #2-115kV Line (-> @ Newark)		94			
0.08*Newark-Ravenswood 230kV Line		23			
	Total (Temp<70)	102	MW	107	
	Total (Temp<75)	102	MW	104	
	Total (Temp<80)	102	MW	102	
	Total (Temp<85)	102	MW	99	
	Total (Temp<90)	102	MW	96	
	Total (Temp<95)	102	MW	94	
	Total (Temp>95)	102	MW	91	

More room for Error

Opportunity for Change

The Must haves:

- ***Dynamic***
- ***Trend***
- ***Audible Alarm***
- ***Standardized***
- ***Repeatable***
- ***Easy to Use and Teach***

Reality Check-Who is this Tool for?

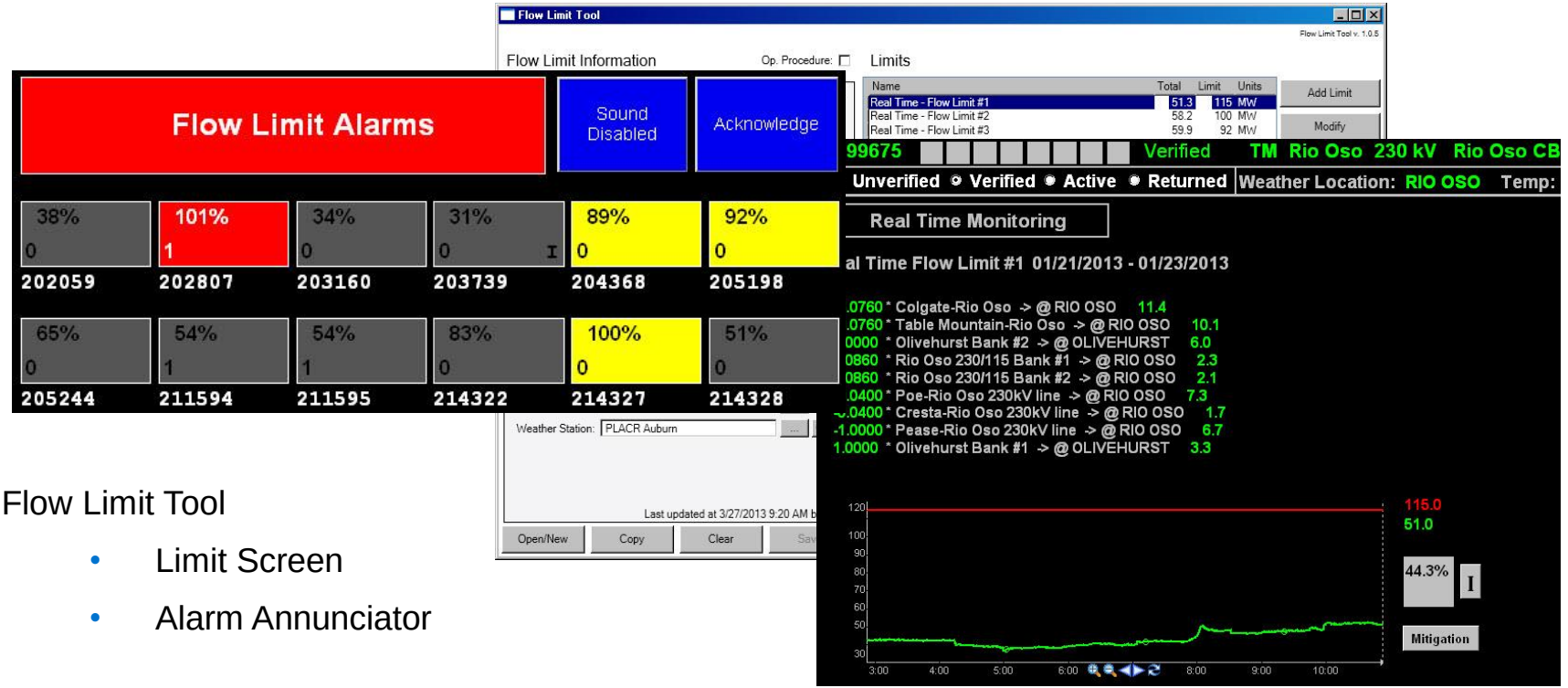
Real Time Operations / Operators

Real Time Tool:

- We're building as many as **20** of these limits per night
- ProcessBook has repeatability **limitations** when building displays
- This is **one** of the **70+ tasks** performed Daily…using just one of those **50+ Tools** we mentioned earlier

Dispatchers are **NOT** Display Builders

The Solution – Flow Limit Tool



Flow Limit Tool

- Limit Screen
- Alarm Annunciator

Flow Limit Tool

Limits:
Type, Actual Flow Total, Limit

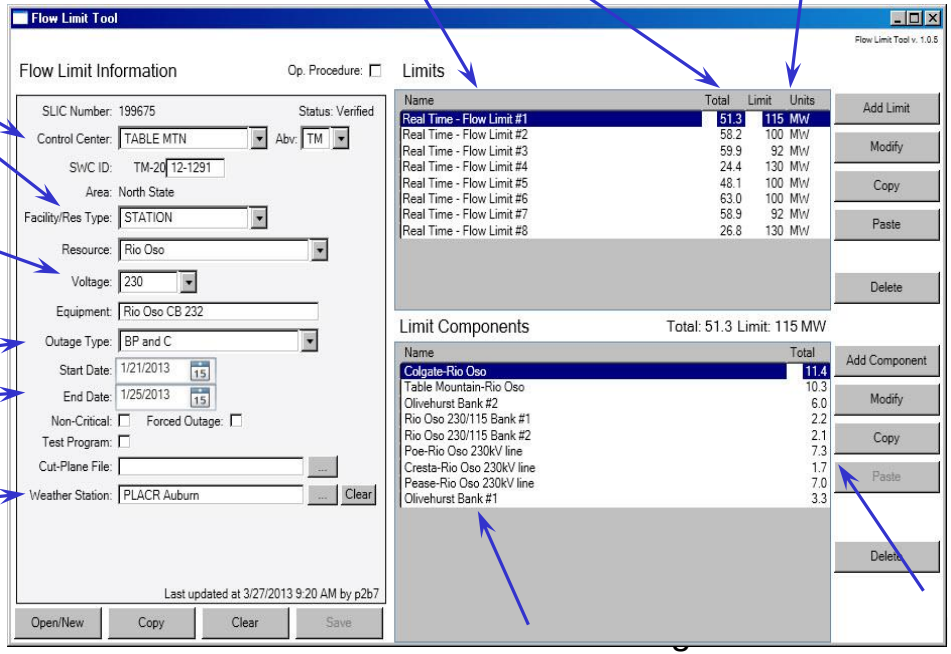
Flow Limit Information:

- Area of Control
- Resource and Type
- Voltage

(This Information is updated Daily from Outage Database)

- Outage Type
- Date
- Weather Station info

  (AF Tables)



ue

(Updated in Real Time)

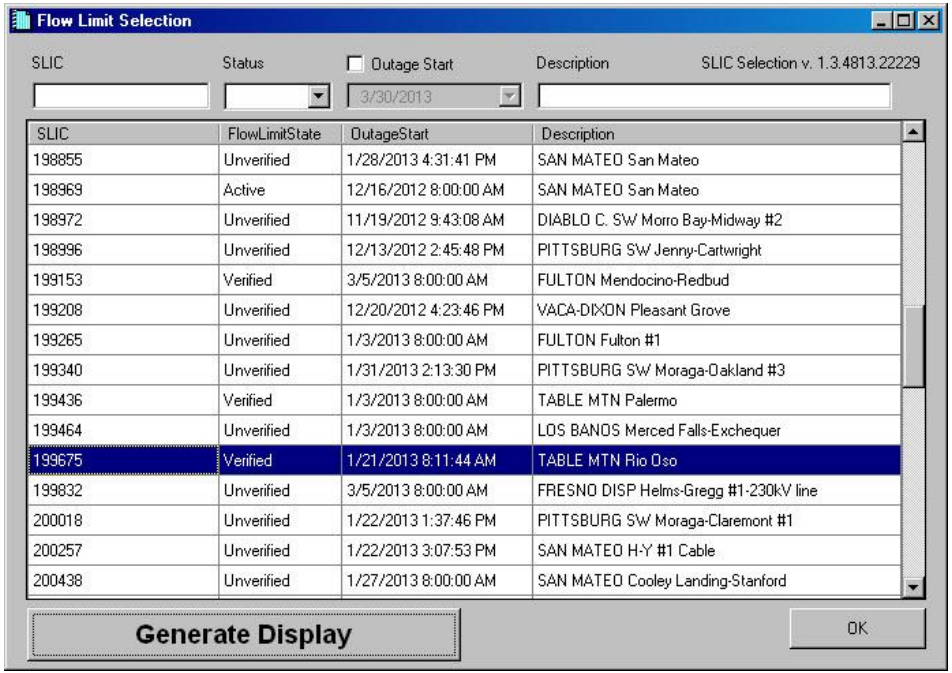
Display Generator

Add-in to Processbook:

Search Fields

- Control Number
- Verification Status
- Date
- Description
- EZ Buttons

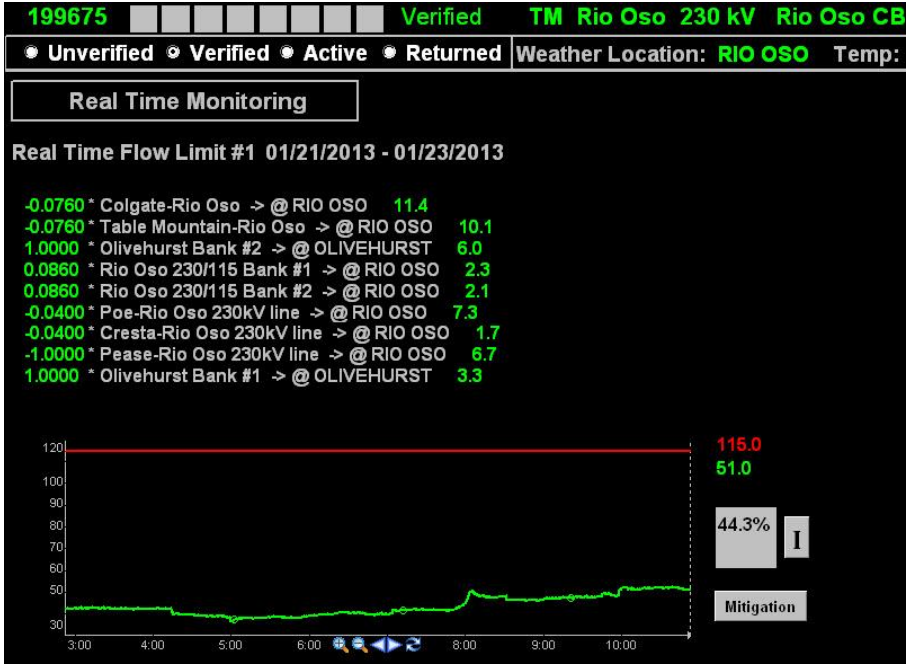
Ease of Use for the END USER was a Priority



Limit Screen

Standard Display:

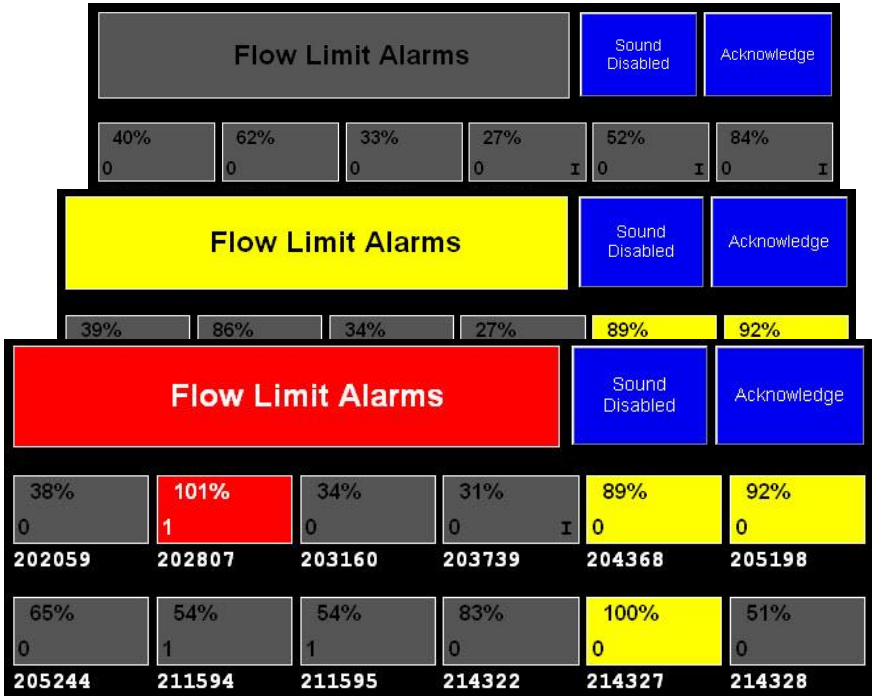
- Real Time Line flows
- Trend with Proximity to alarm
- Staggered Alarm points (*Staged at 85% and 100%)*
- Mitigation info button



Alarm Annunciator

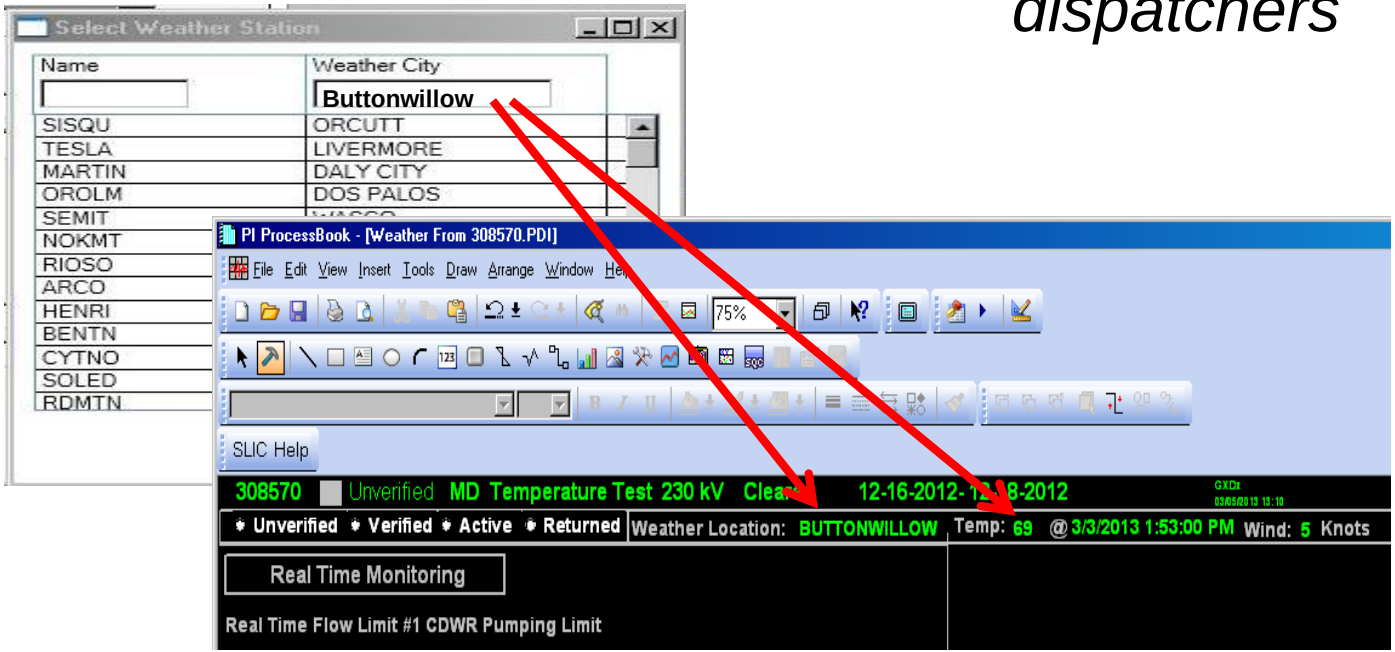
Standard Display:

- Real Time **percentage** to alarm
- **Color Coded** Alarm points (*85% and 100%)*
- **Audible**
- **Linked** to Limit Screen
- Provides **Rapid Situational Awareness**



Adding Weather data

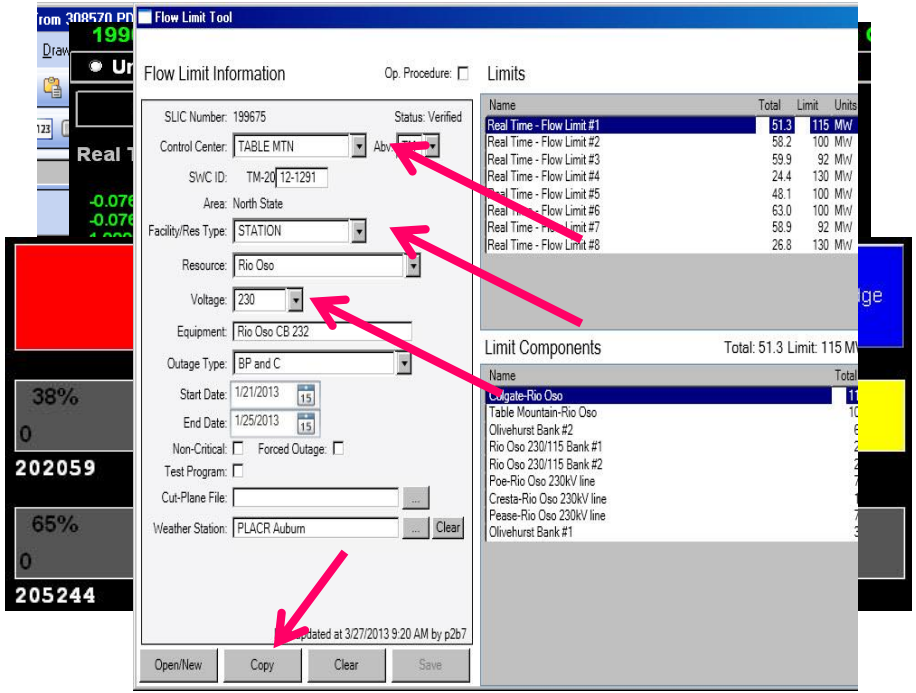
Real time weather always available to dispatchers



Lets see how we did - Results

The Must haves:

- ***Dynamic***
- ***Trend***
- ***Audible Alarm***
- ***Standardized***
- ***Repeatable***
- ***Easy to Use***



Benefits: Enhanced Situational Awareness

Trends

- *Visual Proximity to Limit*
- *Rapid Situational Assessment*

Alarming

- *Audible*
- *Staged 95% and 100%*
- *Color Coded*

Weather

- *Real-Time Temperature*
- *Wind measurements*

Data Quality

- *Displays quality (Good, etc.)*

Efficiency

- *Reduced Set-up time*
- *Lower Training Time*

Financial

- *Rapid implementation of mitigation based on actual data*
- *Customer Power Outages are Expensive*

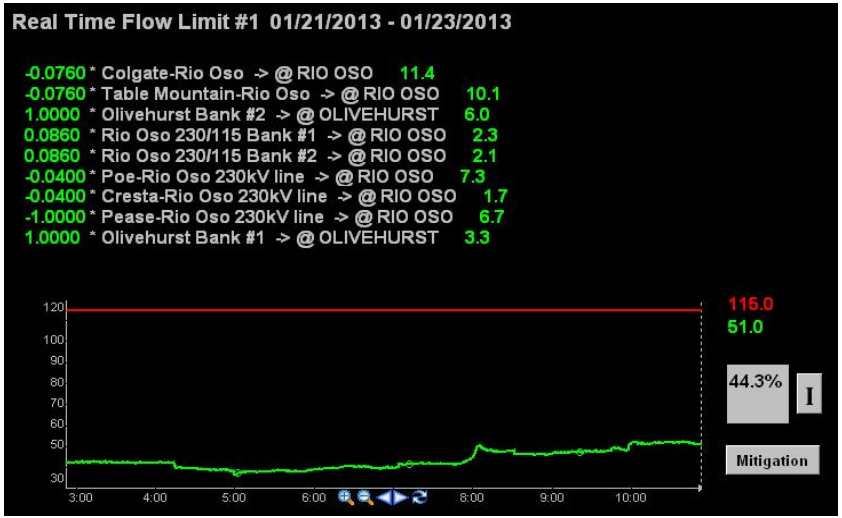
Security

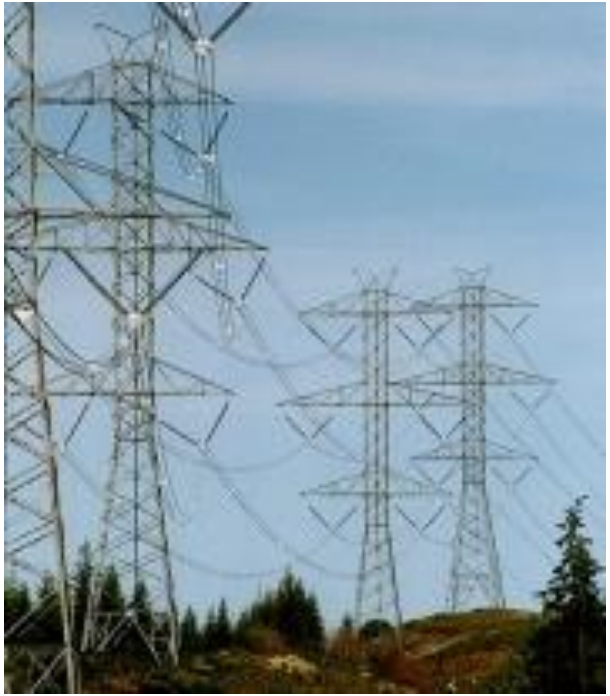
- *Equipment 'At Risk' is more secure*

Safety

- *Crews working on equipment*

Questions?





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