CITY OF RIVERSIDE

Public Utilities Department
Administration

July 22, 2008

Felicia Miller
Project Manager
California Energy Commission
Energy Facility Siting Division
1516 9th Street, MS-15
Sacramento, California 95814-5512

REF: ADMIN 08-047

Subject:

Dear Ms. Miller:

Due to an unexpected increase in power usage among existing customers, Riverside Public Utilities' (RPU) 69 kV system is projected to experience unprecedented overloads on some of its N-1 Contingencies in the 2009 Heavy Summer Peak case. The additions of RERC 3 & 4 will be beneficial to the RPU 69 kV system to reduce the overloads from sixteen (16) down to seven (7) occurrences, as demonstrated in the system studies. RPU acknowledges that the Mountainview-Vista transmission line would experience increased loading rates as a result of the addition of RERC Units 3 & 4. If necessary, RPU would initiate the mitigation measures described below to relieve unacceptable line loading.

Mindful of applicable NERC Standards, RPU will adhere to all relevant NERC Reliability Standards, Regional, sub regional, and Power Pool facility connection requirements and its own transmission System Planning criteria. When mitigating for transmission equipment overloads, the RPU System Dispatchers have the authority to sectionalize the system as necessary to protect the transmission equipment. In addition, the Riverside System Dispatchers have the authority to initiate load shedding to protect transmission system equipment from exceeding emergency equipment ratings, as well as, to bring loadings back down to nominal ratings within allowable time frames.

Sincerely,

Stephen H. Badgett
Utilities Deputy General Manager/Energy Delivery

RG/SHB:gsg
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cc: Bob Gill, Principal Engineer/Project Manager

TABLE 2

A 24-YEAR HISTORY OF 66 KV TRANSMISSION LINE SINGLE AND MULTIPLE FORCED OUTAGES, BY MONTH

YEAR	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER		ANNUAL TOTALS	
	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2
1966			2		1				1				2		3		3		2				3		17	0
1967									1						2		1		2				1		7	0
1968	1			1	1		1	1					2	1	1				1		2		1		10	3
1969	6	1	2		3				1		1					1			2				1		16	2
1970		1	1															2			1		3	1	5	4
1971	1						1								2		1		3		1		1		10	0
1972	(NO DATA AVAILABLE)		2		6								1		2		4				1	1			16	1
1973									1								1								2	0
1974	(NO DATA AVAILABLE)								1				1						1		1				4	0
1975															1								1		3	0
1976				1											1	1									2	2
1977	1						1	1					1		2				2				1		7	0
1978			1																2						5	1
1979	2				1		1				1		1				2		1		1				10	0
1980			1		1		2		2		1	2	2		1		3	1			2	1	3		19	5
1981	2				6					1					1				1		3				12	1
1982	1		1							2			1				1	1					2		5	3
1983	1				4				1		5		2	1	1		1	1							4	0
1984			1								1								4	1	1		1		13	2
1985					2				2			1					1		2	1					11	2
1986			1		1						2		1		1		2		1	1			1		8	3
1987	1	1			4						1						1		1						8	0
1988		1			2				2			1					1		4	1					8	2
1989					2				1		2				1		1		1		1				6	1
1990	1		2		1			1									1		1						208	32
1991							1		1						1		1									
Total M-1	17		13		29		8		12		11		15		19		23		25		16		20			
Total M-2's		4		2		1		3		3		3		2		2		5		3		3		1		

March 18, 1992

SUMMARY OF FORCED OUTAGES BY CAUSE

	M-1	M-2 (Or Higher)
Rain / Wind / Lightning / Fog	72	10
Relay Misoperation, inc. water intrusion of pilot wire	35	3
(Rain / Wind / Lightning / Fog) and (Relay Misoperation)		9
Unknown Cause	31	2
Palm Frond or Tree in Line	20	
Hot Washing of Line	18	
Vehicle Accident	9	
Fire Under Line or Pole Fire	7	1
Crew Error	6	
Animals	3	
Excessive Loading Var Flow	2	2
Flood	1	
Earthquake		1
Miscellaneous	4	4
Totals =	208	32

TABLE 3

A 24-Year History of Multiple Transmission Line Forced Outages on the City of Riverside Electric Transmission System

Year*	Date	Start Time/ Multiple Outage	Description of Outage	Duration of Multiple** Outage (Mins.)	City Load @ Time of Outage (MW)	City Historical Peak Loading (MW	% of Historical Peak Load
1968	Feb 6	06:25	**H.Lynn-Freeman & H.Lynn-Mtn.View**: Severe fault on SCE system caused HCB's on both lines to misoperate, dropping **H.Lynn** Sub. Outage prolonged due to supy misoperation.	8	NA	157	--
	Apr 11	13:40	**H.Lynn-Mtn.View** line was out for work when **Freeman** line relayed at **La Colina** and **Freeman 33kV** line relayed at **Casa Blanca**, dropping Freeman, H.Lynn and part of 33kV system. (**Freeman-Mtn.View** line did not exist at this time.) Exceeding minimum trip of relay was probable cause.	5	NA	157	--
	Jul 28	02:46	**Vista-Hunter #2** previously out due to HCB misoperation. **Vista-Riverside** relayed due to lightning.	12	NA	157	--
1969	Jan 25	04:26	**Hunter-La Colina-University** line relayed due to rain and wind. **La Colina** line opened at **Freeman** due to HCB misoperation, dropping **La Colina** Sub.	11	NA	175	--
	Aug 4	05:52	**Hunter-La Colina-University** line relayed due to flashover in fog. **H.Lynn** line relayed at **Freeman** due to HCB misoperation.	2	NA	175	--
1970	Jan 26	11:59	**Vista-Mtn.View & Vista-Riverside** lines relayed when contractor allowed new 220kV conductor to contact lines at **Vista** substation.	11	NA	183	--
	Sep 3	04:56	**Vista-Mtn.View** line relayed due to flashover and **Mtn.View** line relayed at **Plaza** due to HCB misoperation.	14	NA	183	--
	Sep 28	07:40	**Freeman-LaColina** line tripped due to fire under line, and **Mtn.View** line opened at **Plaza** due to HCB misoperation.	3	NA	183	--
	Dec 14	01:29	**Vista-Mtn.View** line relayed due to lightning and **Vista** line opened at **Riverside** due to HCB misoperation.	8	NA	183	--
1973	Nov 18	16:04	**Vista** line relayed at **Mtn.View** and **Riverside** line relayed at **Vista** -- both apparently caused by lightning-induced trouble in HCB pilot wires.	5	NA	231 (1972)	--
1978	Feb 13	16:25	**Vista-LaColina & Vista-Mtn.View** both relayed during lightning storm.	3	NA	277	--
	Aug 8	20:50	**Freeman-LaColina** line relayed due to lightning and **LaColina** line opened at **Vista** due to HCB misoperation, dropping **LaColina** sub.	6	NA	277	--

* *History covers period of 1966 through 1991, excluding 1972 and 1974 (incomplete transmission line outage data).*

NA - Not Available

** *If load is not interrupted or equipment is not overloaded, duration of outage may be longer due to additional time to patrol lines since line may not be reclosed for test. This only applies to cases where the fault is not permanent.*

Year*	Date	Start Time/ Multiple Outage	Description of Outage	Duration of Multiple** Outage (Mins.)	City Load @ Time of Outage (MW)	City Historical Peak Loading (MW	% of Historical Peak Load
1980	Apr 22	15:27	**Freeman-LaColina & Vista-LaColina** lines relayed due to lightning, dropping **LaColina** sub.	1	NA	312	--
1982	Mar 17	07:22	**Vista** line open at **LaColina** and **Vista** line open at **Mtn.View**, possibly due to lightning-induced trouble in HCB pilot wires.	1	106	318 (1981)	33
	Jun 1	18:36	**Mtn.View** line opened at **H.Lynn**, then **Mtn.View** line opened at **Freeman** when leading P.F. caused directional overcurrent relays to misoperate. Both lines were patrolled before reclosing.	93	133	318 (1981)	42
		21:57	*Same as at 18:36*	NA	118	318 (1981)	37
	Sep 27	13:41	**Vista-LaColina** line relayed due to lightning and **Mtn.View** line opened at **Vista** due to possible HCB pilot wire trouble.	4	146	318 (1981)	46
	Nov 30	09:21	**Vista-Riverside & Vista-LaColina** relayed during rain and wind storm.	4	133	318 (1981)	42
1983	May 1	15:39	**Vista-Hunter & Vista-LaColina** lines relayed during lightning storm. **Vista** line relayed at **Mtn.View** only due to possible HCB pilot wire trouble (N-3).	3	100	318 (1981)	31
1984	May 30	02:18	**Freeman-LaColina** line had previously relayed due to lightning and was still out due to supy trouble at **Freeman** when **Vista-LaColina** line relayed due to lightning, dropping **LaColina** sub.	3	107	331	32
		02:25	**Freeman-LaColina** still open (*see above entry*) and **Hunter-University** line relayed due to lightning.	2	107	331	32
	Sep 16	13:50	**Vista-Mtn.View** line had already relayed due to lightning and locked out when **Vista-Mtn.View-Riverside** line relayed due to lightning and locked out. HCB made non-automatic at each station and lines then tested good.	29	197	331	60
1986	Jul 21	12:54	**Vista-Mtn.View-Riverside** line was already out due to lightning when **Vista-LaColina** line relayed due to lightning.	3	217	331 (1984)	66
	Sep 24	02:48	**H.Lynn-Mtn.View** line relayed due to flashover at riser during rain storm. **Vista-Mtn.View** and **Vista-Mtn.View-Riverside** lines also relayed at same time (N-3).	5	95	331 (1984)	29
1987	Jan 20	04:40	**Vista-Riverside & Vista-Mtn.View-Riverside** lines relayed when wind storm damaged common pole. **Vista-Riverside** line did not open at **Mtn.View** due to stuck OCB, causing following **Mtn.View** lines to relay at far end: **Vista, Freeman, H.Lynn & Plaza**, dropping **Mtn.View** sub (N-6). These lines and **Mtn.View** sub were returned to service in about 90 minutes, when stuck OCB was cleared.	(Hours)	102	331 (1984)	31

7/30/86 N-3 (3 mins) LC T1 & T2 off.

* *History covers period of 1966 through 1991, excluding 1972 and 1974 (incomplete transmission line outage data).*

NA - Not Available

** *If load is not interrupted or equipment is not overloaded, duration of outage may be longer due to additional time to patrol lines since line may not be reclosed for test. This only applies to cases where the fault is not permanent.*

Year*	Date	Start Time/ Multiple Outage	Description of Outage	Duration of Multiple** Outage (Mins.)	City Load @ Time of Outage (MW)	City Historical Peak Loading (MW	% of Historical Peak Load
1987, cont.	Oct 1	07:41	**Mtn.View and Freeman** lines were open-ended at **H.Lynn** when earthquake caused three **H.Lynn** 66kV circuit breakers to open.	1/2	181	331 (1984)	55
1988	Jan 17	14:02	**Vista-Mtn.View-Riverside** line relayed due to lightning and **Vista-Alumax** line relayed at **Hunter** only due to possible HCB pilot wire trouble.	3	137	367	37
	Jun 16	10:48	**Mtn.View-Plaza** line relayed, cause unknown, weather normal. At same time, **H.Lynn** line relayed at **Mtn.View**, possible HCB misoperation. Re-energizing was delayed until line was patrolled.	33	197	367	54
	Oct 23	05:42	**Vista-Alumax-Hunter** line relayed previously due to flashover in fog. When line was tested and locked out, **Riverside** line relayed at **Vista** only, possible HCB misoperation.	8	106	367	29
1990	Apr 5	18:20	**H-Lynn-Mtn.View** line relayed when 66kV cable failed. **Vista-Mtn.View & Vista-Mtn.View-Riverside** lines relayed at same time also, apparently due to HCB misoperation. (N-3). These latter two lines were patrolled before being tested, hence the long outage time.	147	178	407	44
	Oct 8	10:46	**Vista-Mtn.View & Vista-Mtn.View-Riverside** lines relayed due to a fire in the Santa Ana River bottom. At the same time, the **Mtn.View-Plaza** line relayed, apparently due to an HCB misoperation. It was returned to service in 25 minutes (N-3).	(Several days)	262	407	64
1991	Nov 3	11:02	**Hunter-LaColina-University & LaColina-Orangecrest** lines relayed, weather calm, no cause found. Dropped T-3 and T-4 at **LaColina** and **Springs** sub.	2	144	407 (1990)	35

* *History covers period of 1966 through 1991, excluding 1972 and 1974 (incomplete transmission line outage data).*

NA - Not Available

** *If load is not interrupted or equipment is not overloaded, duration of outage may be longer due to additional time to patrol lines since line may not be reclosed for test. This only applies to cases where the fault is not permanent.*

TABLE 4

A Listing of 66kV Transmission Lines Which Share Common Structures

1. **Vista - Riverside** and **Vista - Mountain View - Riverside** (to be looped in at Riverside Substation)

   These lines share common poles for 4.2 miles between Vista Substation and North Main Street. The line route, for the most part, is over unimproved areas, surrounded by low, sparse brush. The lines then follow North Main Street, a busy thoroughfare, for about 1.6 miles, and then an additional 1.3 miles along residential streets approaching Riverside Substation. These lines experienced a simultaneous outage in January, 1987 when a wind storm damaged a common pole. Return-time of the lines was not recorded, but it probably required an hour or more to repair the pole. This fault revealed a stuck circuit breaker at Mountain View Substation, which resulted in the substation being dropped at this same time.

2. **Vista - Mountain View** and **Vista - Mountain View - Riverside** (to be looped in at Riverside Substation)

   These lines share common poles for about 0.6 miles along the Santa Ana River, northeast of Mountain View Substation. Part of this area has thick undergrowth and both lines had a simultaneous outage in October, 1990 due to a "river-bottom" fire. Return-time of the lines was not recorded, but they were out for several days.

3. **Vista - La Colina** and **Hunter - La Colina - University**

   These lines share common poles along 0.7 miles of residential and industrial streets north of University Substation. They also share 0.6 miles of steel pole construction along Canyon Crest Drive, south of University Sub. There is an additional 2.7 miles of common-wood-pole construction through orange groves, backyard easements, etc. which is not exposed to vehicular traffic. There is no record of this double line outage occurring in the past.

4. **La Colina - Orangecrest** and **Orangecrest - Springs**

   While the final route for the Orangecrest - Springs line is yet to be approved, it appears very likely that the eventual route will include a double-circuit section with the La Colina - Orangecrest line along Trautwein Avenue for about 0.2 miles.

Other lines share only a small number of common poles or structures:

5. **Vista - Mountain View**, **Vista - Mountain View - Riverside**, and **Vista - Riverside**

   Just outside, and north of Vista Substation, these three lines are on a common H-frame structure. The H-frame is located in a park, surrounded by lawn and not exposed to traffic.

6. **Hunter - La Colina - University** and **Hunter - Riverside**

These lines share two poles in the center median of Chicago Ave., just south of Hunter Substation and are exposed to vehicular traffic.

7. **Vista - Hunter** and **Vista - Alumax - Hunter**

These lines share one pole at the intersection of Chicago and Columbia Avenues and is exposed to vehicular traffic.

8. **Vista - Mountain View**, **Vista - Mountain View - Riverside**, and **Mountain View - Plaza**

These three lines share a common pole outside of Mountain View Substation on Sheppard St. The pole sits on a corner where the street makes a 90-degree turn and is exposed to vehicular traffic.

9. **Vista - Mountain View - Riverside**, **Mountain View - Plaza** and **Freeman - Mountain View**

These three lines are on a common wood pole within Mountain View Substation.

10. **Freeman - Mountain View** and **Mountain View - Plaza**

These lines share eight wood poles out of Mountain View Substation. Two of the poles are exposed to vehicular traffic at the intersection of Dewey and Phoenix Streets.

11. **Freeman - Mountain View** and **Harvey Lynn - Mountain View**

These lines share a common pole at the intersection of California and Monroe, and are exposed to vehicular traffic.

12. **Harvey Lynn - Freeman -** and **Freeman - Orangecrest**

These lines share a common pole on Gibson St., exposed to vehicular traffic, outside of Freeman Substation, as well as two more poles in a parking lot just outside the substation.

13. **La Colina - Springs** and **La Colina - Orangecrest**

These lines share two wood poles just outside of La Colina Substation. The poles are on vacant land away from roads, with only sparse undergrowth.

14. **La Colina - Orangecrest** and **Freeman - Orangecrest**

These two lines share one common structure on Trautwein Avenue, just outside of Orangecrest Substation. The structure is a mammoth steel pole, approximately 4 feet in diameter.

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TABLE 5

TYPICAL ANNUAL LOAD DATA FOR CITY OF RIVERSIDE
419 MW ANNUAL PEAK LOAD LEVEL BASED ON HISTORICAL ANNUAL LOAD CURVES
(Source: City of Riverside Power Resources Group)

% of Peak Load	MW Level	Hrs Exceeding MW Level	% of Time Exceeding MW Level
100%	419	0 hr	0
99%	415	2 hr	.02%
98%	410	4 hrs	.045%
97%	406	10 hrs	0.11%
96%	402	16 hrs	0.18%
95%	398	24 hrs	0.27%
94%	393	28 hrs	0.32%
93%	389	48 hrs	0.55%
92%	385	60 hrs	0.68%
91%	381	66 hrs	0.76%
90%	377	68 hrs	0.78%
89%	372	84 hrs	0.96%
88%	368	96 hrs	1.10%
87%	364	100 hrs	1.14%
86%	360	106 hrs	1.21%
85%	356	118 hrs	1.35%
80%	335	216 hrs	2.47%
75%	314	357 hrs	4.08%
70%	293	531 hrs	6.07%
65%	272	774 hrs	8.84%
60%	251	1109 hrs	12.66%
55%	230	1647 hrs	18.80%
50%	209	2419 hrs	27.61%
24.5%	102	8760 hrs	100%
40%	168	~4634	~52.9%
30%	126	~7227	~82.5%

TABLE 6

FORCED OUTAGES OF 66-12KV TRANSFORMERS
For The Period 1962 Through 1991

Year	Failed Transformer	Individual Transformer Breaker Installed?	Comments
(Sometime after 1965)	Plaza No. 1	No	Transformer was rebuilt.
1970	Freeman No. 2	Yes	Due to a control scheme failure, a circuit breaker repeatedly closed into a fault until Bank No. 2 failed. Transformer was rebuilt and returned to service.
1989	Freeman No. 3	Yes	Transformer failed and was replaced.
1990	Freeman No. 1	Yes	Transformer failed and was replaced.

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FIGURE 1

DISTRIBUTION FUNCTION OF TRANSMISSION LINE FORCED OUTAGES
CITY OF RIVERSIDE TRANSMISSION SYSTEM - 1981 THROUGH 1991

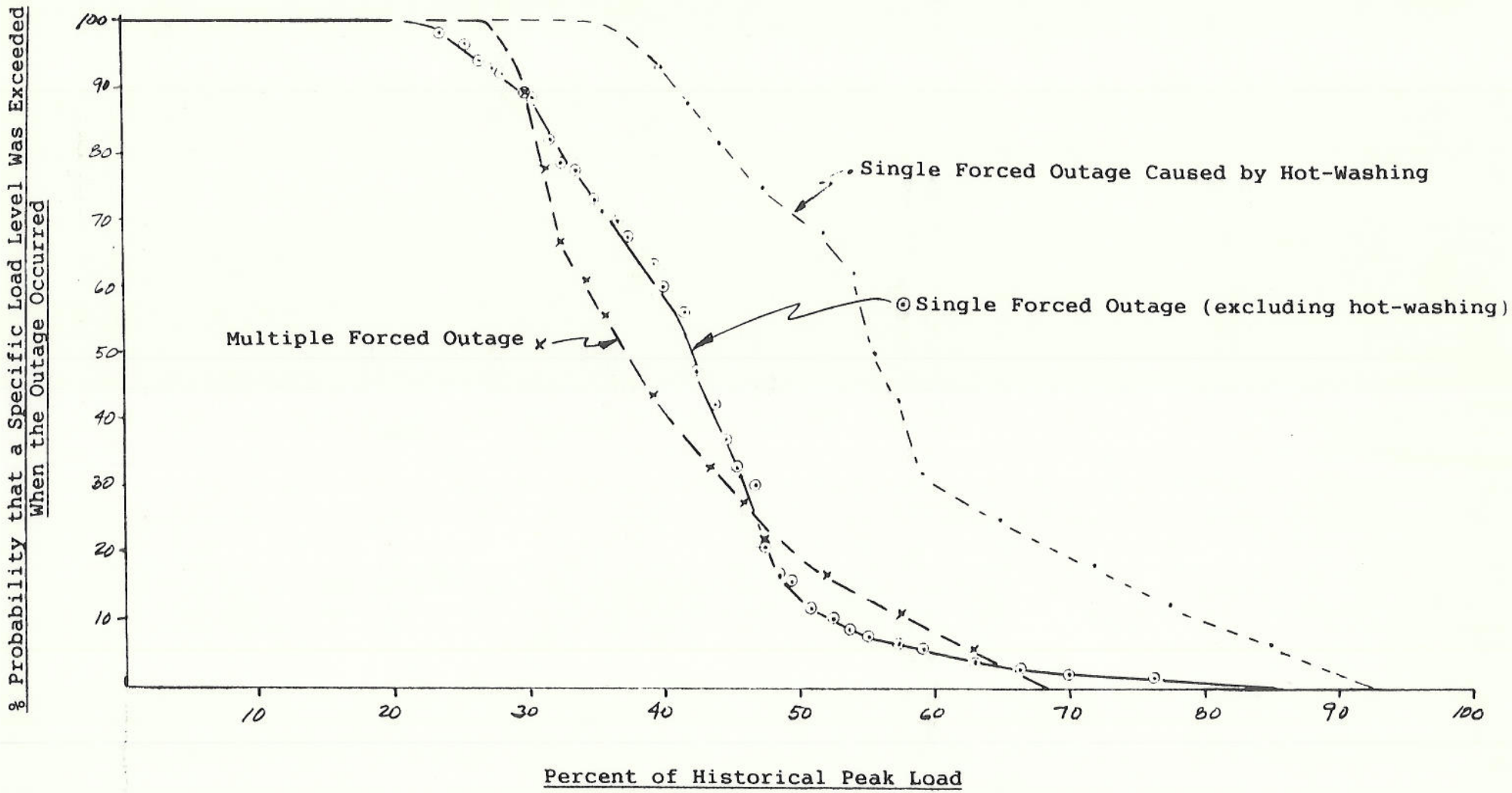

FIGURE 1

2-25-92

VOLTAGE CRITERIA

1.0 INTRODUCTION

The Transmission Planning Criteria limits the voltage drop at the transmission-voltage load bus following a Likely or Unlikely Outage Condition. The criteria, however, is dictated by the need to provide correct customer voltage on the distribution system as described below.

2.0 STATIONS WITH ONE OR MORE FIXED-TAP TRANSFORMERS (NLTC)

2.1 Normal Conditions

The City designs the distribution system for normal conditions so that power is supplied to the customer's meter point at a voltage of at least 120 volts. This is done through the proper selection of equipment, such as no-load taps of 66,000-12,000 and 12,000-240/120 volt transformers, size of 12kV feeder and 120/240 volt service conductors, as well as location of capacitor banks and voltage regulators.

2.2 Likely Outage Conditions

Customer voltage at the service panel is normally designed to be 120 volts. For the loss of a single transmission line, the customer's service voltage should not drop below 114 volts, or a drop of 5.0% from 120 volts. This 114-volt limit is based on the criteria set forth in ANSI Standard C84.1-1989, labeled as Range A (pg. 13). Provided that the customer's electric system is designed properly, this service voltage will allow utilization equipment to operate satisfactorily. Thus, the planned maintenance outage of a transmission line can be performed without adversely effecting service to the City's customers.

Since customer load at summer peak includes a major air conditioning component which is a constant kVA load, a drop of 5.0% at the customer will increase load current and will, therefore, increase voltage regulation of the supply system. Thus, the transmission voltage cannot be allowed to drop as much as the voltage at the customer. The attached Table 7 shows that the transmission bus voltage can drop only 3.5%, to limit the voltage drop at the customer to 5.0%. Accordingly, the transmission voltage drop at any bus will be limited to 3.5% during a Likely Outage Condition at Peak Load.

2.3 Unlikely Outage Conditions

For Unlikely Outage Conditions, the customer's service voltage should not drop below 110 volts, or a drop of 8.3% from 120 volts. This 110-volt limit is also based on ANSI Standard C84.1 and is labeled as Range B (p. 13). Regarding this range, the Standard states the following: "Although such conditions are a part of practical operations, they shall be limited in extent, frequency and duration. When they occur, corrective measures shall be undertaken within a reasonable time to improve voltages to meet Range A requirements", (p. 8). The Standard also states that utilization equipment should be designed to give acceptable performance within Range B,

although not necessarily as good performance as in Range A. The Standard recommends "prompt corrective action" if voltage occurs outside of Range B. "The urgency for such action will depend upon many factors, such as location and nature of load or circuits involved, and magnitude and duration of the deviation beyond Range B limits."

Similar to the "constant kVA" analysis of Likely Outage Conditions, the transmission voltage drop for Unlikely Outage Conditions is limited to 5.8% (see Table 7).

3.0 STATIONS WITH NO FIXED-TAP TRANSFORMERS

The criteria also limits the transmission bus voltage drop for load served from LTC transformers. The allowed voltage drop is increased by the percent LTC reserve expected at the time of the outage, but shall not be increased by more than 2.0%. This ensures that the initial voltage drop will not be excessive, prior to correction by the LTC. Table 8 lists LTC and non-LTC transformers. Presently, only Orangecrest, Plaza, Riverside and Springs Subsatations are totally equipped with LTC transformers. Thus, transmission voltages at these stations would be allowed to exceed the 3.5%/5.8% limits by up to 2.0%, based on anticipated LTC reserve.

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TABLE 7

INCREASED VOLTAGE REGULATION DUE TO CONSTANT KVA CUSTOMER LOAD

Outage Condition	% Voltage Drop At Customer Svc. Point	Increased % Regulation Between Customer's Meter and Transmission Voltage Bus Due To Constant kVA Load				Resulting Voltage Drop Allowed At Transmission Bus *
		Secondary Feeder & Service Wires	Distribution Circuit Transformer (12000-240/120 Volt)	Distribution Circuit	Substation Power Transformer (67-12.47kV)	
	(a)	(b)	(c)	(d)	(e)	(f)
Likely	5.0	0.3	0.3	0.8	0.10	**3.5**
Unlikely	8.3	0.5	0.5	1.3	0.17	**5.8**

* *A voltage drop of 3.5% or 5.8% at the transmission bus will result in a voltage drop of 5.0% or 8.3%, respectively, at the customer's meter.*

NOTES: *(a) This is the voltage drop allowed at the customer, based on ANSI Standard No. C84.1-1989 and City of Riverside design standards.*

(b) Increased voltage regulation through secondary feeder wires and service drops was assumed to be equal to the increased regulation through the distribution circuit transformer based on the relative impedance and ampere loading of typical examples.

(c) Distribution circuit transformer assumptions were as follows:

Overhead — *25 kVA, 12000-208V, 3-phase, z=1.0+j1.8%, 100% loaded at 0.5 and 0.9 var/watt ratios.*

Underground — *50 kVA, 12470-208V, 3-phase, z=1.1+j1.4%, 100% loaded at 0.5 and 0.9 var/watt ratios.*

Range for a 5.0%- drop is 0.1% (underground) to 0.3% (overhead). Range for an 8.3%- drop is 0.2% (underground) to a 0.5% (overhead).

(d) A typical overhead circuit (Circuit No. 1205) was studied using the Scott & Scott DPA Program. Results were relatively insensitive to changing power factor. Other circuits were studied, including totally underground (Circuit No. 1218). The above data, 0.8% and 1.3%, are the largest increase.

(e) The following power transformer data was used:

18 MVA, 67-12.47kV, z=~~7.0~~ 0.3+j7.0 ~~j0.3~~%, 100% loaded at 0.07 var/watt ratio. The resulting high-side var/watt ratio was about 0.15. This is typical at peak load.

(f) This column is arrived at by subtracting columns (b) through (e) from column (a).

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TABLE 8

VOLTAGE CONTROL AT DISTRIBUTION-VOLTAGE BUSSES

Vista Substation 66kV bus voltage is controlled manually, using two 220-66kV transformers equipped with LTC as well as the var output of a 72 MVAR synchronous condenser. The bus voltage is maintained as follows:

Total City Load (MW)	Bus Voltage (kV)
0 - 100	66.0
101 - 150	66.5
151 - 200	67.5
201 - 250	68.0
251 and above	68.5

LTC

In addition to the voltage control at Vista Substation, the following 66kV transformers have LTC's which are used for voltage control:

Freeman	67-12.47kV	T-1, T-3, & T-5 +/-10%
Hunter	65.55-4.36kV	T-2 (both 4kV circuits have regulators; transformer has no LTC)
Hunter	67-12.47kV	T-5 +/-10%
La Colina	67-12.47kV	T-3 +/-10%
Mt.View	67-4.36kV	T-1, T-2 +/-10%
Mt.View	67-12.47kV	T-6 +/-10%
Orangecrest	67-12.47kV	T-1 +/-10%
Plaza	67-4.36kV	T-1, T-2, T-4 +/-10%
Riverside	67-12.47kV	T-3 +/-10%
Springs	67-12.47kV	T-1 +/-10%
University	67-4.36kV	T-1, T-2 +/-10%

The 66-33kV autotransformers at Riverside and Freeman have no LTC; however all 33-4kV transformation served from the 33kV system is equipped with LTC (+/-10%).

Continued..

TABLE 8, Cont.

Non-LTC

The following 66kV transformers have no LTC voltage control:

Alumax	69-4.36kV	T-1 (7.5 MVA)
Freeman	67-12.47kV	T-2 (7.5 MVA)
Freeman	67-12.47kV	T-4 (18 MVA)
Harvey Lynn	67-12.47kV	T-1, T-2, T-3, & T-4 (four @ 18 MVA)
Hunter	65.55-4.36kV	T-1 (one 4kV circuit)
Hunter	67-12.47kV	T-3, T-4 (two @ 10 MVA)
Kaiser	67-4.36kV	T-2 (7.5 MVA)
La Colina	67-12.47kV	T-1, T-2 (two @ 12 MVA)
La Colina	67-12.47kV	T-4 (18 MVA)
Mt.View	67-12.47kV	T-3, T-4 (two @ 18 MVA)
University	67-4.16kV	T-M1 (7.5 MVA)

Summary of Stations With Total Transformer LTC Control

At the following stations, all transformers are equipped with LTC:

Orangecrest	67-12.47kV
Plaza	67-4.36kV
Riverside	67-12.47kV and 33-4.36kV
Springs	67-12.47kV

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A COMPARISON OF CITY OF RIVERSIDE CRITERIA AND CRITERIA OF THE 1987 R. W. BECK TRANSMISSION STUDY

A comparison of this criteria and the criteria used by R. W. Beck in their 1987 Transmission Study yielded the following:

		Criteria Used in the R.W. Beck Study	City of Riverside Criteria
1.	Definition of Likely Outage Condition:	Includes outage of two lines on the same circuit, exposed to heavy vehicular or airline traffic.	Does not include this set of circumstances -- see discussion on Page B-1
2.	Outage Condition Action Plan:	Recommend capitol projects for 100% of Peak Load, as necessary.	• Recommend capitol projects for 80% of Peak Load, as necessary. • Recommend low-cost or no-cost remedial action schemes for 100% of Peak Load, as necessary.
3.	Transmission Line Conductor Ratings, Likely and Unlikely Outage Conditions:	Both criteria use the same conductor ratings for Likely and Unlikely Outage Conditions except for 653.9 MCM ASCR conductor. While the Beck study indicates Edison conductor ratings were used, the rating for 653.9 conductor used in the Study was 820 amps. Edison has historically used 850 amps until 1989 when the rating was raised to 920 amps. The City of Riverside Criteria uses 850 amps. (See Pages A-1, -2)	
4.	Bus Voltage		
	Normal Conditions:	Requires voltage at each transmission bus to be 66kV, ±5%	No requirement. Design system to supply customer at 120 volts, minimum.
	Likely Outage Conditions:	Maximum voltage drop of 3.5% at 12kV/4kV load bus	Maximum voltage drop of 3.5% at 66kV bus (see Page C-1)
	Unlikely Outage Conditions:	Maximum voltage drop of 7.0% at 12kV/4kV load bus	Maximum voltage drop of 5.8% at 66kV bus (see Page C-1)

Other Differences

The Beck criteria included references to automatic underfrequency load shedding, firm generation (within the City's system) and other items which do not apply to the City's system at this time. These were not included in the City's criteria.