



ID	Overloaded Facility	Worst Contingencies	Category	Category Description	Loading (%)						Potential Mitigation Solutions
					2019 Summer Peak	2022 Summer Peak	2027 Summer Peak	2019 Spring Light Load	2022 Spring Off-Peak	2022SP Heavy Renewables & Min Gas Gen	
NOL-T-1	Lugo-Pisgah 230	Lugo 500/230kV Nos. 1 & 2 transformer banks	P6	Two overlapping singles	<95	102.59	102.96	Nconv	Nconv	<95	Mojave Desert RAS
NOL-T-2	Pisgah-Calcite 230	Lugo 500/230kV Nos. 1 & 2 transformer banks	P6	Two overlapping singles	<95	118.31	118.55	Nconv	Nconv	108.26	Mojave Desert RAS
NOL-T-3	Pisgah-Cimat-Eldorado 230 No.1	Lugo 500/230kV Nos. 1 & 2 transformer banks	P6	Two overlapping singles	<95	110.81	111.15	Nconv	Nconv	<95	Mojave Desert RAS
NOL-T-4	Pisgah-Cimat-Eldorado 230 No.2	Lugo 500/230kV Nos. 1 & 2 transformer banks	P6	Two overlapping singles	<95	110.06	110.33	Nconv	Nconv	<95	Mojave Desert RAS
NOL-T-5	Victor-Kramer 115kV Line	Kramer-Victor Nos. 1&2 230kV lines	P7	Common structure	<95	<95	<95	104.47	<95	121.20	Mojave Desert RAS
NOL-T-6	Kramer-Roadway 115kV Line	Kramer-Victor Nos. 1&2 230kV lines	P7	Common structure	<95	<95	<95	105.62	97.38	124.16	Mojave Desert RAS
NOL-T-7	Case Diverge	Kramer-Cool Water and Kramer-Tortilla 115kV lines	P6	Two overlapping singles	Nconv	Nconv	Nconv	<95	<95	<95	SCE Operating Procedure 127, separating Kramer 115kV system from the Cool Water 115kV system
NOL-T-8	Case Diverge	Ivanpah-Eldorado & Ivanpah-Primm 230kV lines	P7	Common structure	Nconv	Nconv	Nconv	<95	Nconv	Nconv	Ivanpah RAS
NOL-T-9	Case Diverge	Ivanpah-Eldorado & Primm-Eldorado 230kV lines	P7	Common structure	Nconv	Nconv	Nconv	<95	Nconv	Nconv	Ivanpah RAS
NOL-T-10	Inyo 115kV Phase Shifter	Line INYOKERN - KRAMER 115.0 ck 1 line KRAMER-INYOKERN-RANDSB 115 ck 1	P6	Two overlapping singles	<95	<95	<95	119.98	<95	<95	Apply 2 hour emergency rating, followed by congestion management
NOL-T-11	Inyo 115kV Phase Shifter	Line OXBOW B - CONTROL 115.0 ck 1	P1	Single contingency	<95	103.07	113.84	<95	<95	<95	Apply 2 hour emergency rating, followed by congestion management



Thermal Overload

ID	Overloaded Facility	Worst Contingencies	Category	Category Description	Loading (%)						Potential Mitigation Solutions
					2019 Summer Peak	2022 Summer Peak	2027 Summer Peak	2019 Spring Light Load	2022 Spring Off-Peak	2022SP Heavy Renewables & Min Gas Gen	

Study Area: SCE North of Lugo

Voltage Deviations



ID	Substation	Worst Contingencies	Category	Category Description	Post Cont. Voltage Deviation %						Potential Mitigation Solutions
					2019 Summer Peak	2022 Summer Peak	2027 Summer Peak	2019 Spring Light Load	2022 Spring Off-Peak	2022SP Heavy Renewables & Min Gas Gen	
NOL-VD-1											
NOL-VD-2											
X-VD-3											
X-VD-4											
X-VD-5											
X-VD-6											
X-VD-7											
X-VD-8											
X-VD-9											
X-VD-10											
X-VD-11											
X-VD-12											
X-VD-13											
X-VD-14											
X-VD-15											
X-VD-16											
X-VD-17											
X-VD-18											
X-VD-19											
X-VD-20											
X-VD-21											
X-VD-22											
X-VD-23											
X-VD-24											
X-VD-25											
X-VD-26											
X-VD-27											
X-VD-28											
X-VD-29											
X-VD-30											
X-VD-31											
X-VD-32											



ID	Substation	Worst Contingencies	Category	Category Description	Post Cont. Voltage Deviation %						Potential Mitigation Solutions
					2019 Summer Peak	2022 Summer Peak	2027 Summer Peak	2019 Spring Light Load	2022 Spring Off-Peak	2022SP Heavy Renewables & Min Gas Gen	
X-VD-33											
X-VD-34											
X-VD-35											

Study Area: SCE North of Lugo

High/Low Voltage



ID	Substation	Worst Contingencies	Category	Category Description	Voltage (PU)						Potential Mitigation Solutions
					2019 Summer Peak	2022 Summer Peak	2027 Summer Peak	2019 Spring Light Load	2022 Spring Off-Peak	2022SP Heavy Renewables & Min Gas Gen	
NOL-V-1	Control 115	Control WEST BUS: INYO PHASE SHIFTER (CONTROL-INYO) CONTROL-CASA DIABLO- SHERWIN 115 kV CONTROL-HAIWEE-INYOKREN CONTRO	P2	Bus fault	>0.9	0.8882	>0.9	>0.9	>0.9	>0.9	Adjust voltage schedules, drop distribution load at Control Substation, add shunt capacitors
NOL-V-2	DSRTSTLN 230	Line IVANPAH - ELDORDO2 230.0 ck 1 Line PRIMM - IVANPAH 230.0 ck 1	P7	Common Structure	<1.1	<1.1	<1.1	1.1553	<1.1	<1.1	Ivanpah RAS
		Line IVANPAH - ELDORDO2 230.0 ck 1 Line PRIMM - IVANPAH 230.0 ck 1	P7	Common Structure	<1.1	<1.1	<1.1	1.2916	<1.1	<1.1	Ivanpah RAS
NOL-V-3	Ivanpah 230	Line IVANPAH - ELDORDO2 230.0 ck 1 Line PRIMM - IVANPAH 230.0 ck 1	P7	Common Structure	<1.1	<1.1	<1.1	1.1551	<1.1	<1.1	Ivanpah RAS
		Line IVANPAH - ELDORDO2 230.0 ck 1 Line PRIMM - IVANPAH 230.0 ck 1	P7	Common Structure	<1.1	<1.1	<1.1	1.2914	<1.1	<1.1	Ivanpah RAS
NOL-V-4	Primm 230	Line IVANPAH - ELDORDO2 230.0 ck 1 Line PRIMM - ELDORDO2 230.0 ck 1	P7	Common Structure	<1.1	<1.1	<1.1	1.2935	<1.1	<1.1	Ivanpah RAS
NOL-V-5	SILVERST 230	Line IVANPAH - ELDORDO2 230.0 ck 1 Line PRIMM - ELDORDO2 230.0 ck 1	P7	Common Structure	<1.1	<1.1	<1.1	1.2936	<1.1	<1.1	Ivanpah RAS
NOL-V-6	Cool Water 115	Kramer-Cool Water and Cool Water-TAP705 115kV lines	P6	Two overlapping singles	>0.9	>0.9	>0.9	>0.9	0.86	>0.9	Mojave Desert RAS
NOL-V-7	Cool Water 115	Kramer-Cool Water and Kramer-Tortilla 115kV lines	P6	Two overlapping singles	>0.9	>0.9	>0.9	>0.9	>0.9	0.828	SCE Operating Procedure 127, separating Kramer 115kV system from the Cool Water 115kV system
NOL-V-8											
NOL-V-9											
NOL-V-10											
NOL-V-11											
NOL-V-12											
NOL-V-13											
NOL-V-14											
NOL-V-15											



ID	Substation	Worst Contingencies	Category	Category Description	Voltage (PU)						Potential Mitigation Solutions
					2019 Summer Peak	2022 Summer Peak	2027 Summer Peak	2019 Spring Light Load	2022 Spring Off-Peak	2022SP Heavy Renewables & Min Gas Gen	
NOL-V-16											
NOL-V-17											

Study Area: SCE North of Lugo

Transient Stability



ID	Contingency	Category	Category Description	Transient Stability Performance						Potential Mitigation Solutions
				2019 Summer Peak	2022 Summer Peak	2027 Summer Peak	2019 Spring Light Load	2022 Spring Off-Peak	2022SP Heavy Renewables & Min Gas Gen	
NOL-TS-1	Control-Casa Diablo 1150kV (Fault 20% from Control)	P4.2	Stuck Breaker	Inyo, Oxbow B buses voltages fails to recover	Inyo, Oxbow B buses voltages fails to recover	Inyo, Oxbow B buses voltages fails to recover	Inyo, Oxbow B buses voltages fails to recover	Inyo, Oxbow B buses voltages fails to recover	Inyo, Oxbow B buses voltages fails to recover	Install Local Breaker Failure Backup (LBFB) scheme
NOL-TS-2	Control-Casa Diablo 1150kV (Fault 20% from Casa Diablo)	P4.2	Stuck Breaker	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-3	Control-Coso-Haiwee-Inyokern 115kV (Fault 20% from Inyokern)	P4.2	Stuck Breaker	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-4	Control-Coso-Haiwee-Inyokern 115kV (Fault 20% from Control)	P4.2	Stuck Breaker	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-5	Control-Inyo 115kV (Fault 20% from Control)	P4.2	Stuck Breaker	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-6	Inyokern-Downs 115kV (Fault 20% from Inyokern)	P4.2	Stuck Breaker	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-7	Inyokern-McGen-Searles 15kV (Fault 20% from Inyokern)	P4.2	Stuck Breaker	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-8	Kramer-Roadway 115kV (Fault 20% from Kramer)	P4.2	Stuck Breaker	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-9	Kramer-Roadway 115kV (Fault 20% from Roadway)	P4.2	Stuck Breaker	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-10	Kramer-Victor 115kV (Fault 20% from Kramer)	P4.2	Stuck Breaker	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-11	Kramer-Victor 115kV (Fault 20% from Victor)	P4.2	Stuck Breaker	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-12	Control 115/55kV Transforemer Banks	P6	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-13	Kramer 230/115kV Transformer Banks	P6	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-14	Lugo 500/230kkV Transformer Banks no RAS	P6	Normal clearing	Diverge	Diverge	Diverge	Diverge	Diverge	Diverge	Mojave RAS

Study Area: **SCE North of Lugo**

Transient Stability



ID	Contingency	Category	Category Description	Transient Stability Performance						Potential Mitigation Solutions
				2019 Summer Peak	2022 Summer Peak	2027 Summer Peak	2019 Spring Light Load	2022 Spring Off-Peak	2022SP Heavy Renewables & Min Gas Gen	
NOL-TS-15	Lugo 500/230kV Transformer Banks RAS	P6	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-16	Kramer-Inyokern-Randsburg Nos.1 & 3 115kV	P6	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-17	Coolwater-Kramer & Coolwater-Seg2-Tortilla 115kV (Fault at Coolwater)	P6	Normal clearing	Voltage dips violation at Coolwater and Tortilla	Voltage dips violation at Coolwater and Tortilla	Voltage dips violation at Coolwater and Tortilla	Voltage dips violation at Coolwater and Tortilla	Voltage dips violation at Coolwater and Tortilla	Voltage dips violation at Coolwater and Tortilla	Operating Procedure 127: open Ivanpah-Mountain Pass line
NOL-TS-18	Coolwater-Kramer & Coolwater-Seg2-Tortilla 115kV_OP (Fault at Coolwater)	P6	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-19	Coolwater-Kramer & Kramer-Tortilla 115kV (Fault at Kramer)	P6	Normal clearing	Diverge	Diverge	Diverge	Diverge	Diverge	Diverge	Operating Procedure 127: open Ivanpah-Mountain Pass line
NOL-TS-20	Coolwater-Kramer & Kramer-Tortilla 115kV_OP (Fault at Kramer)	P6	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-21	Kramer-Victor 230kV Nos.1 & 2 no RAS	P7	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-22	Kramer-Victor 230kV Nos.1 & 2 RAS	P7	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-23	Lugo-Victor 230kV Nos.1 & 2 no RAS	P7	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-24	Lugo-Victor 230kV Nos.1 & 2 RAS	P7	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-25	Control-Coso-Haiwee-Inyokern & Control-Haiwee-Inyokern 115kV no RAS	P7	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-26	Control-Coso-Haiwee-Inyokern & Control-Haiwee-Inyokern 115kV RAS	P7	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	

Study Area: **SCE North of Lugo**

Transient Stability



ID	Contingency	Category	Category Description	Transient Stability Performance						Potential Mitigation Solutions
				2019 Summer Peak	2022 Summer Peak	2027 Summer Peak	2019 Spring Light Load	2022 Spring Off-Peak	2022SP Heavy Renewables & Min Gas Gen	
NOL-TS-27	Kramer-Victor & Roadway-Victor 115kV	P7	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-28	Kramer-Victor & Kramer-Roadway 115kV	P7	Normal clearing	Stable	Stable	Stable	Stable	Stable	Stable	
NOL-TS-29										
NOL-TS-30										
NOL-TS-31										

Study Area: **SCE North of Lugo**



Single Contingency Load Drop

ID	Worst Contingencies	Category	Category Description	Amount of Load Drop (MW)										Potential Mitigation Solutions
				Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	
X-SLD-1														

No single contingency resulted in total load drop of more than 250 MW.

Study Area: **SCE North of Lugo**



Single Source Substation with more than 100 MW Load

ID	Substation	Load Served (MW)										Potential Mitigation Solutions
		Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	Select..	
X-SS-1												

No single source substation with more than 100 MW Load