



Imperial Irrigation District

Summary of Investigation

WECC Path 49 Short Term Upgrades (8055 MW)

2007 Addendum to Original Report on

Special Protection Scheme for Protection of the IID EI Centro 230/161kV Transformer

Prepared by
Imperial Irrigation District

August 7, 2007

TABLE OF CONTENTS

	<u>Page</u>
Executive Summary	3
Introduction	3
Study Assumptions and Methodology	3
Study Findings	5
Conclusions	7

APPENDICES

- A. Monitored Elements by Case
- B. Thermal Overloads for 2008 and 2009
- C. Case Comparison
- D. IV Generation Comparison
- E. 2008 Case Power Flow Maps
- F. 2009 Case With 230/161kV Xfmr Power Flow Maps
- G. 2009 Case Without 230/161kV Xfmr Power Flow Maps
- H. 2009 Case 1 IV Generation Power Flow Maps
- I. 2009 Case 2 IV Generation Power Flow Maps
- J. 2009 Case 3 IV Generation Power Flow Maps
- K. 2009 Case 4 IV Generation Power Flow Maps
- L. Original Report from January 2006 with Appendices

Executive Summary

The findings from this analysis support that a Special Protection Scheme (“SPS”) is still a valid interim solution to mitigate overloads experienced in the southern portion of the IID transmission service area for the loss of the Imperial Valley – North Gila 500kV line through 2009.

The findings also support that the proposed Path 49 Short Term Upgrades rating of 8055MW is not impacted by the interim implementation of the SPS

The original study conducted in late 2005 identified the opening of the Imperial Valley – El Centro 230kV line as the SPS for the loss of the Imperial Valley – North Gila 500kV line to protect El Centro 230/161kV transformer. The result of the current studies validates the continued use of the SPS as an interim solution for protection of the southern portion of the IID transmission service area through 2009 while not impacting the Path 49 8055MW rating.

I. Introduction

The purpose of the studies was to validate the SPS that was identified in the 2005 original report through 2009. IID has identified several transmission upgrades to the southern portion of the IID transmission service area that could have an impact on the SPS that was identified in late 2005 in the original report to the WECC/WATS PRG for the Path 49 Short-Term Upgrades Project. Prior to any upgrades of the IID system taking place, the SPS has been validated through 2009 through this study effort.

Without any of the planned upgrades the limiting element is the El Centro 230/161kV transformer. The planned upgrades include the installation of El Centro Bank 4, a 230/92kV transformer that is expected to be in operation by late 2008. A 230kV transmission line extending from Imperial Valley substation to Dixieland substation along with a 230/92kV transformer located at Dixieland is proposed to be in operation by late 2009. In addition to the upgrades IID has planned for the relocation of the 230/161kV transformer located at El Centro.

II. Study Assumptions and Methodology

The SPS analysis summarized in this report included one primary Path 49 case that was approved through the WECC Regional Planning Rating Process, specifically SCE’s 2009 Light Autumn Path 49 8055MW case (Pre-PVD2 Project case). This case has been reviewed and approved through the WECC/Western Arizona Transmission Studies (“WATS”) Peer Review planning group. Per the request of both SDG&E and IID on the WATS conference call of April 17, 2007 SDG&E was allowed to insert an updated representation in the approved case supplied by CAISO and IID modeled its transmission and generation updates to the case to more accurately reflect the anticipated systems for 2009. The following is a list of IID and SDG&E’s transmission and generation updates to the cases:

IID Transmission and Generation Updates to Approved Case

- CEU 1 Gen Status Off and related POS (173MW) 2007
- Niland Generation On (100MW) 2008
- El Centro Bank 4 230/92kV 300MVA Transformer 2008
- IV-Dixieland 230kV Line 2009
- El Centro Repower Unit 3 On (85MW) 2009

SDG&E Transmission and Generation Updates to Approved Case

- Reconductor Shadowridge – Calavera 138 kV line 2009
- Reconductor Talega – Pico 138 kV line 2009
- Reconductor Division – Naval Station 69 kV line 2008
- Updated Lake Hodges pump storage 2008
- Reconductor Escondido – Felicita Tap 69 kV line 2009
- Updated Otay Mesa generation and transmissions 2009
- New Silvergate Substation 2008
- Modified impedances for Miguel – Sycamore 230 kV and Miguel – OldTown 230 kV line to reflect latest data.
- Updated configuration for Miguel-Sycamore 230 kV
- Updated configuration for Miguel-Old Town 230 kV
- Updated Penasquitos 230/138 kV bank data
- Other updates
 - South Bay Area 69 kV system
 - Bus voltage adjustments
 - SWPL line impedance
 - SDG&E load at load buses

From the supplied case, four base cases were created to show timing of upgrades and their impacts. The following table summarizes the cases that were run for this analysis:

Table 1: Summary of Cases

Case	Upgraded Elements	IV Gen	Blythe Gen
Case 1 (2008 Base)	None	425MW	360MW
Case 2 (2009 Base)	EC Bank 4 (230/92kV)	425MW	360MW
Case 3 (2009)	EC Bank 4 IV-Dixieland 230kV Line	425MW	360MW
Case 4 (2009)	EC Bank 4 IV-Dixieland Removed EC Bank 1 (230/161kV)	425MW	360MW

In addition to the initial four Base cases developed, cases depicting various levels of IV generation were created to study the impact generation from Imperial Valley has on the IID overloads caused by the IV – North Gila 500kV outage. IV generation levels from 0 to 350MW in 50MW increments were used to develop an overload table that would show the impact the IV generation has on overloading of elements in the southern portion of the IID transmission service area. The IV generation level cases were constructed for all four cases listed in Table 1. These tables are located in appendix D.

III. Findings

The investigation of the interim use of an SPS to protect the southern portion of the IID transmission service area did find that the SPS as identified in the 2005 report is still valid through 2009 under most conditions.

Without any additional upgrades to the IID system the limiting element is the 230/161kV transformer located at El Centro. This element overloads to a minimum of 165% and varies with different IV generation levels. Operation of the SPS will mitigate the overloads experienced during an IV-N.Gila 500kV Line outage.

IID’s El Centro Bank 4, a 230/92kV transformer, is expected to be in operation by late 2008. The most significant limiting element after the addition of Bank 4 is the IV-El Centro 230kV line during an IV-N.Gila 500kV outage. The IV-El Centro 230kV line overloads to 125% in the base case and to 135% with 0MW of IV generation. During an IV-N.Gila outage and 0MW of IV generation the El Centro Bank 4 transformer experiences overloading of 106%. The Bank 4 overload is also affected by the amount of

flow on the SWPL line prior to the outage. The approximate ratio of additional overloading is 7% for every 100MW of flow above 1520MW. The operation of the SPS under these conditions will mitigate the overloads experienced. The SPS is intended to be a temporary solution through 2009 at which time a long term solution must be in place.

With the addition of the IV – Dixieland 230kV line and its associated 230/92kV transformer which is proposed to be in operation in late 2009¹, the limiting element will be the El Centro-Pilot Knob 161kV line for an IV-North Gila outage. The overload of this element varies with different levels of IV generation. The line experiences overloading as IV generation decreases with 109% overloading occurring with 0MW of generation during an IV-North Gila outage. Please note that the IV generation is relatively new plants, therefore, its generation output is not likely to be 0MW. If IV generation is at or above 400MW during an IV-North Gila 500kV outage an SPS will not be operated for these conditions. Operating the SPS will cause overloading to occur on the El Centro and Dixieland 92kV sub-systems.

IID's expansion plans include the relocation of the 230/161kV transformer (Bank 1) located at the ECSS. The relocation of the ECSS 230/161kV transformer would cause the most significant limiting element to become the 161/92kV transformer at El Centro. This element overloads to 117% in the base case and overloads to 131% with 0MW of IV generation during an IV-North Gila 500kV outage. The Bank 2 overload is also affected by the amount of flow on the SWPL line (Imperial Valley – Miguel 500kV) prior to the outage. The approximate ratio of additional overloading is 7% for every 100MW of flow above 1520MW. Operation of the SPS causes overloading in the El Centro and Dixieland 92kV sub-systems regardless of the IV generation level studied if the existing 230/161kV transformer at ECSS is relocated. Therefore, a long term solution must be in place prior to when the ECSS 230/161kV transformer is relocated.

The analysis indicates that there are overloads occurring in the looped 161kV system, specifically in the Pilot Knob area. These overloads are as high as 109% and are experienced in all cases. The overloads vary with different IV generation levels. The SPS operation will mitigate the overloads. Additional analysis will take place in the next phase of the study to ensure that the permanent solution will mitigate the 161kV overloads.

The analysis also indicates that the SPS does not impact regional transmission system, specifically CFE and SDG&E, and can provide the interim protection to the southern portion of the IID transmission service area until a long term solution can be in operation. This long term solution is required to be in operation when either IID initiates the relocation of the ECSS 230/161kV transformer or before the end of the year 2009, whichever occurs before. IID considers the SPS to be an interim solution until the permanent solution is implemented.

Please refer to the specific appendix for the supporting material for these findings.

¹ IID is currently going through environmental and real estate studies associated with this proposed upgrade

IV. Conclusions

The SPS is a valid interim solution to protecting the southern portion of the IID transmission service area through 2009 prior to IID completing its internal upgrades and relocation of the existing 230/161kV transformer at ECSS. Beyond 2009 if IID completes the proposed upgrades within the IID system and successfully relocates the existing 230/161kV transformer at ECSS to another location, the interim SPS then may not be able to mitigate the potential overloading concerns. By then either a permanent mitigation will need to be completed. The evaluation for the longer term (i.e., beyond 2009 time frame) need of a permanent solution will be jointly evaluated in the next study phase by the CAISO, SDG&E, and IID team.

2009 Scenario's

Case 2 (Bank 4 installed)

- The SPS is required to be operated for loss of IV-North Gila 500kV

Case 3 (Bank 4, IV-Dixieland 230kV)

- IV generation 400MW or above - SPS required but may not be operated for loss of IV-North Gila 500kV
- IV generation below 400MW – Overloading of the El Centro-Pilot Knob 161kV line to 109% depending on IV generation level.
- Operation of the SPS causes cascading overloads in the El Centro-Dixieland 92kV Sub-System

Case 4 (Bank 4, IV-Dixieland 230kV, Bank 1 Relocated)

- Long term solution required due to overloading caused by operating the SPS regardless of IV generation level