PowerWorld Simulator and CIP-014-01

Tracy Rolstad
System Planning
Apologies for the Massive Amount of Background Slides…but they matter!

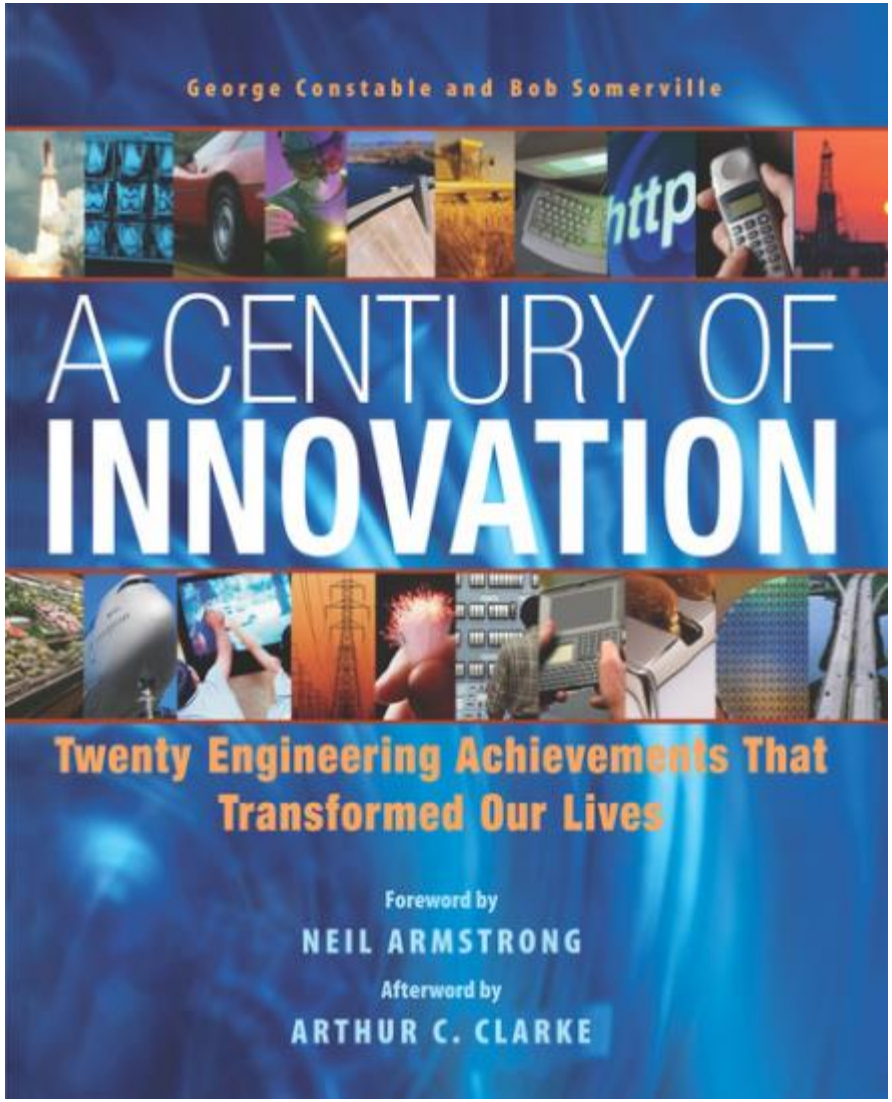
Tracy Rolstad (Education)

- United States Navy (1980 to 2003)
  - Nuclear Power School
    - Various schools too numerous to list
- University of Idaho
  - BSEE, 1992
    - Engineering Advisory Board Member (Present)
- Naval War College
  - Diploma, Naval Command and Staff, 1999
    - Joint Professional Military Education, phase I

Resume…

- Avista Corporation
  - Senior Pwr Sys Consultant, System Planning
  - WECC TSS Chair
- Utility System Efficiencies
  - Senior Power Systems Analyst
- The Bonneville Power Administration
  - Senior Engineer, System Operations
- The Joint Warfare Analysis Center
  - **EP Senior Analyst, PACOM Chief of Targets**
  - **Special Technical Operations Action Officer**
- Nuclear Navy (Attack Submarines)
  - Engineering Watch Supervisor
  - Reactor Operator

Greatest Engineering Achievements of the 20th Century



Greatest Engineering Achievements of the 20th Century

Welcome!

How many of the 20th century's greatest engineering achievements will you use today? A car? Computer? Telephone? Explore our list of the top 20 achievements and learn how engineering shaped a century and changed the world.

1. Electrification
2. Automobile
3. Airplane
4. Water Supply and Distribution
5. Electronics
6. Radio and Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning and Refrigeration
11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household Appliances
16. Health Technologies
17. Petroleum and Petrochemical Technologies
18. Laser and Fiber Optics
19. Nuclear Technologies
20. High-performance Materials

Greatest Achievements

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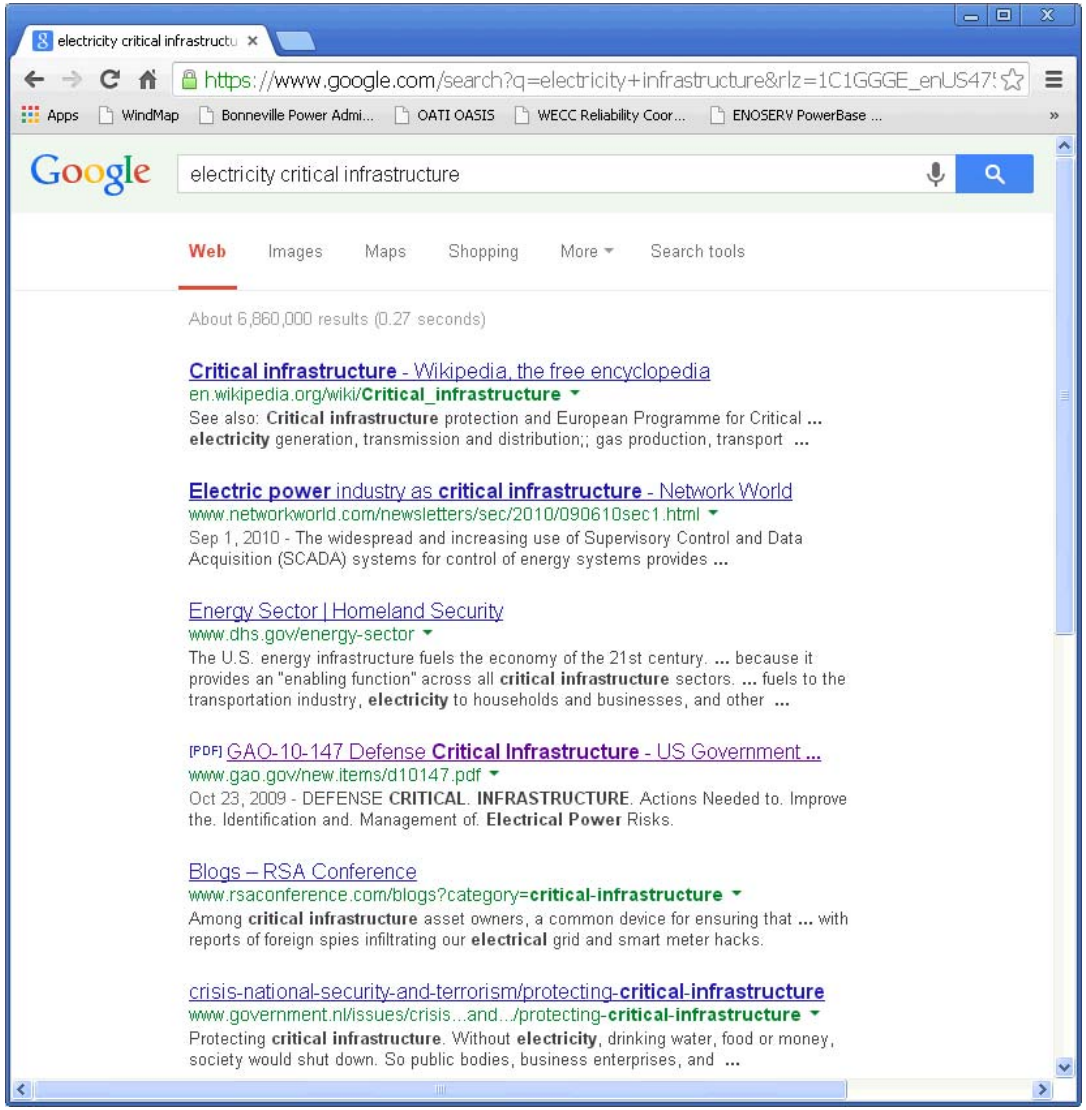
Electricity is THE Critical Infrastructure



AVISTA

PG&E Metcalf Substation Incident 4/16/2013

Silicone Valley Area – Adjacent to City of San Jose, CA – Between US 101 and a 600 MW Calpine generating plant.

Communication vaults for two communications providers damaged prior to substation attack. AT&T first. Then Level 3 Communications. Fiber cut flush with conduit entrance to vault to make repairs more difficult. Team apparently brought ladders or ropes to access the Level 3 vault.

Although utility communications went through those vaults the utility has alternate communications paths through microwave communication links. Communications to substation was not interrupted.

911 communications affected by the communications interruptions. Communications cut off to closest three towns from AT&T cut. Generating plant communications cut off by Level 3 vault attack.

Fence alarm detection, cameras on fence line, card reader access through fence. Fence alarms triggered three times due to bullets hitting fence. Attackers never entered substation.

More than 120 - 7.62x39 rifle rounds fired at autotransformers. 10 of 11 – 500/230 kV transformers and 3 of 4 – 230/115 kV transformers damaged and taken out of service. Only energized transformers shot.

Shots fired primarily low on the radiators. > 51,000 gals of oil spilled. Transformers tripped due to high temperature or low oil as cooling lost. First alarms came in about one minute after first shots detected.

Appears to have been a team of multiple people not just one or two. Spotters, shooters, communications attack, etc.

Shots in the Dark

A look at the April 16 attack on PG&E's Metcalf Transmission Substation

1	2	3	4	5	6	7
12:58 a.m., 1:07 a.m. Attackers cut telephone cables	**1:31 a.m.** Attackers open fire on substation	**1:41 a.m.** First 911 call from power plant operator	**1:45 a.m.** Transformers all over the substation start crashing	**1:50 a.m.** Attack ends and gunmen leave	**1:51 a.m.** Police arrive but can't enter the locked substation	**3:15 a.m.** Utility electrician arrives

Sources: PG&E; Santa Clara County Sheriff's Dept.
The Wall Street Journal

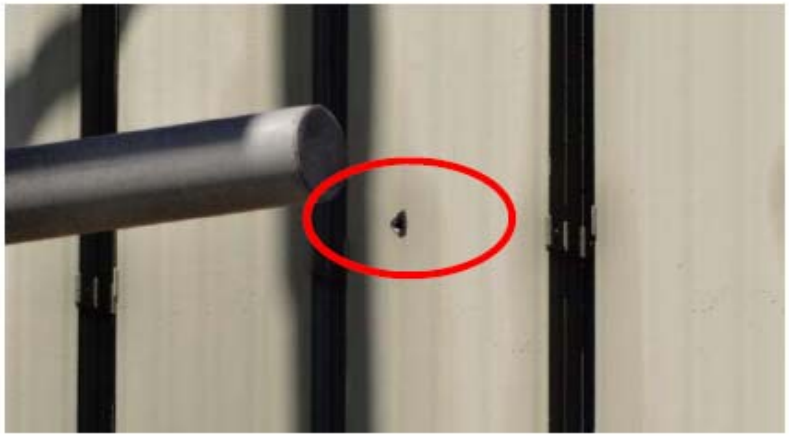
When seconds matter cops are only minutes away…

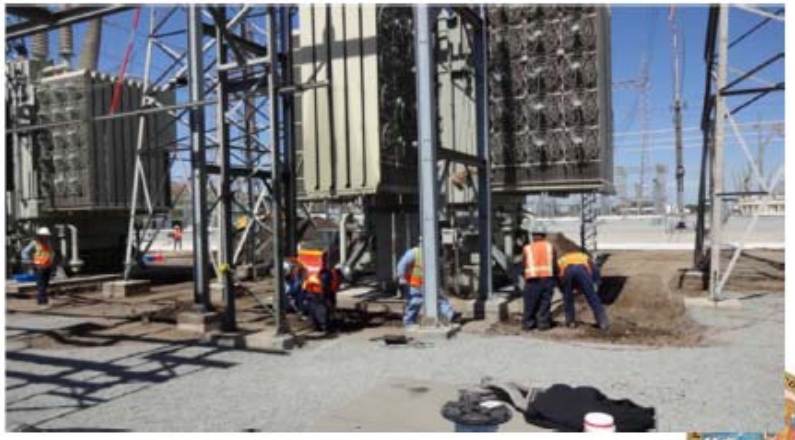
Event summary

- 0058 Hours
  - AT&T Fiber Cut
- 0107 Hours
  - Level 3 Line Cut
- 0137 Hours
  - Fence Alarm Activated
- 0138 Hours
  - Initial Transformer System Alarm
- 0141 Hours
  - 911 Call - Shooting
- 0151 Hours
  - Police Arrive On Scene

Damage to Substation

Damage at Scene





Damage to Facilities

- 500kV Yard
  - 10 transformers
- 230kV Yard
  - 7 transformers
- 115kV Yard
  - 6 circuit breakers
- Total of 52,000 gallons of oil
- $15.4 in restoration costs
- No outages

At least five 10,000 tanker trucks @$10 a gallon. Where did the oil go?

$15.4 million

Security Briefing
Industry Update – How Did We Get Here?

Attack Ideas Available on the Internet

1/15/2013

"If someone decides to blast a transformer at its base as prepper Bryan Smith did, and the oil drains out, then the transformer either burns out catastrophically, or if the utility is lucky, a software routine notices the problem and shuts the substation (or at least the affected portion) down" (http://www.bob-owens.com/2013/01/shock-the-system/)

Attacks on Critical Infrastructure

Metcalf 4/16/2013

Arkansas 9/16/2013

Weekend Attacks on Arkansas' Electric Grid Leave 10,000 Without Power; 'YOU SHOULD HAVE EXPECTED U.S.'

Security Briefing
Industry Update – How Did We Get Here?

Press Reports Fan The Flames… and Politics in Action…

Bloomberg News

Rifle-Toting Terrorists Pose Great Threat to Power Grid

By Brian Wingfield | November 20, 2012

THE WALL STREET JOURNAL.

U.S. Risks National Blackout From Small-Scale Attack

Federal Analysis Says Sabotage of Nine Key Substations Is Sufficient for Broad Outage

Wellinghoff: Physical security, not cybersecurity, threatens the grid

Details 30 Apr 2013

Despite the current buzz about cybersecurity and other threats to the electric transmission and distribution grid Regulatory Commission Chairman Jon Wellinghoff says he's more concerned about old-fashioned physical ass was in New York last week, talking at the Bloomberg New Energy Finance gabfest. Speaking on a Bloomberg TV he made clear where he sees threats to the grid. "I personally believe we are more subject to physical attacks issues with our utility system than we are cyber. I think physical is much more important. You had a physical att York. The physical attack was Hurricane Sandy," he said. "You could have physical attacks not only by climactic by actors. What keeps me up at night are physical attacks on our grid system."

See what keeps Wellinghoff up at night here.

REP. WAXMAN AND SEN. MARKEY INTRODUCE GRID ACT TO PROTECT ELECTRICAL GRID FROM PHYSICAL, CYBERATTACK

News Release: March 7, 2014
Docket No. RD14-6-000
Order PDF

Smart Grid Security

Terrorist gunman could bring down the grid, warns FERC's Wellinghoff

Nov 26, 2012 Talk Back Free Alerts More On This Topic SHARE

FERC Directs Development of Physical Security Standards

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U.S. Risks National Blackout From Small-Scale Attack

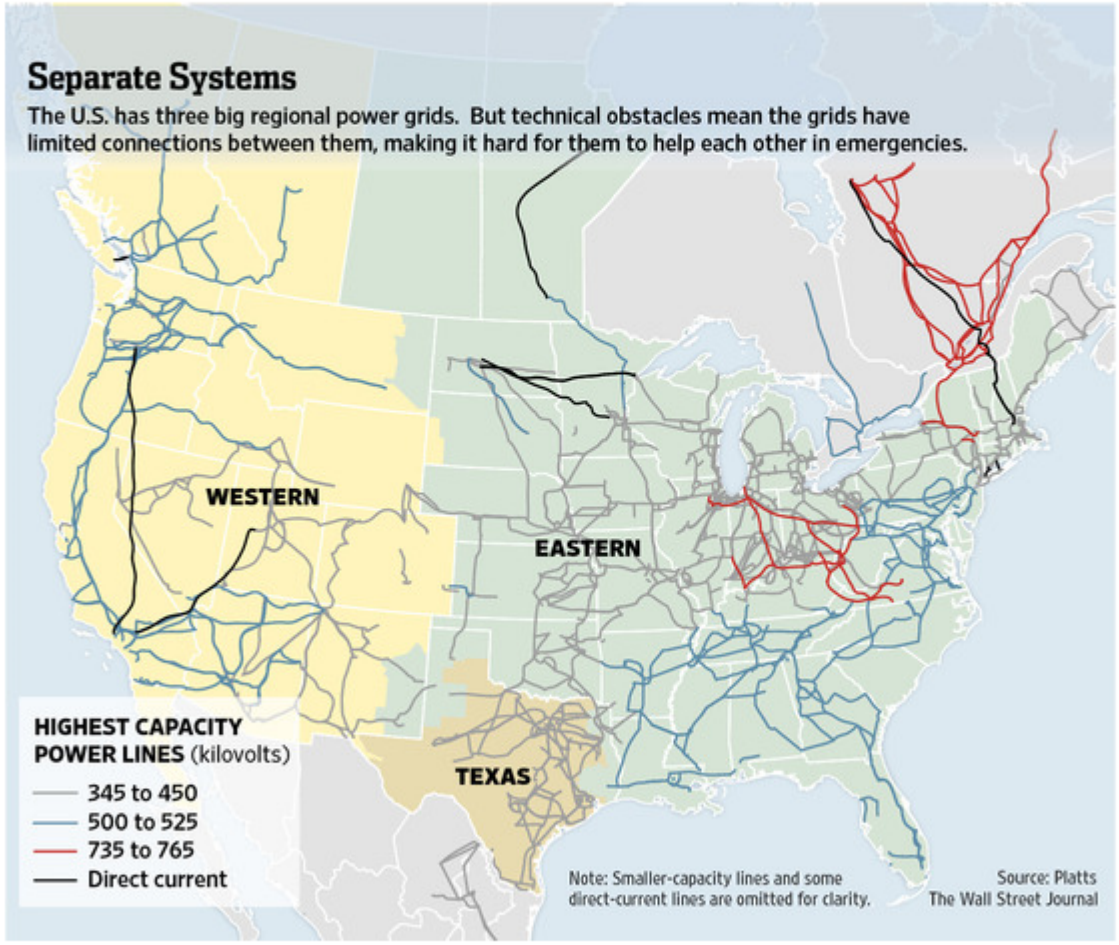
Federal Analysis Says Sabotage of Nine Key Substations Is Sufficient for Broad Outage

By Rebecca Smith

The Wall Street Journal

March 12, 2014

What the?



The U.S. could suffer a coast-to-coast blackout if saboteurs knocked out just nine of the country's 55,000 electric-transmission substations on a scorching summer day, according to a previously unreported federal analysis.

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What Policy Makers Hear!

Get the FACTS Out There
YOU are the EXPERTS!

The memo reflected a belief by some people at the agency that an attack-related blackout could be extraordinarily long, in part because big transformers and other equipment are hard to replace. Also, each of the three regional electric systems—the West, the East and Texas—have limited interconnections, making it hard for them to help each other in an emergency.

Some experts said other simulations that are widely used in the electricity industry produced similar results as the FERC analysis.

"This study used a relatively simplified model, but other models come to the same conclusion," said A.P. "Sakis" Meliopoulos, professor of electrical and computer engineering at the Georgia Institute of Technology in Atlanta. He estimated it would take "a slightly larger number" of substation attacks to cause a U.S.-wide blackout.

In its modeling, FERC studied what would happen if various combinations of substations were crippled in the three electrical systems that serve the contiguous U.S. The agency concluded the systems could go dark if as few as nine locations were knocked out: four in the East, three the West and two in Texas, people with knowledge of the analysis said.

This study lacks technical merit!
OMG! So NOT true!!!

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Physical Threat (>risk than Cyber Threat)

- Direct Fire
  - Small Arms (Rifles…Pistols need not apply)
    - 5.56 mm or 7.62 mm
      - 0.47” (12 mm) **armor** plate at 100 meters (5.56 mm)
      - 0.59” (15 mm) **armor** plate at 300 meters (7.62 mm)
    - Typical small arms will easily penetrate a transformer case
    - Some protection can be provided against direct fire on a case by case basis
      - Cost/risk/consequences
- Indirect fire or crew served (no real defense)
  - Serious Firepower (Crew Served Weapons)
    - Mortars, rockets, explosives, .50 cal or greater
      - This is what the US Military is for (defense)

Direct Fire Small Arms Penetration (Rifle)

NATO OTAN — NATO Army Armaments Group

NATO Rifle Calibers

	7.62 x 51 NATO	5.56 x 45 NATO
STANAG	2310	4172
Cartridge length (mm)	71.0	57.0
Cartridge weight (g)	24.0	12.7
Bullet weight (g)	9.5	4.0
Bullet diameter (mm)	7.82	5.70
Muzzle velocity (m/s)	830	930
Muzzle energy (J)	3270	1730
Core material	Lead	Steel/Lead
Rifling twist	1/12" (305 mm)	1/7" (178 mm)
Penetration of 3 mm steel plate at (m)	800	1300
Penetration in RHA at 100m and 0° NATO of APHC projectile	18mm 0.709"	12mm 0.472"

3 mm = 0.118"

RHA: Rolled Homogenous Armor
APHC: Armor Piercing Hard Core

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Rifle Rounds

- M2 ball AP (.30-06) at 100 yards penetrates
  - 7 inches of concrete
  - 14 inches of rubble
  - 19 inches of sand
  - 48 inches of timbers
- Cover vs. Concealment
  - Tanks, bunkers, and battleships offer cover
  - Bullets shoot **THROUGH** sandbags and trees!
    - Being shot is **BAD!**
    - Stopping bullets is expensive and hard work
    - Stopping frag is the typical military objective
      - Much more frag flying around than bullets

Standards for Ballistic Protection

- UL Standard 752
- National Institute of Justice 018.01
- State Department SD-STD-02.01
- ASTM-F-1233
- DIN EN 1063
- BS 5051
- DIN 52-290

Defending Against Indirect Fire (DPRK)

39° 40'24.46"N 125° 42'57.77"E

Point Targeting (Amateur)

- CARVER
  - **C**riticality
  - **A**ccessibility
  - **R**ecuperability
  - **V**ulnerability
  - **E**ffect
  - **R**ecognizability
- RAM-T
  - **R**isk **A**ssessment **M**ethodology-**T**ransmission

Objective Based Targeting (Professional)

- Where the big kids play (Modeling & Simulation)
  - WHAT is the desired objective or endstate
    - What the targeteer wants to accomplish
      - Think like a bad guy with **perfect Intel** and **buckets of cash**
    - The flip side (defense)
      - What does your company/agency FEAR
        - » Lost Revenue, Lost Capital, Lost Prestige, Lost Pride
        - » Death
        - » Political Costs
    - The objective of targeting is to affect, change, modify, or impede enemy activity through destruction, damage, deception, or neutralization

Thoughts on Metcalf Attack

- Amateurs! It could have been much worse…
  - They used > 120 of 7.62 x 39 mm rounds
    - Soviet round, must have been on a budget!
      - Must have sounded like a war…left their brass behind!
    - No subsonic ammunition. No suppressed firearms.
  - Shot radiators NOT bushings
  - No use of combined effects munitions
    - Strictly small arms apparently
    - No incendiaries used
- Metcalf was NOT important…at that time
- **Truly diabolical methods were NOT used**

CIP-014-01

- Fastest moving Standard to date
- Our Regulator WILL regulate.
- Recognize that the EPA of 2005 gives this stuff the weight of LAW!
  - Standards are the MINIMUM level of performance
    - What ever happened to Good Utility Practice?
- Read all about it here:
  - http://www.nerc.com/pa/Stand/Prjct201404PhsclScrty/CIP-014-1_Physical_Sec_draft_2014_0409.pdf

Physical Security Standard (CIP-014-01)

- Identify Stations on the “List”
  - **All 500 kV stations**
  - **200 kV to 499 kV** with **3 or more lines** and where the **summed aggregate of the lines exceed 3000** (see table for weights):

Voltage Value of a Line	Weight Value per Line
less than 200 kV (not applicable)	(not applicable)
200 kV to 299 kV	700
300 kV to 499 kV	1300
500 kV and above	0

By the Way…the CIP Method is Awful

- Case Info
  - Bus/Sub MW Throughflow
    - http://www.powerworld.com/knowledge-base/physical-security-assessment
  - Neighbors
- Ctg Analysis
  - Line, Bus, and Station Outages
    - And whatever combinations
- Transient Stability
  - See above, with and without faults

You can TRY to get off the list…

- Honestly…good luck with that!
- Need to show that loss of the station does NOT:

CIP-014-1 — Physical Security

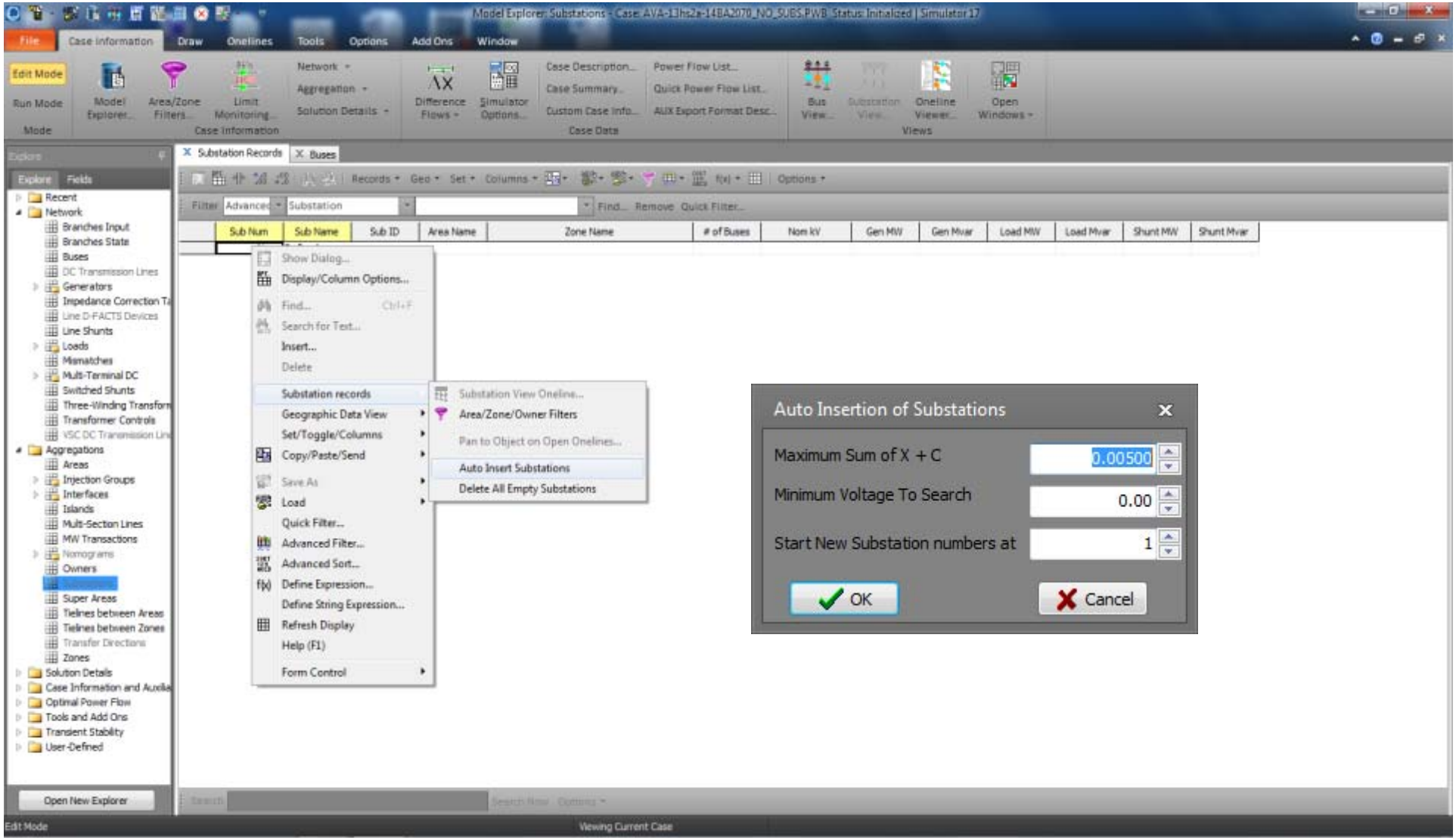
B. Requirements and Measures

R1. Each Transmission Owner shall perform an initial risk assessment and subsequent risk assessments of its Transmission stations and Transmission substations (existing and planned to be in service within 24 months) that meet the criteria specified in Applicability Section 4.1.1. The initial and subsequent risk assessments shall consist of a transmission analysis or transmission analyses designed to identify any Transmission station(s) and Transmission substation(s) that if rendered inoperable or damaged could result in widespread instability, uncontrolled separation, or Cascading within an Interconnection. *[VRF: High; Time-Horizon: Long-term Planning]*

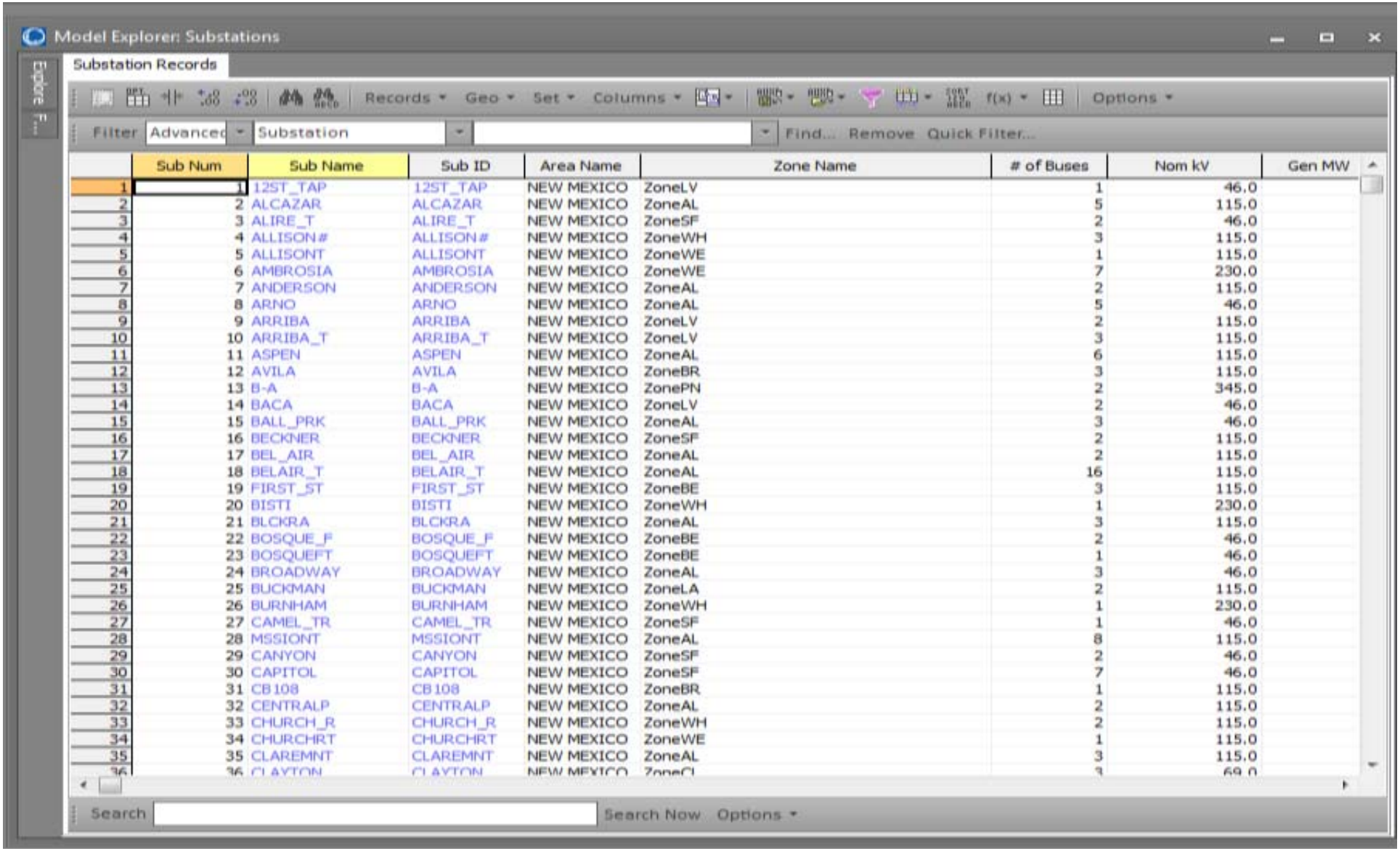
Making it happen with PWS (Go Jamie!)

- Build Substations
  - You SHOULD have these already
    - We shall auto-insert them as an exercise
- 500 kV stations are IN
- Apply the “List” filter
  - Ignore generator lead-in lines
    - This would require manual work
- Build the **substation** contingency files
- Work up a physical security plan

Auto-Inserting Substations



9351 Substations in WECC?



	Sub Num	Sub Name	Sub ID	Area Name	Zone Name	# of Buses	Nom kV	Gen MW
1	1	12ST_TAP	12ST_TAP	NEW MEXICO	ZoneLV	1	46.0	
2	2	ALCAZAR	ALCAZAR	NEW MEXICO	ZoneAL	5	115.0	
3	3	ALIRE_T	ALIRE_T	NEW MEXICO	ZoneSF	2	46.0	
4	4	ALLISON#	ALLISON#	NEW MEXICO	ZoneWH	3	115.0	
5	5	ALLISONT	ALLISONT	NEW MEXICO	ZoneWE	1	115.0	
6	6	AMBROSIA	AMBROSIA	NEW MEXICO	ZoneWE	7	230.0	
7	7	ANDERSON	ANDERSON	NEW MEXICO	ZoneAL	2	115.0	
8	8	ARNO	ARNO	NEW MEXICO	ZoneAL	5	46.0	
9	9	ARRIBA	ARRIBA	NEW MEXICO	ZoneLV	2	115.0	
10	10	ARRIBA_T	ARRIBA_T	NEW MEXICO	ZoneLV	3	115.0	
11	11	ASPEN	ASPEN	NEW MEXICO	ZoneAL	6	115.0	
12	12	AVILA	AVILA	NEW MEXICO	ZoneBR	3	115.0	
13	13	B-A	B-A	NEW MEXICO	ZonePN	2	345.0	
14	14	BACA	BACA	NEW MEXICO	ZoneLV	2	46.0	
15	15	BALL_PRK	BALL_PRK	NEW MEXICO	ZoneAL	3	46.0	
16	16	BECKNER	BECKNER	NEW MEXICO	ZoneSF	2	115.0	
17	17	BEL_AIR	BEL_AIR	NEW MEXICO	ZoneAL	2	115.0	
18	18	BELAIR_T	BELAIR_T	NEW MEXICO	ZoneAL	16	115.0	
19	19	FIRST_ST	FIRST_ST	NEW MEXICO	ZoneBE	3	115.0	
20	20	BISTI	BISTI	NEW MEXICO	ZoneWH	1	230.0	
21	21	BLCKRA	BLCKRA	NEW MEXICO	ZoneAL	3	115.0	
22	22	BOSQUE_F	BOSQUE_F	NEW MEXICO	ZoneBE	2	46.0	
23	23	BOSQUEFT	BOSQUEFT	NEW MEXICO	ZoneBE	1	46.0	
24	24	BROADWAY	BROADWAY	NEW MEXICO	ZoneAL	3	46.0	
25	25	BUCKMAN	BUCKMAN	NEW MEXICO	ZoneLA	2	115.0	
26	26	BURNHAM	BURNHAM	NEW MEXICO	ZoneWH	1	230.0	
27	27	CAMEL_TR	CAMEL_TR	NEW MEXICO	ZoneSF	1	46.0	
28	28	MSSIONT	MSSIONT	NEW MEXICO	ZoneAL	8	115.0	
29	29	CANYON	CANYON	NEW MEXICO	ZoneSF	2	46.0	
30	30	CAPITOL	CAPITOL	NEW MEXICO	ZoneSF	7	46.0	
31	31	CB108	CB108	NEW MEXICO	ZoneBR	1	115.0	
32	32	CENTRALP	CENTRALP	NEW MEXICO	ZoneAL	2	115.0	
33	33	CHURCH_R	CHURCH_R	NEW MEXICO	ZoneWH	2	115.0	
34	34	CHURCHRT	CHURCHRT	NEW MEXICO	ZoneWE	1	115.0	
35	35	CLAREMNT	CLAREMNT	NEW MEXICO	ZoneAL	3	115.0	
36	36	CLAYTON	CLAYTON	NEW MEXICO	ZoneCL	3	69.0	

Build the List…Thanks Jamie!

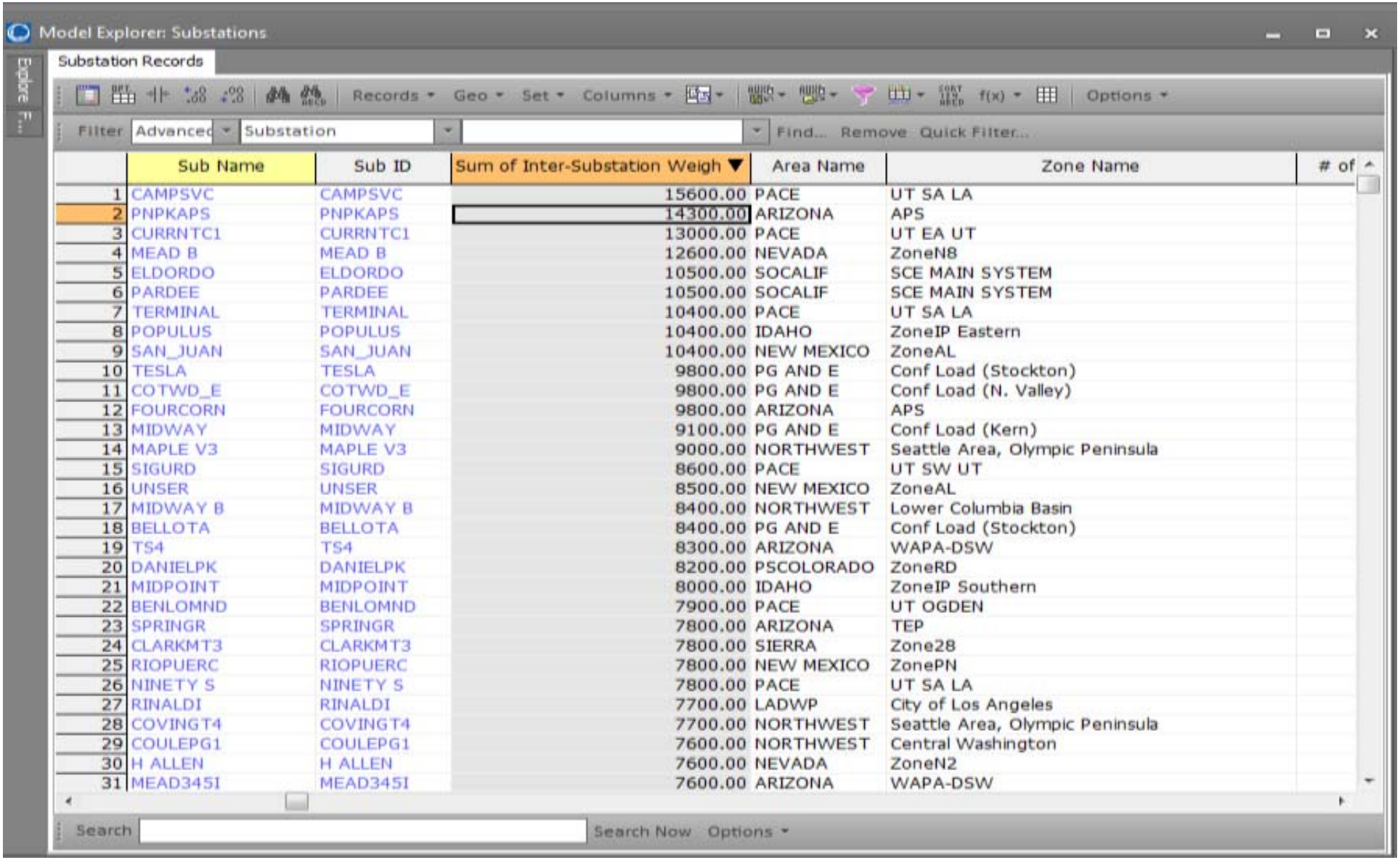
```
// Step 1 Custom Expression
DATA (CUSTOMEXPRESSION,
[ObjectType,ObjectType:1,CustomExpressionString,VariableName,VarBlankIsZero])
{
"Branch:1" "Weight" "iif(x1 > 499.9, 0, iif(x1>299.9, 1300, iif(x1>199.9, 700, 0)))"
"LineMaxNomVolt" "YES"
}
// Step 2 Calculated Field
DATA (BGCALCULATEDFIELD,
[WhoAmI,ObjectType,VariableName,BGCalcFieldOperation,BGCalcFieldUseAbsolute,
   BGCalcFieldBlankEntries,ObjectType:1,FilterName,FilterLogic,FilterPre])
{
"Sum of Inter-Substation Weights" "Branch" "CustomExpression" "Sum" "NO " "As Zeros"
"Branch" "YES" "AND" "NO "
   <SUBDATA Condition>
     SubNum <> "SubNum:1" 0 Field
   </SUBDATA>
}
```

Aside on IIF

From PWS Help→ i.e. CALL JAMIE!
IIF If condition Iif(1+1==2,4,5) = 4

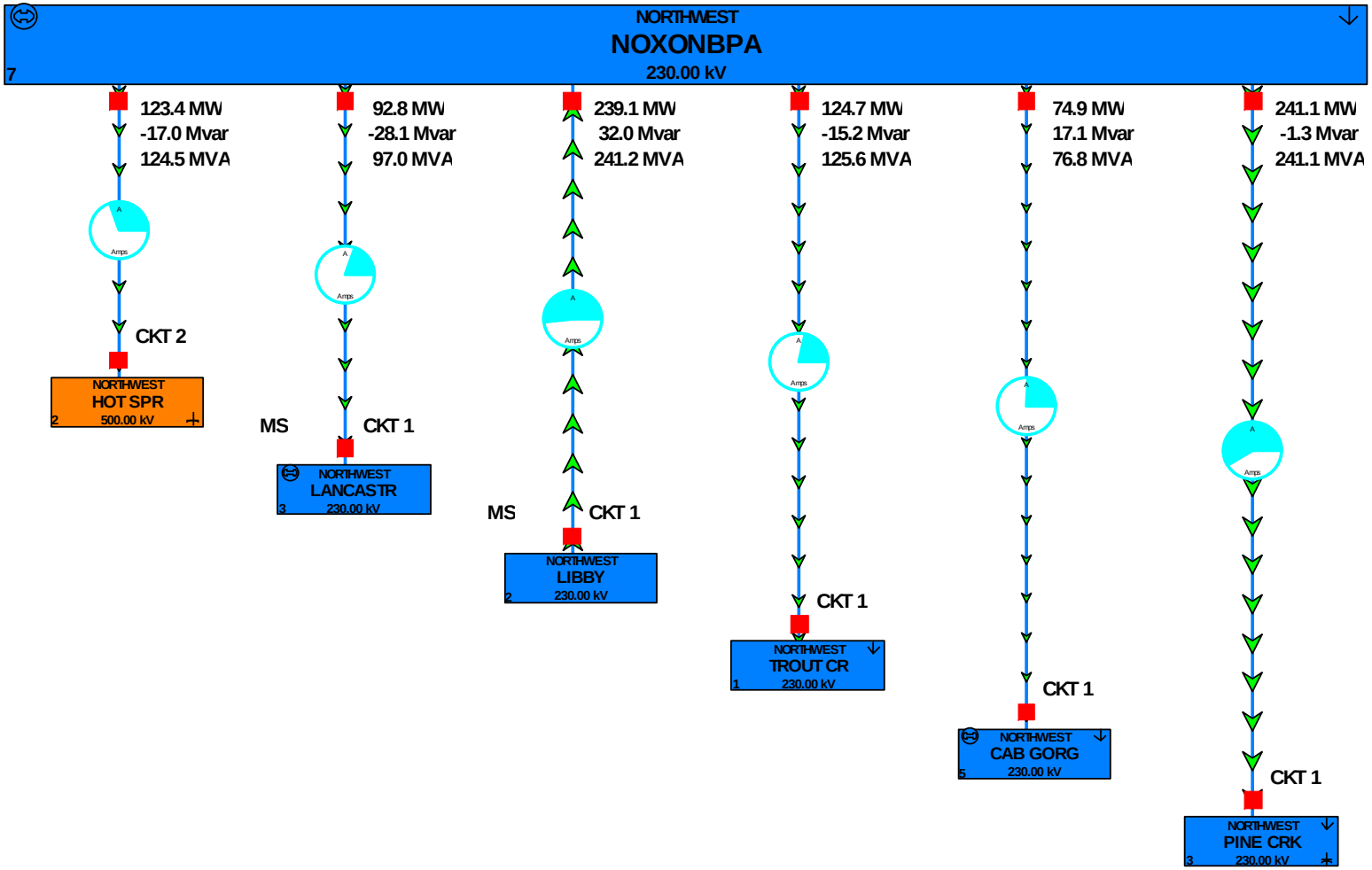
- IIF function
  - In-line IF or Immediate IF
  - **IIf**(*expr*, *truepart*, *falsepart*)
    - Expression Required (Boolean).
      - The expression you want to evaluate.
    - True Part Required (Object).
      - Returned if Expression evaluates to True.
    - False Part Required (Object).
    - Returned if Expression evaluates to False
  - IIF must evaluate the entire statement when preparing the argument

First Pass Results



	Sub Name	Sub ID	Sum of Inter-Substation Weigh	Area Name	Zone Name	# of
1	CAMPSVC	CAMPSVC	15600.00	PACE	UT SA LA	
2	PNPKAPS	PNPKAPS	14300.00	ARIZONA	APS	
3	CURRNTC1	CURRNTC1	13000.00	PACE	UT EA UT	
4	MEAD B	MEAD B	12600.00	NEVADA	ZoneN8	
5	ELDORDO	ELDORDO	10500.00	SOCALIF	SCE MAIN SYSTEM	
6	PARDEE	PARDEE	10500.00	SOCALIF	SCE MAIN SYSTEM	
7	TERMINAL	TERMINAL	10400.00	PACE	UT SA LA	
8	POPULUS	POPULUS	10400.00	IDAHO	ZoneIP Eastern	
9	SAN_JUAN	SAN_JUAN	10400.00	NEW MEXICO	ZoneAL	
10	TESLA	TESLA	9800.00	PG AND E	Conf Load (Stockton)	
11	COTWD_E	COTWD_E	9800.00	PG AND E	Conf Load (N. Valley)	
12	FOURCORN	FOURCORN	9800.00	ARIZONA	APS	
13	MIDWAY	MIDWAY	9100.00	PG AND E	Conf Load (Kern)	
14	MAPLE V3	MAPLE V3	9000.00	NORTHWEST	Seattle Area, Olympic Peninsula	
15	SIGURD	SIGURD	8600.00	PACE	UT SW UT	
16	UNSER	UNSER	8500.00	NEW MEXICO	ZoneAL	
17	MIDWAY B	MIDWAY B	8400.00	NORTHWEST	Lower Columbia Basin	
18	BELLOTA	BELLOTA	8400.00	PG AND E	Conf Load (Stockton)	
19	TS4	TS4	8300.00	ARIZONA	WAPA-DSW	
20	DANIELPK	DANIELPK	8200.00	PSCOLORADO	ZoneRD	
21	MIDPOINT	MIDPOINT	8000.00	IDAHO	ZoneIP Southern	
22	BENLOMND	BENLOMND	7900.00	PACE	UT OGDEN	
23	SPRINGR	SPRINGR	7800.00	ARIZONA	TEP	
24	CLARKMT3	CLARKMT3	7800.00	SIERRA	Zone28	
25	RIOPUERC	RIOPUERC	7800.00	NEW MEXICO	ZonePN	
26	NINETY S	NINETY S	7800.00	PACE	UT SA LA	
27	RINALDI	RINALDI	7700.00	LADWP	City of Los Angeles	
28	COVINGT4	COVINGT4	7700.00	NORTHWEST	Seattle Area, Olympic Peninsula	
29	COULEPG1	COULEPG1	7600.00	NORTHWEST	Central Washington	
30	H ALLEN	H ALLEN	7600.00	NEVADA	ZoneN2	
31	MEAD345I	MEAD345I	7600.00	ARIZONA	WAPA-DSW	

Note the Generator Lead-Ins



3rd Party might remove you from the list?

R2. Each Transmission Owner shall have an unaffiliated third party verify the risk assessment performed under Requirement R1. The verification may occur concurrent with or after the risk assessment performed under Requirement R1. *[VRF: Medium; Time-Horizon: Long-term Planning]*

2.1. Each Transmission Owner shall select an unaffiliated verifying entity that is either:

- A registered Planning Coordinator, Transmission Planner, or Reliability Coordinator; or
- An entity that has transmission planning or analysis experience.

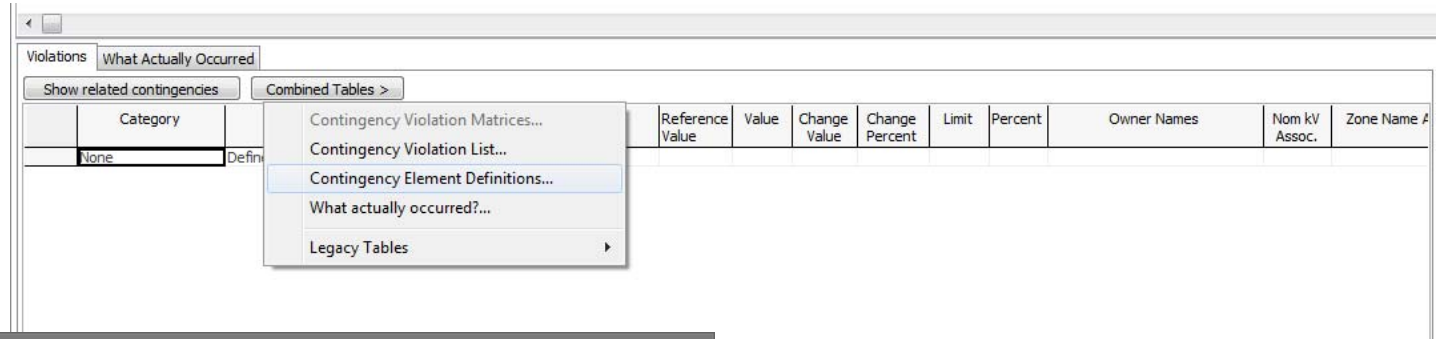
2.2. The unaffiliated verifying entity shall either verify the Transmission Owner's risk assessment performed under Requirement R1 or recommend the addition or deletion of a Transmission station(s) or Transmission substation(s). The Transmission Owner shall ensure the verification is completed within 90 calendar days following the completion of the Requirement R1 risk assessment.

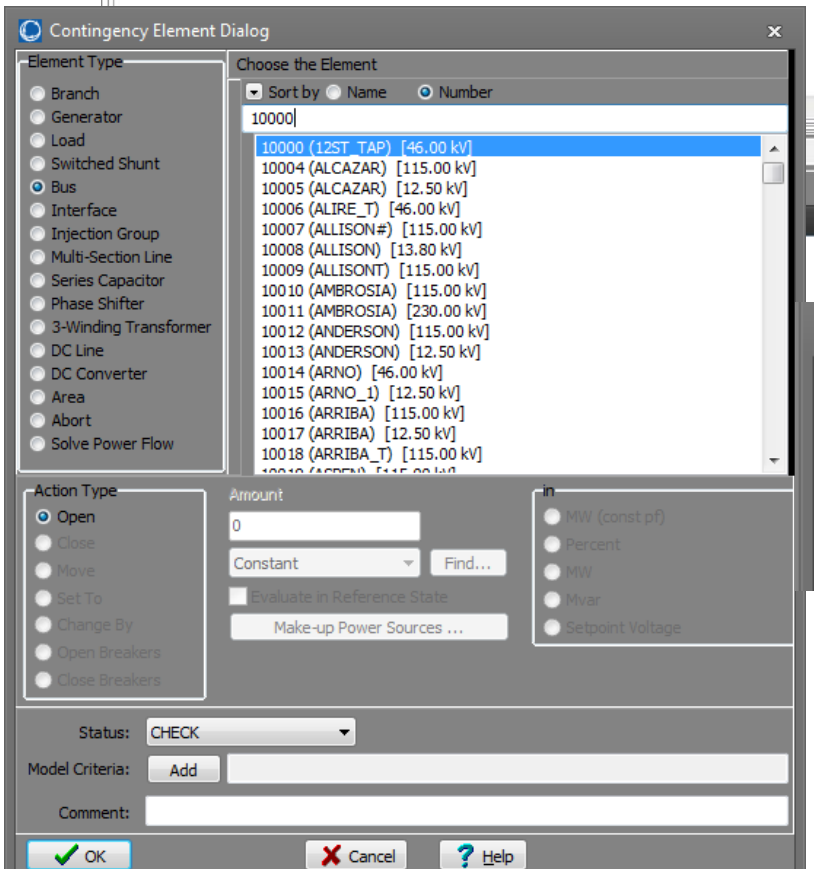
2.3. If the unaffiliated verifying entity recommends that the Transmission Owner add a Transmission station(s) or Transmission substation(s) to, or remove a Transmission station(s) or Transmission substation(s) from, its identification under Requirement R1, the Transmission Owner shall either, within 60 calendar days of completion of the verification, for each recommended addition or removal of a Transmission station or Transmission substation:

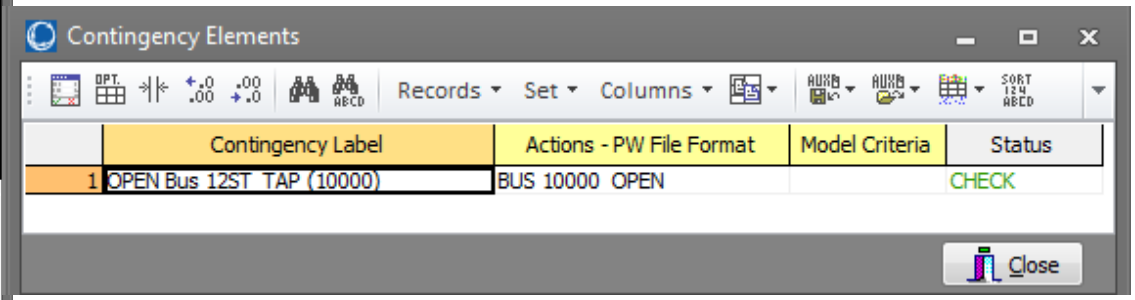
- Modify its identification under Requirement R1 consistent with the recommendation; or
- Document the technical basis for not modifying the identification in accordance with the recommendation.

2.4. Each Transmission Owner shall implement procedures, such as the use of non-disclosure agreements, for protecting sensitive or confidential information exchanged with the unaffiliated verifying entity.

Build Substation Contingencies, Part A







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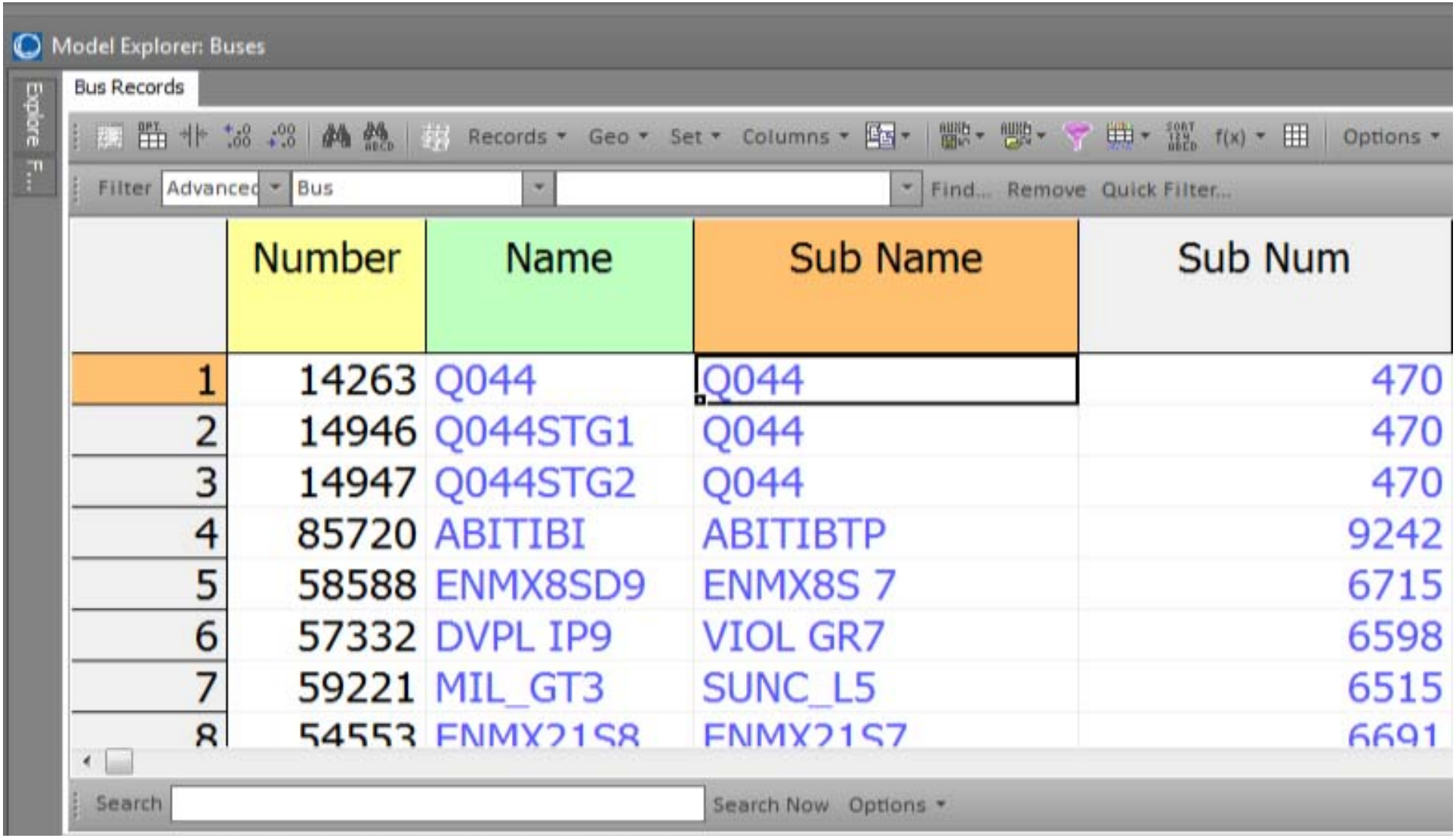
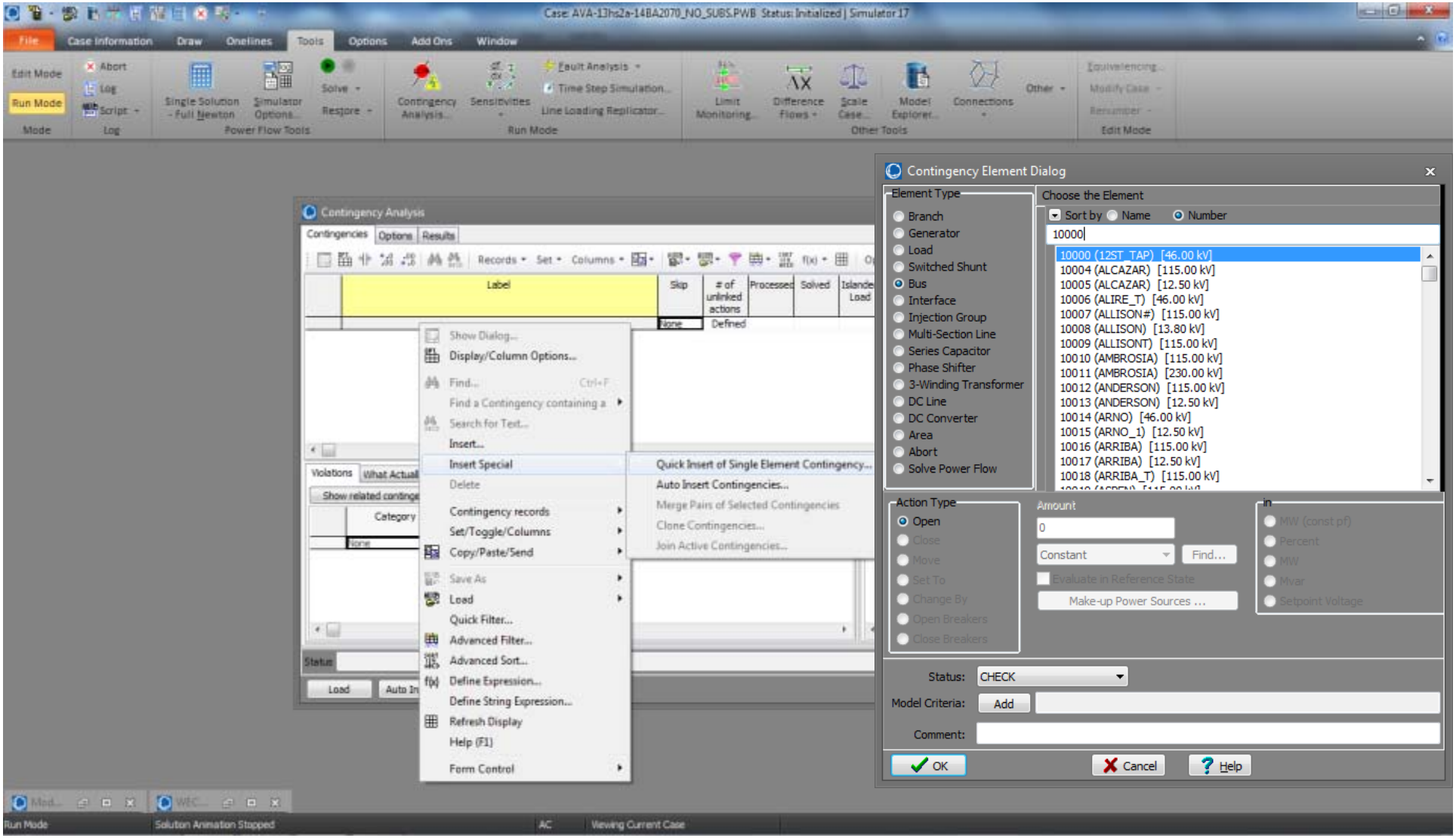
Build Substation Contingencies, Part B

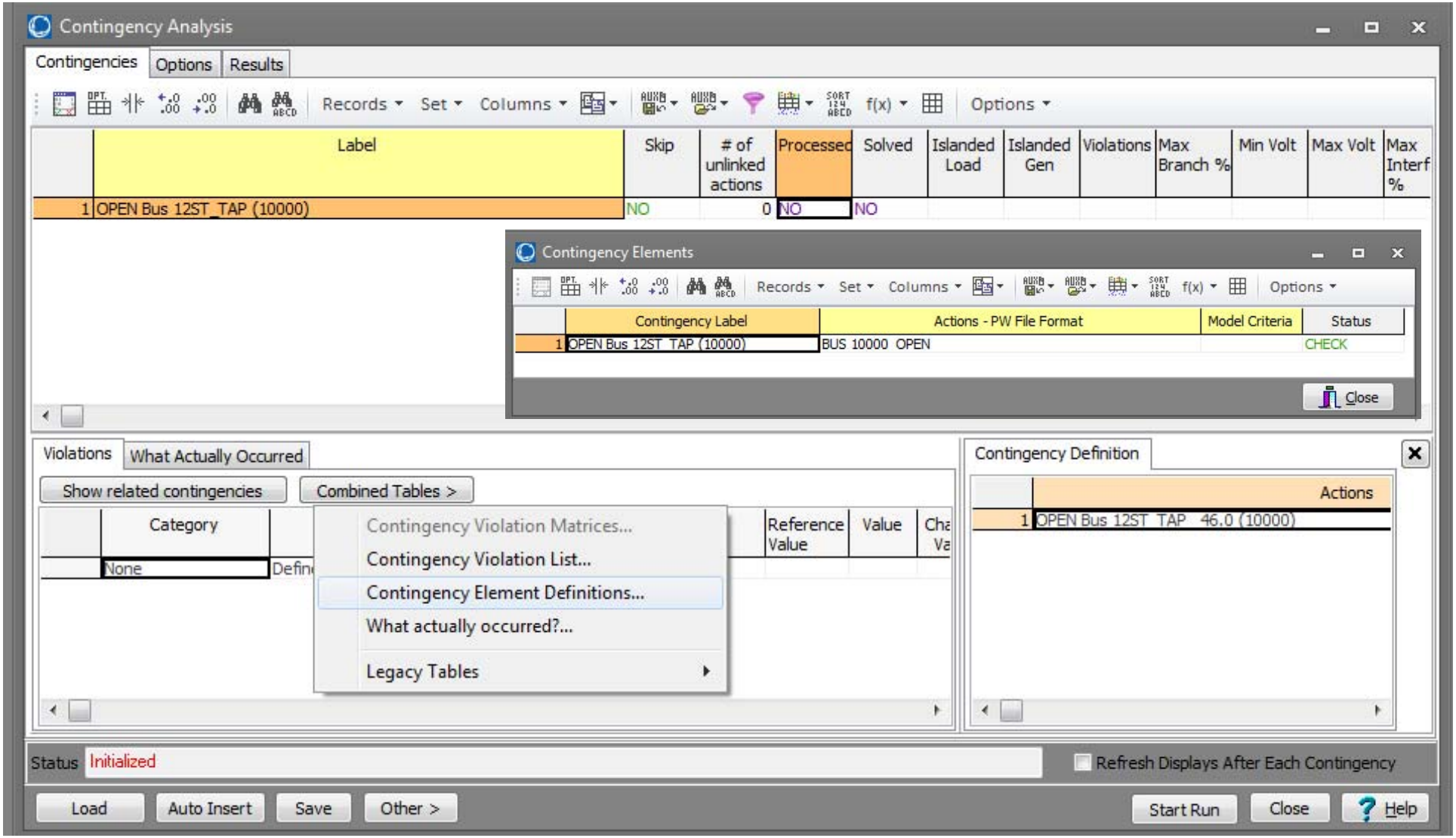


	Number	Name	Sub Name	Sub Num
1	14263	Q044	Q044	470
2	14946	Q044STG1	Q044	470
3	14947	Q044STG2	Q044	470
4	85720	ABITIBI	ABITIBTP	9242
5	58588	ENMX8SD9	ENMX8S 7	6715
6	57332	DVPL IP9	VIOL GR7	6598
7	59221	MIL_GT3	SUNC_L5	6515
8	54553	ENMX21S8	ENMX21S7	6691

We need a sample bus ctg for Excel



Off to work in Excel from PowerWorld



Making Substation CTGs happen in Excel

Book1

	A	B	C	D	E	F	G	H	I	J	K
1	Bus Records					ContingencyElement					
2	Number	Name	Sub Name	Sub Num		Contingency Label	Actions - PW File Format	Model Criteria			
3	10000	12ST_TAP	12ST_TAP	1		SUB: 12ST_TAP	BUS 10000 OPEN				
4	10004	ALCAZAR	ALCAZAR	2		SUB: ALCAZAR	BUS 10004 OPEN				
5	10005	ALCAZAR	ALCAZAR	2		SUB: ALCAZAR	BUS 10005 OPEN				
6	10006	ALIRE_T	ALIRE_T	3		SUB: ALIRE_T	BUS 10006 OPEN				
7	10007	ALLISON#	ALLISON#	4		SUB: ALLISON#	BUS 10007 OPEN				
8	10008	ALLISON	ALLISON#	4		SUB: ALLISON#	BUS 10008 OPEN				
9	10009	ALLISONT	ALLISONT	5		SUB: ALLISONT	BUS 10009 OPEN				
10	10010	AMBROSI/	AMBROSIA	6		SUB: AMBROSIA	BUS 10010 OPEN				
11	10011	AMBROSI/	AMBROSIA	6		SUB: AMBROSIA	BUS 10011 OPEN				
12	10012	ANDERSOI	ANDERSON	7		SUB: ANDERSON	BUS 10012 OPEN				
13	10013	ANDERSOI	ANDERSON	7		SUB: ANDERSON	BUS 10013 OPEN				
14	10014	ARNO	ARNO	8		SUB: ARNO					
15	10015	ARNO_1	ARNO	8		SUB: ARNO					
16	10016	ARRIBA	ARRIBA	9		SUB: ARRIBA					
17	10017	ARRIBA	ARRIBA	9		SUB: ARRIBA					
18	10018	ARRIBA_T	ARRIBA_T	10		SUB: ARRIBA_T					
19	10019	ASPEN	ASPEN	11		SUB: ASPEN					
20	10020	ASPEN	ASPEN	11		SUB: ASPEN					
21	10021	AVILA	AVILA	12		SUB: AVILA					
22	10022	AVILA	AVILA	12		SUB: AVILA					
23	10023	AVILA_T	AVILA	12		SUB: AVILA					
24	10024	B-A	B-A	13		SUB: B-A					
25	10025	B-A	B-A	13		SUB: B-A					
26	10026	BACA	BACA	14		SUB: BACA					
27	10027	BACA	BACA	14		SUB: BACA					

ContingencyElement | Bus Records

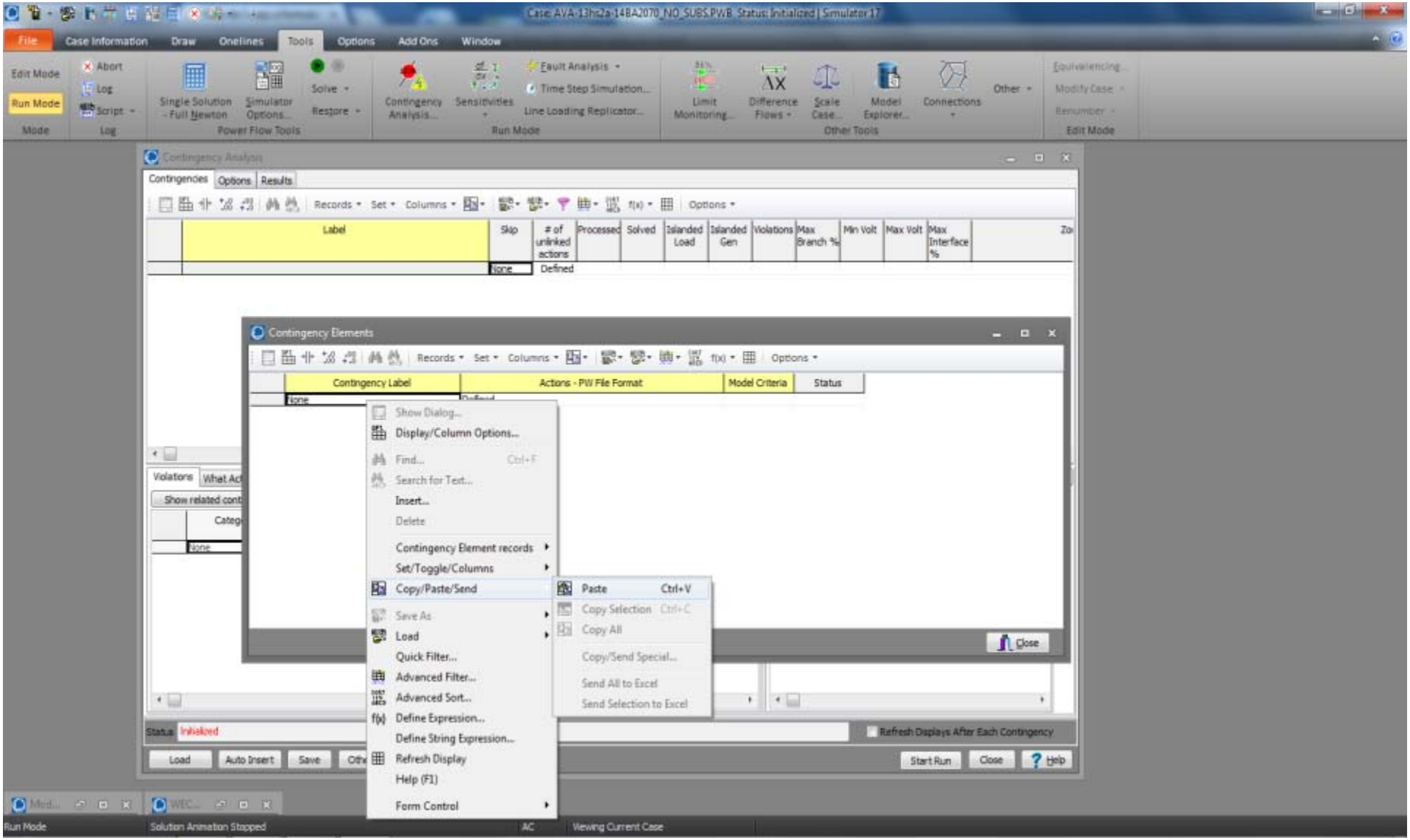
=CONCATENATE("SUB: ", C3)

=CONCATENATE("BUS ",A3, " OPEN ")

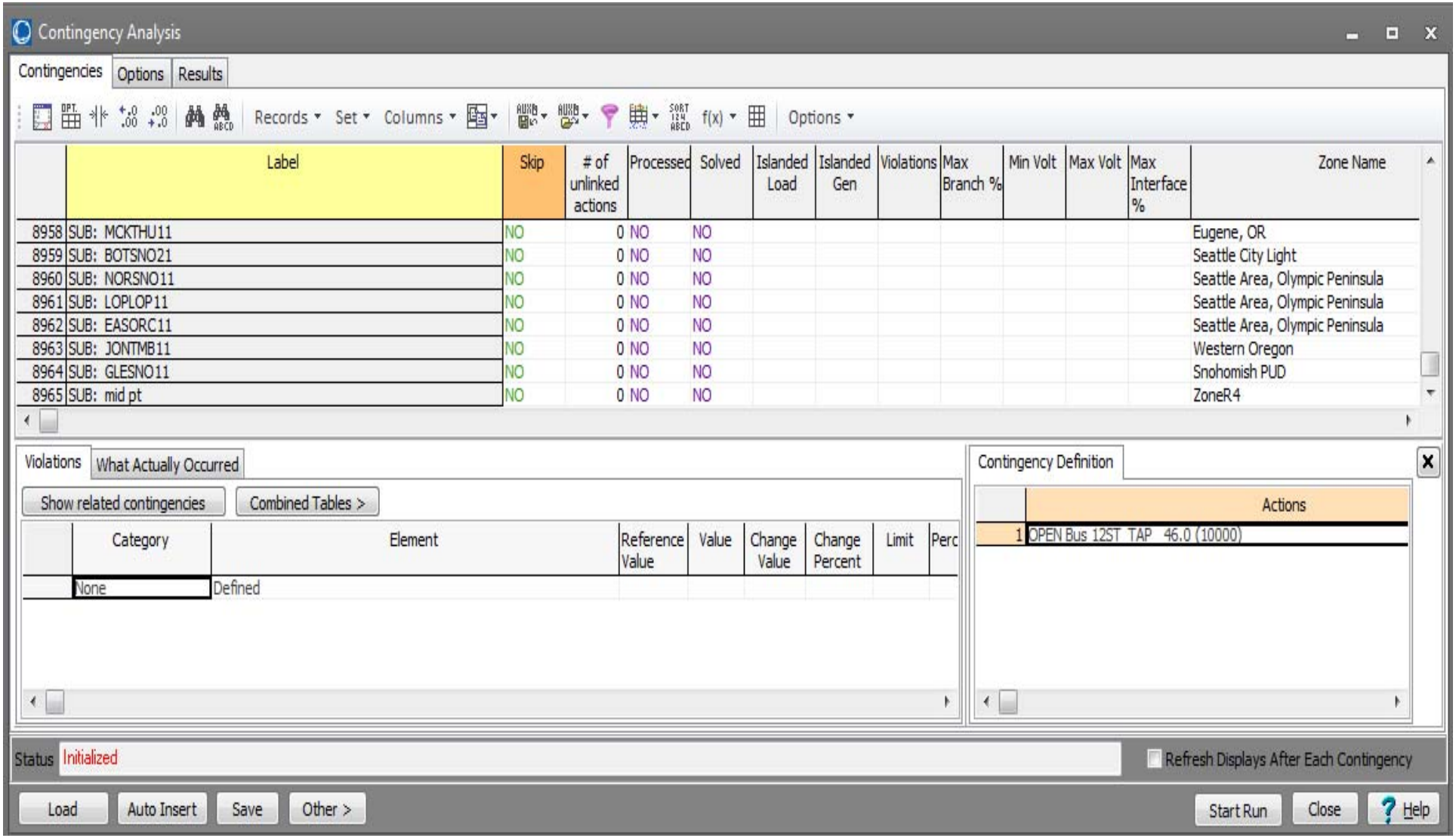
Pasting Down a Column:

Highlight the cell with the formula.
CTRL-C.
Click once in the topmost cell of the column.
CTRL-SHIFT-DOWN ARROW
CTRL-V

Paste In the Substation Contingencies



Good Luck!


Contingency Analysis
Contingencies
Options
Results
Records
Set
Columns
f(x)
Options
Label
Skip
# of unlinked actions
Processed
Solved
Islanded Load
Islanded Gen
Violations
Max Branch %
Min Volt
Max Volt
Max Interface %
Zone Name
8958 SUB: MCKTHU11 NO 0 NO NO Eugene, OR
8959 SUB: BOTSNO21 NO 0 NO NO Seattle City Light
8960 SUB: NORSNO11 NO 0 NO NO Seattle Area, Olympic Peninsula
8961 SUB: LOPLOP11 NO 0 NO NO Seattle Area, Olympic Peninsula
8962 SUB: EASORC11 NO 0 NO NO Seattle Area, Olympic Peninsula
8963 SUB: JONTMB11 NO 0 NO NO Western Oregon
8964 SUB: GLESNO11 NO 0 NO NO Snohomish PUD
8965 SUB: mid pt NO 0 NO NO ZoneR4
Violations
What Actually Occurred
Show related contingencies
Combined Tables >
Category
Element
Reference Value
Value
Change Value
Change Percent
Limit
Perc
None
Defined
Contingency Definition
Actions
1 OPEN Bus 12ST TAP 46.0 (10000)
Status
Initialized
Refresh Displays After Each Contingency
Load
Auto Insert
Save
Other >
Start Run
Close
Help

What Improvements *Should* We Make?

This question leads to several others…

- What can we do to improve substation security?
- How far do we go? What are we “required” to do?
- Who are we really protecting our subs from?
- Why do they want to get in? Do they want to get in?
- Are we a target? What subs are most important?
- And what impact do they have?

Let’s start with what we can do now… to at least impede any physical entrance into our substations.

Short-Term Physical Substation Security
EEI and SAIC Recommendations

- Improve/upgrade existing fencing – opaque
- Install barriers along fence lines to impede access
- Remove outside the fence obstacles (brush, trailers, equipment, etc.)
- Install signs warning of 24-hour surveillance
- Adjust lighting levels for both deterrence and detection capability.
- Place barriers around critical equipment
- Install better controls limiting key access

Good Fencing Construction Practice

Deary Substation

Short-Term Physical Substation Security

Beacon Storage Yard

Short-Term Physical Substation Security

Glenrose Substation

Short-Term Physical Substation Security

Pre-Cast Concrete Double-T Wall

Francis & Cedar Substation

Short-Term Physical Substation Security

Lyons & Standard Substation

Options Moving Forward – Site Specific

Alternative Perimeter Barriers

- Wrought Iron Fencing (Simulated)
- Pre-cast Concrete Wall
- Concrete Masonry (CMU) Block Wall
- Combination of the Above

Options Moving Forward – Site Specific

Options Moving Forward – Site Specific

Pre-Cast Concrete

Options Moving Forward – Site Specific

Meadow Substation – Longmont, CO
12-ft high wall – by Allan Block

CMU Block Wall

Options Moving Forward – Site Specific

Combination

Assessment

- Be a Hard Target
  - Evaluate risk/consequences/costs
    - Look tough…Make “them” go to the next guy
- Try NOT to be important!!!!
  - To WECC that is…see simulations
  - Security is a process
  - Visibility is security at the beginning
    - Comms to stations=better system=better security
    - Physical Protection in initial design is better than retro fitting
  - **Build for compliance with the NERC standards?**
  - **RESILENCY**

Recognize Your Limits (Green & Yellow)

C	E	G	I	M	O	Q	R	S	T	U	V	W	X	Y
Threat Actor Profile	Business Area	Critical Functions or Assets	Risk Likelihood	Likelihood Control Effectiveness	Severity Control Effectiveness	Score	EPS: Revenue Expense Lost / Gained business	Balance Sheet Cashflow Liquidity	Stakeholder Relations	Customer Service and Reliability	Employee Safety and Health	Public Safety and Health	Environmental	Accept or Mitigate
Low - minimal knowledge - one person - theft or vandalism	T&D	Substations	5	2	5	2.652	2	1	3	3	2	1	2	
Medium - Some knowledge of targets - 1-4 people - Surveillance skills / Insider threat - knowledge of LLE response - Diversion tactics - Not willing to kill - Target is single facility - Rifles, small bombs, Molotov cocktails	T&D	Substations	3	1	4	6.080	2	1	3	3	2	1	2	
High - Detailed target knowledge - Multiple assault teams - Military grade attacks methods - Willing to kill - System or regional grid shutdown	T&D	Substations	1	1	2	0.646	2	1	3	3	2	1	2	

Willing to kill…I suggest you don't worry about the red

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Questions?