February 20, 2008

Protective Relay Subcommittee

Subject: March 4, 2008 Protective Relay Subcommittee Meeting

Dear Subcommittee Member:

The Protective Relay Subcommittee will meet March 4, 2008 beginning at 9:00am at the Holiday Inn Select located at Three Appletree Square; Bloomington, MN. The agenda for this meeting is attached.

Overnight accommodations can be made via one of the following methods:

Phone
(952) 854-9000
Ask for MRO rate of $103/night + tax (Standard), $128/night + tax (Suite)

Internet
http://www.himspairport.com
Click "Book Now" and select date(s) of stay
Enter "100228113" as your Worldwide Corporate Account Number
Click "Check Availability"

If you have any questions regarding this meeting please contact Sandy Humenansky via email at sl.humenansky@midwestreliability.org or telephone at (651) 855-1730.

Sincerely,

Deven Bhan, Chair
Protective Relay Subcommittee

DB:sh

Attachment

MEETING AGENDA
MIDWEST RELIABILITY ORGANIZATION
PROTECTIVE RELAY SUBCOMMITTEE
Holiday Inn Select – Bloomington, MN
March 4, 2008 – 9:00am – 5:00pm

1. Welcome Deven Bhan
- *a. Determination of Quorum*
- *b. Agenda Additions*
- *c. Review MRO Policy and Procedure 4*

2. Approve Minutes of November 27-28, 2007 Meeting Dan Jesberg

3. Chairman's Report Deven Bhan

4. PRC-023 (BZ3) Update Don Raveling

5. Update on Approval of PRC-013 Dan Jesberg

6. Review the Latest Draft on MRO Guideline PRC-014 Dede Subakti

7. Special Protection Systems
- *a.* Update on Joint PRS/TAS/MISO SPS Review Team (SPSRT) Dan Jesberg
- *b.* SPS Retirement – Nelson-Dewey SPS Dede Subakti
- *c.* Procedural Review for SPS Retirements Review Process Dede Subakti

8. Mis-Operations
- *a.* 2007 Yearly Review – Summary of 2007 Mis-Operations Dan Jesberg
- *b.* 2008 Preview – New Team and Updates Spreadsheet Dan Jesberg

9. Technical Reference Paper on Recommended Auto-Reclosing (First Draft) Len Yee

10. Technical Reference Paper on Thermal Overload vis a vis Effect on CTs, Relays, Meters RTU Scales (First Draft) Steve Mittelstead

11. Miscellaneous

12. Next Meetings
- *a. Scheduled*
  May 22-23 12:00pm – 5:00pm 8:00am – 12:00pm
  August 26, 8AM-5PM
  November 13-14 12:00pm – 5:00pm 8:00am – 12:00pm
- *b. Additional Meetings (if needed)*

13. Adjourn

Agenda 1.
Welcome

Agenda 1.a.
Welcome
Determination of Quorum

Protective Relay Subcommittee
2008 Roster

Name	Sector	Company
Ding Lin	Canada	Manitoba Hydro
Len Yee	Canada	Saskatchewan Power
Don Ravling, Vice Chair	Dakotas	Montana-Dakota Utilities
Deven Bhan, Chair	Dakotas	Western Area Power Administration
Russ Miller	Iowa	Alliant Energy
Ken Birt	Iowa	MidAmerican Energy Company
Mark Peterson	Minnesota	Great River Energy
David Bisel	Minnesota	Minnesota Power
Steve Wadas	Nebraska	Nebraska Public Power District
Ron McIvor	Nebraska	Omaha Public Power District
Keith Orsted	Wisconsin	American Transmission Company
Terry Hopkins	Wisconsin	Dairyland Power Cooperative
Dede Subakti	MISO Liaison	Midwest ISO
Richard Quest	PAC Liaison	Xcel Energy
Steve Mittelsteadt	RTC Liaison	Basin Electric Power Cooperative
Dan Jesberg, Secretary		Midwest Reliability Organization
John Seidel, Alt. Secretary		Midwest Reliability Organization

Agenda 1.b.
Welcome
Agenda Additions

Standards of Conduct Reminder

FERC Standards of Conduct prohibit MRO staff, committee, subcommittee and task force members from sharing non-public transmission sensitive information with anyone who is either an affiliate merchant or could be a conduit of information to an affiliate merchant.

Anti-trust Reminder

Participants in Midwest Reliability Organization meeting activities must refrain from the following when acting in their capacity as participants in Midwest Reliability Organization activities (i.e. meetings, conference calls, and informal discussions):

- Discussions involving pricing information; and
- Discussions of a participant's marketing strategies; and
- Discussions regarding how customers and geographical areas are to be divided among competitors; and
- Discussions concerning the exclusion of competitors from markets; and
- Discussions concerning boycotting or group refusals to deal with competitors, vendors, or suppliers.

Agenda 2.
Approve Minutes of November 27-28, 2007

MEETING MINUTES
MIDWEST RELIABILITY ORGANIZATION
PROTECTIVE RELAY TASK FORCE
Holiday Inn Downtown – Bloomington, MN
November 27, 2007 – 1:00pm – 5:00pm
November 28, 2007 – 8:00am – 12:00pm

1. Call to Order - Deven Bhan
Chair Bhan called the meeting to order at 1:00pm. The following Members, Guests, and Staff were present:

Members Present

Deven Bhan, Chair, WAPA	Don Raveling, MDU, Vice Chair
Andrew Lucero, MRO, Secretary (Day 2)	Dan Jesberg, MRO, Alt. Secretary
Russ Miller, ALT	Keith Orsted, ATC
Terry Hopkins, DPC	Mark Peterson, GRE
Ken Birt, MEC	Ding Lin, MH (1:16pm)
David Bisel, MP	Steve Wadas, NPPD
Ron McIvor, OPPD	Len Yee, SPC
Richard Quest, XEL (PAC Liaison)	Steve Mittelsteadt, BECP (RTC Liaison)

Guests Present

Dede Subakti, MISO (Day 1 only)	Wenchun Zhu, ATC (via phone – Day 1)

Staff Present
Sandy Humenansky

Chair Bhan welcomed the two MRO staff members that join as part of the Protective Relay Task Force team, Dan Jesberg as Secretary and Sandy Humenansky as administrative support. Chair Bhan also reported that Mark Peterson and Pratap Mysore have joined the NERC standards drafting team for PRC 005 and PRC-001 respectively

2. Determination of Quorum
Mr. Jesberg determined that a quorum was present.

3. MRO Standards of Conduct and Anti-Trust Guidelines
Pursuant to Policy and Procedure 4, Chair Bhan reviewed the Standards of Conduct and Anti-trust Guidelines.

4. Consent Agenda
a. *Approve Minutes of September 24-25, 2007 - Andrew Lucero*
Chair Bhan called for discussion on the minutes of the September 24-25, 2007 meeting.

Upon motion duly made by Vice Chair Raveling and seconded by Mr. Orsted, the Protective Relay Task Force unanimously approved the minutes of the September 24-25, 2007 Protective Relay Task Force meeting as amended.

b. *Agenda Additions (if any)*
Chair Bhan reviewed today's agenda.

Alternate Secretary Jesberg reported that a new Protective Relay Subcommittee exploder has been developed (mro-prs@midwestreliability.org). Staff will maintain the mro-prtf@midwestreliability.org exploder until the end of 1Q08.

c. *Approve Dede Subakti as Non-Voting Member of PRS*
Upon motion duly made by Chair Bhan and seconded by Mr. Hopkins, the Protective Relay Task Force unanimously approved Dede Subakti as a non-voting member of the Protective Relay Task Force.

Action:
Secretary Jesberg will draft a letter for Chair Bhan's signature, addressed to the Chair of the Reliability Assessment Committee, stating that Mr. Subakti is approved as a non-voting member of the Protective Relay Task Force.

d. *Ratify Dede Subakti as Chairman of SPSRT*
Upon motion duly made by Chair Bhan and seconded by Mr. Miller, the Protective Relay Task Force unanimously ratified Dede Subakti as chair of the SPS Review Team.

Action:
Secretary Jesberg will draft a letter for Chair Bhan's signature, addressed to the Chair of the Reliability Assessment Committee, stating that Mr. Subakti is ratified as chair of the SPSRT.

e. *Approve 2008 Meeting Dates*
Chair Bhan proposed the following dates:

March 4	8:00am – 5: 00pm	
May 22-23	12:00pm – 5:00pm	8:00am – 12:00pm
August 26	8:00am – 5:00pm	
November 13-14	12:00pm – 5:00pm	8:00am – 12:00pm

Upon motion duly made by Mr. Quest and seconded by Mr. Mittelsteadt, the Protective Relay Task Force unanimously approved the proposed 2008 meeting dates.

5. Chairman's report
Chair Bhan reported that the Reliability Assessment Committee last met November 2, 2007. At this meeting, the Committee approved the charter to convert the Protective Relay Task Force to a subcommittee; the Board of Directors will formally ratify this change at its meeting on December 6, 2007; the task force will officially become a subcommittee upon ratification by the Board.

Chair Bhan also reported that the MRO has set a policy whereby chairs shall serve a term of 2 years upon which the vice chair will succeed the chair.

Action:

Chairman Bhan to follow up with Hoa Nguyen, Reliability Assessments Chair, regarding the MRO's issuance of a procedure for PRC-002. Although the Protective Relay Task Force has finished its work on PRC-002, the MRO has not yet issued their procedure. NERC has specifically asked Xcel Energy, and maybe others, for supporting evidence that the MRO has not issued these requirements.

6. SPS Periodic Review Procedure: Anticipated Workload for 2008

Chair Bhan requested that Mr. Subakti keep the Task Force informed of the review teams activities via monthly reports.

Action:

A brief report will be provided following the completion of each SPS review with a more detailed report to be completed monthly. Reports will be sent to the Transmission Assessment Subcommittee with a copy to the Protective Relay Task Force.

Mr. Subakti reviewed PRC-014 which states that a SPS shall be reviewed every five (5) years. Mr. Subakti reported that the MRO does not have all the data from those systems installed before the MRO became effective and started to follow NERC rules. A review should be done to remove or update those systems which are ineffective and/or unnecessary.

Action:

The Special Protection System Task Force will draft a list of those systems needing data and review those on a yearly basis until all systems have been reviewed and put on a five year cycle.

Action:

The SPS Review Team is tasked with developing a draft procedure regarding periodic review of SPS systems. Mr. Subakti will schedule meetings as needed and coordinate with Ms. Zhu for further coordination between the Transmission Assessment Subcommittee and Protective Relay Subcommittee.

The Subcommittee recessed at 3:05pm.
The Subcommittee reconvened at 3:25pm.

7. Special Protection Systems

a. *Weston 4 SPS Review Approval*

Alternate Secretary Jesberg reported that the review team has completed its review and has forwarded it to the Transmission Assessment Subcommittee for its acceptance. The review team is asking the Protective Relay Task Force to accept the review.

Upon motion duly made by Mr. Mittelsteadt and seconded by Mr. Peterson, the Protective Relay Task Force unanimously accepted the Weston 4 SPS review.

b. *Update on Joint PRS/TAS/MISO SPS Review Team (SPSRT)*
Mr. Jesberg reported on the following:

- The review team is now tasked with PRC-014.
- The review team is finalizing the Weston 4 vote.
- The review team is working on three (3) additional SPS'; Tatanka, Langdon, and Ramsey. The review team is working with Montana-Dakota Utilities on Tatanka; a review of the SPS packages for Ramsey and Langdon will be completed by weeks end.
- Mr. Seidel and Alternate Secretary Jesberg drafted a formal MRO letter to be submitted to entities when the entire SPS review process has been completed.

c. *SPS Database Review*
Mr. Jesberg reviewed the SPS database.

Action:
Alternate Secretary Jesberg will send the entire database file, with associated subfiles, to the review team for review and comment.

The Task Force recessed for the day at 4:52pm.
The Task Force reconvened for Day 2 at 8:03am.

8. Review Latest Drafts on MRO Guidelines for PRC-013 and PRC-014

Mr. Lin reviewed PRC-013 (reline attached as Exhibit #1). Requirement 1 specifies that the MRO shall maintain a SPS database; the database shall contain the following information:

- Design Objectives - Contingencies and system conditions for which the SPS was designed.
- Operation - The actions taken by the SPS in response to disturbance conditions.
- Modeling - Information on detection logic and/or relay settings that control the operation of the SPS.

Action:
Alternate Secretary Jesberg will add the three additional sub requirements (initial in service date of SPS, most recent MRO review date, and next scheduled MRO review date) to the spreadsheet. He is also directed to update the spreadsheet to include the three additional sub requirements. He is further instructed to send the final document to the Task Force for final comment. Once comments have been received and incorporated, the document will be posted on the MRO website; Chair Bhan will seek Reliability Assessment Committee approval via email.

7. Special Protection Systems

d. *SPS Redundancy Question: TAS Comments*
Secretary Lucero reviewed Section 4.1 of the guidelines for the design of critical communication circuits (as prepared by WECC). Chair Bhan suggests that the Task Force also review RFC's guidelines.

Mr. Lin stated that there are two issues:

1. When reviewing SPS' there is some confusion. If you have two fiber optic cables running through the same route, is this considered a redundant system?
2. There are systems designed to be redundant. Is it acceptable, for temporary operation, to have one communication channel out?

The SPS Review Team will review the SPS and if inadequacies are found, send back to the entity for revisions.

The Task Force recessed at 9:54am.
The Task Force reconvened at 10:18am.

9. Status Reports / Updates

a. *Beyond Zone 3 Compliance*
Vice Chair Raveling reported that the deadline for mitigation plans for Beyond Zone 3 (200kV and above) is YE07. Should we request an update on these mitigation plans?

Action:
Vice Chair Raveling and Alternate Secretary Jesberg to draft a request letter asking for updates on the mitigation plans for Beyond Zone 3 (200kV and above) from those TPSOs that had previously indicated they had mitigations that needed to be completed by YE07. Any updates to the spreadsheet should be sent to Vice Chair Raveling.

b. *SPCTF - Deven Bhan*
Chair Bhan reported that the task force is reviewing the redundancy whitepaper; send comments to Chair Bhan.

c. *MRO-RAC - John Siedel*

i. MRO UFLS Plan
Mr. Seidel was not in attendance to give an oral report and so this item will be addressed at the next meeting.

ii. September 18 Disturbance
Mr. Miller reported that the Event Analysis Team met October 31, 2007. At this meeting, three sub teams were formed:

1. Operational Analysis Team. Review system setup and evolution of system from the operating perspective. Consider prior outage conditions and relevant guidelines.
2. Sequence of Events Team. Develop detailed time line for event. Develop data in table format with additional commentary as required to ensure complete understanding of the sequence.
3. System Modeling Team. Develop load flow and stability models for the system at the time of the disturbance, determine monitoring limits at initial point, check sensitivity to initial conditions, develop dynamic representation of the disturbance – check against theories.

The Event Analysis Team is scheduled to meet again December 6, 2007.

The Sequence of Events Team has held two meetings (November 13-14 face-to-face and November 16 via conference call).

Conclusions of the groups will not be disseminated until a final report is made.

Mr. Quest reported that Xcel Energy is taking an independent approach and feels their response will meet or exceed what will be required by the NERC investigation.

d. *Third Quarter Relay Mis-Operations*
Alternate Secretary Jesberg reported that the information was sent at the end of October. The team has not had time to review.

e. *Review of Revised Mis-Operation Spreadsheet*
Alternate Secretary Jesberg reported that several new TOs have been added to the registry; they will be added to the spreadsheet in 2008.

Action:
Mis-Operations Review Team to prepare a summary presentation of experiences in 2007.

f. *Review of Mis-Operation Issues Submitted by Ron McIvor/Lewis Ross*
Mr. McIvor reported that Mr. Ross submitted an email asking what constitutes slow tripping. Mr. McIvor is asking the Task Force if PRC-003 should be updated to remove the reference to system stability.

Action:
Mis-Operations Review Team to propose wording changes to PRC-003. It is suggested that R1 be replaced with the NERC wording.

g. *Relay Mis-Operations Review Team for 2008 - Deven Bhan*
Chair Bhan reviewed the 2007 operation review assignments

First Quarter – Steve Wadas, Ron McIvor, Ken Birt
Second Quarter - Steve Mittelsteadt, Don Ravling, Terry Hopkins
Third Quarter – Richard Quest, Mark Peterson, Dave Bisel
Fourth Quarter – Russ Miller, Ding Lin, Len Yee

The new team for 2008 Relay Misoperation Review will consist of Richard Quest, Mark Peterson, and Dave Bisel. Ron McIvor, Ken Birt, and Steve Wadas will complete the work of 2007 fourth quarter mis-operations review after January 31, 2008 when the reports are available.

h. *Significant Relay Mis-Operations - Technical Discussions*
Chair Bhan requests team to forward lesson learned types of things to the group.

10. Miscellaneous

a. *Technical Reference Paper on Auto-Reclosing Practices in MRO*
No progress. Mr. Miller will forward summary of the data that has been received.

b. *Technical Reference Paper of Thermal Overload of Facilities*
No progress.

i. Scaling Factors - Protection and Control Issues
No progress.

c. *Other*
Andrew Lucero Thanks
Upon motion duly made by Chair Bhan and seconded by Vice Chair Raveling, the Protective Relay Task Force extends its gratitude to Andrew Lucero for his time and dedication to his support of the Protective Relay Task Force.

Alternate Secretary Jesberg will assume the position PRS Secretary effective this date.

SPS Review Team for 2008
Ron McIvor, Terry Hopkins, Don Raveling, Dede Subakti will be the SPS Review Team PRS members effective January 1, 2008.

Action:
Secretary Lucero is to send email to Transmission Assessment Subcommittee informing them of the changes.

11. Adjourn
Having no further business, Chair Bhan adjourned the meeting of the Protective Relay Subcommittee at 11:59am.

Prepared by:
Sandy Humenansky, Administrative Assistant
Midwest Reliability Organization

Reviewed and Submitted by:
Dan Jesberg, Alternate Secretary
Protective Relay Subcommittee

Agenda 3.
Chairman's Report

Agenda 4.
PRC-023 (BZ3) Update

Agenda 5.
Update on Approval of PRC-013

Midwest Reliability Organization Procedure for Special Protection System Database

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A. Introduction

1. Title: Special Protection System Database

2. Reference NERC Standard PRC-013-0

3. Purpose: To ensure that all Special Protection Systems (SPSs) are properly designed, meet performance requirements, and are coordinated with other protection systems.

4. Applicability: The BES within the area under the MRO.

5. Most Recent Update: February 11, 2008

B. Requirements

R1. MRO staff shall maintain an SPS database based on the information submitted by the SPS owners in accordance with PRC-012-MRO. This database shall include the following information:

R1.1. Design Objectives - Contingencies and system conditions for which the SPS was designed.

R1.2. Operation - The actions taken by the SPS in response to disturbance conditions.

R1.3. Modelling - Information on detection logic and/or relay settings that control the operation of the SPS.

R1.4. Initial in service date of the SPS.

R1.5. Most recent MRO review date (per PRC-012-MRO or PRC-014-MRO).

R1.6. Next scheduled MRO review date (per PRC-014-MRO).

R2. The MRO shall provide to the NERC (and any affected RROs) documentation of this SPS database (and any information contained in it) within 30 calendar days of the request.

Special Protections Systems in the MRO

			Attached documents	SPS name or location	R1.1 - Design contingencies and conditions	R1.2 - Actions taken by SPS in response to disturbance	R1.3 - Info on detection logic or relay settings that control operation of SPS	Initial in-service date	Latest MRO review date	Next scheduled MRO review date
1	MP-1	ALLETE, Inc. d/b/a Minnesota Power	MP1.pdf MP2.pdf	Taconite Harbor Energy Center	See Attached Document MP1	See Attached Document MP1	See Attached Document MP2			
2	MP-2	ALLETE, Inc. d/b/a Minnesota Power	MP1.pdf MP2.pdf	Taconite Harbor Energy Center	See Attached Document MP1	See Attached Document MP1	See Attached Document MP2			
3	MP-3	ALLETE, Inc. d/b/a Minnesota Power	MP1.pdf MP3.pdf	Boswell Energy Center	See Attached Document MP1	See Attached Document MP1	See Attached Document MP3			
4	ALTE-1	Alliant Energy	ALTE1.pdf	Edgewater Generating Plant	See Attached Document ALTE1	See Attached Document ALTE1	See Attached Document ALTE1	October, 1986		
5	ALTE-2	Alliant Energy	ALTE2.pdf	Nelson Dewey Generating Station	See Attached Document ALTE2	See Attached Document ALTE2	See Attached Document ALTE2	1970		
6	ATC-1	American Transmission Company	ATC1.pdf ATC12.pdf	Gran Grae Substation	See Attached Document ATC1	See Attached Document ATC1	See Attached Document ATC12	2002		
7	ATC-2	American Transmission Company	ATC2.pdf	North Appleton Substation	See Attached Document ATC2	See Attached Document ATC2	See Attached Document ATC2	2004		
8	ATC-3	American Transmission Company	ATC3.pdf	Point Beach Substation	See Attached Document ATC3	See Attached Document ATC3	See Attached Document ATC3	1984		
9	ATC-4	American Transmission Company	ATC4.pdf ATC13.pdf	Port Edwards Substation	See Attached Document ATC4	See Attached Document ATC4	See Attached Document ATC13	1986		
10	ATC-5	American Transmission Company	ATC5.pdf	Kewaunee Bank 10	See Attached Document ATC5	See Attached Document ATC5	See Attached Document ATC5	1990		
11	ATC-6	American Transmission Company	ATC6.pdf	Morgan Substation	See Attached Document ATC6	See Attached Document ATC6	See Attached Document ATC6	2004		
12	ATC-7	American Transmission Company	ATC7.pdf	Plains Substation	See Attached Document ATC7	See Attached Document ATC7	See Attached Document ATC7	May 21st, 1988		

13	ATC-8	American Transmission Company	ATC8.pdf	Plains Substation Reactors	See Attached Document ATC8	See Attached Document ATC8	See Attached Document ATC8	2004		
14	ATC-9	American Transmission Company	ATC9.pdf	Pleasant Prairie Substation	See Attached Document ATC9	See Attached Document ATC9	See Attached Document ATC9	September 23rd, 1994		
15	ATC-10	American Transmission Company	ATC10.pdf	Presque Isle Power Plant	See Attached Document ATC10	See Attached Document ATC10	See Attached Document ATC10	1988		
16	ATC-11	American Transmission Company	ATC11.pdf	Wien Substation	See Attached Document ATC11	See Attached Document ATC11	See Attached Document ATC11	June 20th, 2002		
17	ATC-12	American Transmission Company	ATC14.pdf ATC15.pdf	Weston 4	See Attached Document ATC14	See Attached Document ATC14	See Attached Document ATC15	December, 2007	November 14th, 2007	
18	BEPC-1	Basin Electric Power Cooperative	BEPC1.pdf	Rapid City	See Attached Document BEPC1	See Attached Document BEPC1	See Attached Document BEPC1	October, 2003		
19	GRE-2	Great River Energy	GRE3.pdf	Pleasant Valley (345 kV)	See Attached Document GRE3	See Attached Document GRE3	See Attached Document GRE3	October 1st, 2002		
20	GRE-3	Great River Energy	GRE4.pdf	Coal Creek (400 kVDC)	See Attached Document GRE4	See Attached Document GRE4	See Attached Document GRE4	October 2nd, 1981		
21	GRE-4	Great River Energy	GRE5.pdf GRE6.pdf	Lakefield Generation Station	See Attached Document GRE5	See Attached Document GRE5	See Attached Document GRE6	November 2nd, 2006		
22	GRE-5	Great River Energy	GRE7.pdf GRE8.pdf	Ramsey	See Attached Document GRE7	See Attached Document GRE7	See Attached Document GRE8	December 15th, 2007	December 13th, 2007	
23	MH-1	Manitoba Hydro	MH1.pdf	Dorsey - Whiteshell	See Attached Document MH1	See Attached Document MH1	See Attached Document MH1			
24	MH-2	Manitoba Hydro	MH1.pdf	HVDC Regional Export	See Attached Document MH1	See Attached Document MH1	See Attached Document MH1			
25	MH-4	Manitoba Hydro	MH2.pdf	Northern Crosstrip Scheme	See Attached Document MH1	See Attached Document MH1	See Attached Document MH1			
26	MEC-1	MidAmerican Energy Company	MEC1.pdf	Tiffin Substation	See Attached Document MEC1	See Attached Document MEC1	See Attached Document MEC1	2005		
27	MPC-1	Minnkota Power Cooperative	MPC1.pdf MPC2.pdf	Langdon	See Attached Document MPC1	See Attached Document MPC1	See Attached Document MPC2	December 15th, 2007	December 13th, 2007	

28	MDU-1	Montana-Dakota Utilities & Minnkota Power Cooperative, Inc.	MDU1.pdf MDU2.pdf	Center(345kV), Center(230kV), Square Butte, Coyote	See Attached Document MDU1	See Attached Document MDU1	See Attached Document MDU2 & MDU4	January 5th, 2004		
29	MDU-2	Montana-Dakota Utilities	MDU3.pdf MDU4.pdf	Continuity Trip Scheme	See Attached Document MDU3	See Attached Document MDU3	See Attached Document MDU4			
30	MDU-3	Montana-Dakota Utilities	MDU5.pdf MDU6.pdf	Coyote-Beulah	See Attached Document MDU5	See Attached Document MDU5	See Attached Document MDU6			
31	MDU-4	Montana-Dakota Utilities	MDU7.pdf MDU8.pdf	Coyote-Dikenson	See Attached Document MDU7	See Attached Document MDU7	See Attached Document MDU8			
32	MDU-5	Montana-Dakota Utilities	MDU9.pdf MDU10.pdf	Beulah Junction Substation	See Attached Document MDU9	See Attached Document MDU9	See Attached Document MDU10			
33	MDU-6	Montana-Dakota Utilities	MDU11.pdf MDU12.pdf	Tioga B10T OOS Scheme	See Attached Document MDU11	See Attached Document MDU11	See Attached Document MDU12			
34	MDU-7	Montana-Dakota Utilities	MDU13.pdf	Tioga 230 Breaker 882 High South Flow Trip Scheme	See Attached Document MDU13	See Attached Document MDU13	See Attached Document MDU13			
35	MDU-8	Montana-Dakota Utilities	MDU14.pdf MDU15.pdf MDU16.pdf	Tatanka	See Attached Document MDU14	See Attached Document MDU15	See Attached Document MDU16			
36	NPPD-1	Nebraska Public Power District	NPPD1.pdf	Gerald Gentleman Station, Units 1 & 2	See Attached Document NPPD1	See Attached Document NPPD1	See Attached Document NPPD1			
37	OTP-1	Otter Tail Power Company	OTP1.pdf OTP2.pdf	Big Stone 230, Big Stone Plant, 230 Kv	See Attached Document OTP1	See Attached Document OTP1	See Attached Document OTP2	1994		
38	SPC-1	Saskatchewan Power Corporation	SPC1.pdf	Coteau Creek	See Attached Document SPC1	See Attached Document SPC1	See Attached Document SPC1			
39	SPC-2	Saskatchewan Power Corporation	SPC2.pdf	Boundary Dam	See Attached Document SPC2	See Attached Document SPC2	See Attached Document SPC2			
40	SPC-3	Saskatchewan Power Corporation	SPC3.pdf	Boundary Dam	See Attached Document SPC3	See Attached Document SPC3	See Attached Document SPC3			
41	SPC-4	Saskatchewan Power Corporation	SPC4.pdf	Meridian	See Attached Document SPC4	See Attached Document SPC4	See Attached Document SPC4			

42	SPC-5	Saskatchewan Power Corporation	SPC5.pdf	Poplar River	See Attached Document SPC5	See Attached Document SPC5	See Attached Document SPC5			
43	SPC-6	Saskatchewan Power Corporation	SPC6.pdf	McNeill	See Attached Document SPC6	See Attached Document SPC6	See Attached Document SPC6			
44	WAPA-1	Western Area Power Administration	WAPA1.pdf WAPA2.pdf WAPA3.pdf	Rapid City Converter Station	See Attached Document WAPA2	See Attached Document WAPA2	See Attached Document WAPA3			
45	WAPA-4	Western Area Power Administration	WAPA4.pdf WAPA5.pdf	Eastern Montana Generation Dropping	See Attached Document WAPA4	See Attached Document WAPA4	See Attached Document WAPA5			
46	WAPA-5	Western Area Power Administration	WAPA6.pdf	Garrison	See Attached Document WAPA6	See Attached Document WAPA6	See Attached Document WAPA6			
47	WAPA-6	Western Area Power Administration	WAPA7.pdf WAPA8.pdf	Western Montana Generation Dropping	See Attached Document WAPA7	See Attached Document WAPA7	See Attached Document WAPA8			
48	WAPA-7	Western Area Power Administration	WAPA9.pdf WAPA10.pdf	Miles City Area	See Attached Document WAPA9	See Attached Document WAPA9	See Attached Document WAPA10			
49	XEL-1	XCEL Energy	XEL1.pdf	Eau Claire	See Attached Document XCEL1	See Attached Document XCEL1	See Attached Document XCEL1			
50	XEL-2	XCEL Energy	XEL1.pdf	Mankato Energy Center	See Attached Document XCEL1	See Attached Document XCEL1	See Attached Document XCEL1			
51	XEL-3	XCEL Energy	XEL1.pdf XEL2.pdf	Trimont- October, 2007	See Attached Document XCEL2	See Attached Document XCEL2	See Attached Document XCEL2	October, 2007	October 9th, 2007	

Agenda 6.
Review Draft on MRO Guideline PRC-014

Midwest Reliability Organization Procedure for
Special Protection System Assessment

A. Introduction - The following procedure developed by the MRO Protective Relay Subcommittee is considered a technical guideline and should be followed as good utility practice.

1. Title: Special Protection System Assessment

2. Reference NERC Standard PRC-014-0

3. Purpose: To ensure that all Special Protection Systems (SPSs) are properly designed, meet performance requirements, and are coordinated with other protection systems. To ensure that maintenance and testing programs are developed and mis-operations are analyzed and corrected.

4. Applicability: The BES within the area under the MRO.

5. Most Recent Update: January 31, 2008

B. Requirements

R1. The MRO shall review the operation, coordination, and effectiveness of all SPSs installed in its Region at least once every five years for compliance with NERC Reliability Standards and MRO criteria.

R1.1 SPS shall be reviewed during the year of its 5th anniversary following its last previous review. A record of "last reviewed" and "next scheduled" dates shall be maintained in the MRO SPS database along with other documentation required by NERC Standard PRC-013-0.

R1.1.1 The MRO may review an SPS at any time within the normal five year cycle if it is felt necessary to do so by the MRO.

R1.1.2 MRO to notify SPS owner(s) 90 calendar days in advance of an upcoming SPS re-review.

R1.2 The SPS owner(s) shall review/assess their SPS and the SPS documentation in accordance to PRC-012-0-MRO procedure at least once every five years. The following issues should be addressed in the review/assessment:

R1.2.1 Review BES changes that may require re-study of the SPS actions taken and/or the SPS design.

R1.2.2 Report study years, system conditions, and contingencies analyzed in the technical studies on which the assessment is based and when those technical studies were performed.

R1.2.3 Review any old and/or new coordination requirements that may exist with other protection and control systems.

R1.2.4 Summarize past correct and incorrect SPS operations; include corrective actions taken for any misoperations over the past five year period.

R1.2.5 If SPS has operated in the past five year period, review and evaluate the effectiveness of the SPS performance.

R1.3 SPS owner(s) to submit a report on its review of the SPS to the MRO within the 90 calendar day period. Submit report to:

mro-spsreview@midwestreliability.org

R1.4 The SPS owner(s) may be required to present its review report of the SPS to the MRO. Presentation to be of sufficient technical detail so the group understands the scheme and can perform an assessment.

R1.5 Any SPS modifications needed as a result of this review process shall follow the process outlined in the MRO procedure PRC-012-0-MRO.

R1.6 The backlog of legacy SPSs within the MRO region will be integrated into the review process over a five year period beginning in July, 2008 with the intention of completing their reviews by the end of June, 2013.

R1.6.1 Priority of review of legacy SPSs shall be based on its impact to the wide area BES.

R2. The MRO shall provide either a summary report or a detailed report of its review of the assessment of the operation, coordination, and effectiveness of all SPSs installed within the MRO region to the affected RROs or NERC on request (within 30 calendar days).

R3. The documentation of the MRO SPS review group's assessment shall be filed in the MRO SPS database and shall include the following elements:

R3.1. Identification of group conducting the assessment and the date the assessment was performed.

R3.2. Study years, system conditions, and contingencies analyzed in the technical studies on which the assessment is based and when those technical studies were performed.

R3.3. Discussion of any coordination problems found between a SPS and other protection and control systems.

R3.4. Identification of SPSs that need a modification or decommissioning review (per the review process outlined in PRC-012-0-MRO) as a result of this review process.

Procedure Review and Approval

The MRO shall review this procedure at least every five years or following a revision of any relevant NERC standards and shall submit a review report and/or revised procedure for approval.

Agenda 7.
Special Protection Systems

Agenda 7.a.
Special Protection Systems
Update on Joint PRS/TAS/MISO SPS Review Team

MRO SPS Review Team Log

SPS Name	Owner	Receipt of Request for Review	SPS Team Conf Call to determine if package is complete	Face to Face Meeting with SPS Owner	PRS Approval	TAS Approval	Approval Notice Sent to TOS Owner
Stone Lake-Gardner Park SPS	XEL				5-Jun-07	9-Jul-07	13-Jul-07
Trimont SPS modification	XEL	15-Sep-07	26-Sep-07	9-Oct-07	30-Oct-07	7-Nov-07	16-Nov-07
Weston 4 SPS	ATC	23-Aug-07	26-Sep-07	14-Nov-07	27-Nov-07	30-Nov-07	30-Nov-07
Tatanka SPS	MDU	31-Oct-07	14-Nov-07	19-Dec-07	18-Jan-08	18-Jan-08	4-Feb-08
Langdon SPS	MPC	16-Nov-07	29-Nov-07	13-Dec-07	31-Dec-07	31-Dec-07	11-Jan-08
Ramsey SPS	GRE	16-Nov-07	29-Nov-07	13-Dec-07	31-Dec-07	31-Dec-07	11-Jan-08
Nelson Dewey retirement	ALTE	9-Jan-08	17-Jan-07				

Agenda 7.b.
Special Protection Systems
SPS Retirement – Nelson-Dewey SPS

Nelson Dewey
Special Protection System Review

Report Date: October 12, 2007

Tom Dagenais
System Planning
American Transmission Co.

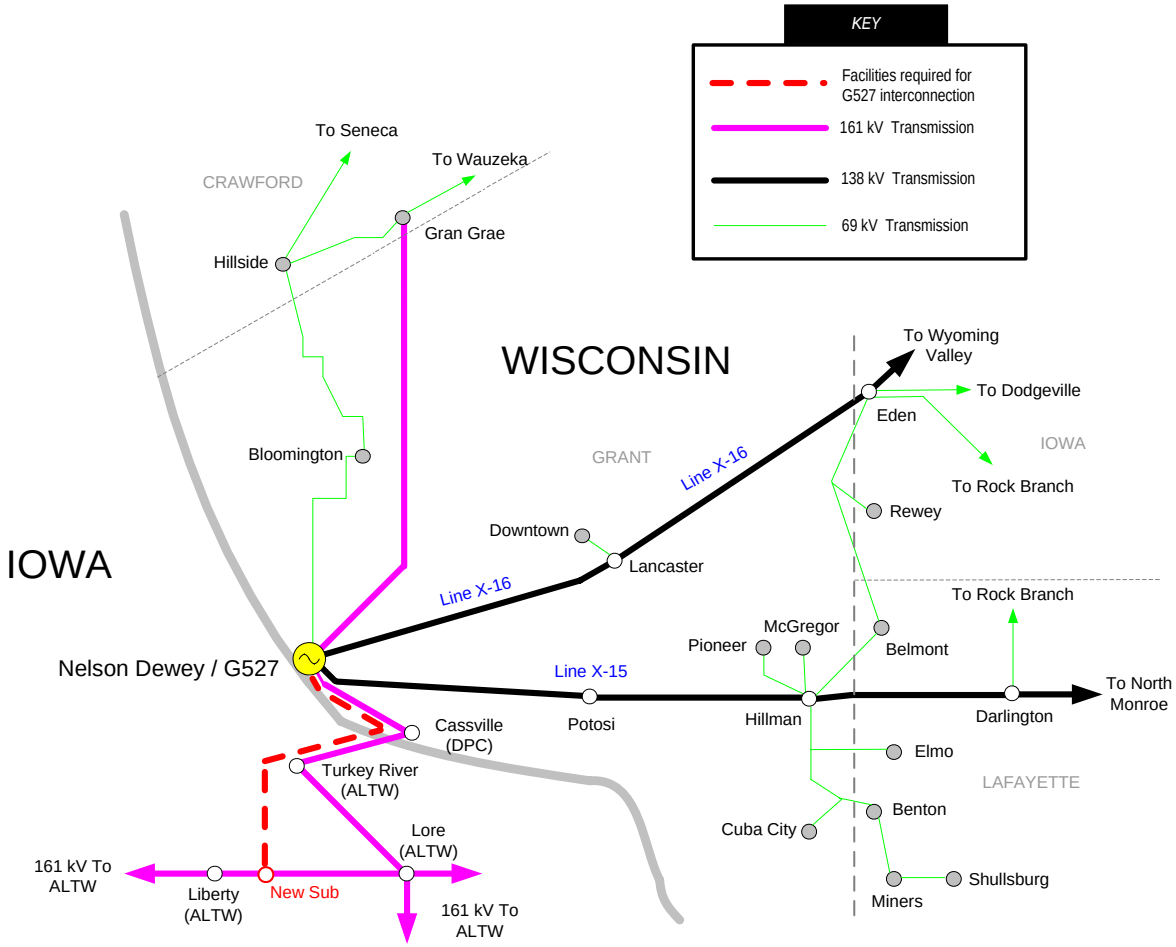
Table of Contents

Executive Summary

The Nelson Dewey special protection system was created to protect the Nelson Dewey generating units during the outage of a 138-kV outlet from the station. The system was created before the installation of the 161/138-kV transformer at Nelson Dewey and calls for reduction of total generation at Nelson Dewey to about 50% of the plant capacity during a 138-kV outage. The special protection system was created because the loss of a 138-kV line from Nelson Dewey was found to cause instability issues on the Nelson Dewey units. Since the addition of the Nelson Dewey 161/138-kV transformer T91 the special protection system has been modified to only be active while transformer T91 is out of service.

This review analyzed the need for the special protection system taking into account the current transmission system configuration and also the possible future addition of G527 and its required new 161-kV outlet. G527 is a 280 MW coal generator proposed for interconnection on the 161-kV bus at Nelson Dewey. Results of this review show that both under the present system configuration and after the addition of G527 and related upgrades the special protection system at Nelson Dewey is not necessary, although certain operating restrictions must be observed during some system conditions unless upgrades are made at the Nelson Dewey substation.

Figure 1 – Nelson Dewey and Surrounding Area



Methodology and Assumptions

The models used for this study were created from the 2011 Light Load stability case used to study G527, which is a proposed 280 MW coal unit at Nelson Dewey. A light load case was used because this load condition causes the largest amount of through-flow in the Nelson Dewey area and this condition models less local load that may serve to damp out unit oscillations. Nelson Dewey units 1 and 2 were set to maximum output for the study (113 net MW each) while controlling the Nelson Dewey 138-kV bus voltage to 1.0250 p.u., which approximately corresponds to a unity power factor for the units. Additionally, a proposed wind farm (G282) near Nelson Dewey was modeled as on-line at 99 MW in the cases.

Two sets of cases were created in order to study the special protection system both with and without the addition of G527. In the first set of cases, G527 and all G527-related interconnection upgrades were omitted. In the second set of cases, G527 and its associated transmission upgrade were included. The transmission upgrade included in the cases in support of G527 consists of a new 161-kV line from Nelson Dewey to a new substation located between the ALTW Liberty and Lore substations. Appendix D details the assumptions used for the creation of the new line. G527 was set to its maximum output of 280 MW while controlling the Nelson Dewey 161-kV bus voltage to 1.0280 p.u., which corresponds to a unity power factor for the unit. For each set of cases, a variety of prior outages of the 138-kV Nelson Dewey outlets, including the 161/138-kV transformer, were tested for both normal and delayed clearing scenarios.

Cases were built to model prior outages of line X-15 (Nelson Dewey – Potosi 138-kV segment), line X-16 (Nelson Dewey – Lancaster 138-kV segment or Lancaster – Eden 138-kV segment), and the Nelson Dewey 161/138-kV Transformer 91. Each prior outage scenario was built in each set of cases in order to study the system both with and without the proposed G527 generation and its associated upgrade. Each prior outage case was then studied under multiple first contingency (N-1) conditions.

In each of the prior outage cases developed, three-phase faults were applied near Nelson Dewey on one of the intact 138-kV outlets. Then, for testing delayed clearing (zone 2) scenarios, single-phase faults were applied to the remote ends of the Nelson Dewey 138-kV outlets in each case. See Appendix A for a full list of contingencies tested.

For all simulations, faults were applied at t = 0.5 seconds and simulations were run to t = 20 seconds. Results were monitored for unit trips and for insufficiently damped generator angle oscillations.

Study Conclusions

Analysis shows that in most scenarios the calculated clearing times (CCT) exceed the maximum expected clearing time (MECT) by at least a one-cycle margin without tripping Nelson Dewey units 1 or 2 or the proposed G527 unit. In all scenarios responses are appropriately damped without unacceptable oscillations.

During prior outage of either the Nelson Dewey – Lancaster segment or the Lancaster – Eden segment of the 138-kV line X-16, a three-phase fault applied on the Nelson Dewey 161/138-kV transformer results in an insufficient CCT for the cases in which G527 is omitted from the model as well as for the cases in which G527 is included in the model. The calculated CCTs in these scenarios do not provide the required margin over the existing MECT, which is 5.0 cycles. In order to remedy the inadequate clearing times in these prior outage scenarios, Nelson Dewey units 1 and 2 were tested with restricted MW outputs and with alternate voltage schedules.

In cases omitting G527 and G527 related upgrades, reducing the output of Nelson Dewey units 1 and 2 to a combined total of 200 MW during the prior outage of either segment of 138-kV line X-16 resulted in the CCT's exceeding the MECT by the required margin. Alternatively, altering the voltage schedule of the Nelson Dewey units 1 and 2 to control the Nelson Dewey 138-kV voltage to at least 1.0375 p.u. during the prior outage of either segment of 138-kV line X-16 also resulted in the CCTs exceeding the MECT by the required margin.

For cases that include G527 and the G527 related upgrades, reducing the output of Nelson Dewey units 1 and 2 to a combined total of 200 MW during the prior outage of either segment of 138-kV line X-16 resulted in the CCT's exceeding the MECT by the required margin. Alternatively, altering the voltage schedule of the Nelson Dewey units 1 and 2 to control the Nelson Dewey 138-kV voltage to at least 1.0350 p.u. during the prior outage of either segment of the 138-kV line X-16 also resulted in the CCTs exceeding the MECT by the required margin.

Per this study, the current Nelson Dewey rollback special protection system can be replaced with operating restrictions on the units. The current SPS will not mitigate the first swing instability of units 1 and 2, but the operating restrictions listed in Tables 1 and 2 on the following page will protect against this instability. A summary of the results of the operating restriction analysis is provided in Appendix E.

Table 1 – Operating Restrictions pre-G527

Prior Outage	Operating Restriction*	Notes
Nelson Dewey – Lancaster 138-kV Or Lancaster – Eden 138-kV (Line X16)	Nelson Dewey units 1 and 2 should be restricted to a total combined output of 200 MW or less. Alternatively, Nelson Dewey units 1 and 2 could be set to control Nelson Dewey 138-kV bus voltage to **1.0375 p.u.** In the model studied, this setting is equivalent to a minimum output of 4.1 MVAr on each Nelson Dewey generator.	Protects against instability during fault on 138-kV side of Nelson Dewey 161/138-kV transformer. Other approaches may be feasible. Installation of new equipment at Nelson Dewey could negate the need for operating restrictions.
Nelson Dewey – Potosi 138-kV (Line X15)	None	N/A
Nelson Dewey 161/138-kV T91 (Transformer 91)	None	N/A

* See Appendix E for results of operating restriction analysis.

Table 2 – Operating Restrictions with G527 and associated upgrades in-service

Prior Outage	Operating Restriction*	Notes
Nelson Dewey – Lancaster 138-kV Or Lancaster – Eden 138-kV (Line X16)	Nelson Dewey units 1 and 2 should be restricted to a total combined output of 200 MW or less. Alternatively, Nelson Dewey units 1 and 2 could be set to control Nelson Dewey 138-kV bus voltage to **1.0350 p.u.** In the model studied, this setting is equivalent to a minimum output of 28.0 MVAr on Nelson Dewey units 1 and 2.	Protects against instability during fault on 138-kV side of Nelson Dewey 161/138-kV transformer. Other approaches may be feasible. Installation of new equipment at Nelson Dewey could negate the need for operating restrictions.
Nelson Dewey – Potosi 138-kV (Line X15)	None	N/A
Nelson Dewey 161/138-kV T91 (Transformer 91)	None	N/A

* See Appendix E for results of operating restriction analysis.

Removing the Operating Restrictions

To negate the need for operating restrictions, it may be possible to install additional relaying on each side of the Nelson Dewey 161/138-kV Transformer 91 utilizing SEL-421 relays and replace the circuit breaker on the 138-kV side of the transformer with a 2-cycle circuit breaker. It may be possible to complete these projects during the construction of interconnection facilities for G527 by March 2011 at an approximate cost of $500,000 (preliminary good-faith cost estimate in 2007 dollars).

Assuming the installation of the equipment above at the Nelson Dewey substation, the operating restrictions on Nelson Dewey units 1 and 2 can be lifted. The data in Appendix F shows the CCT's for scenarios which were shown to be unstable using the existing MECT's. These scenarios include those in which any line segment of line X-16 is out of service and a three-phase fault occurs on the 138-kV side of the Nelson Dewey 161/138-kV Transformer.

With the new relays and breaker at Nelson Dewey, the Maximum Expected Clearing Time (MECT) of 3.5 cycles or faster for these fault scenarios provides the required margin below the CCTs determined in this study. Therefore, the operating restrictions are not needed if the 3.5 cycle MECT can be met through upgrades.

Following the installation of new equipment at Nelson Dewey, a relay communications failure would cause the MECT to revert to 5.0 cycles. To verify stability under extreme conditions, with full output of Nelson Dewey units 1 and 2, a single-phase fault with delayed clearing due to protection system failure was tested during the prior outage of each segment of line X-16. This scenario was tested both with and without the addition of G527 and associated upgrades. In Appendix F, these scenarios are shown to be stable for a fault length of six cycles, which provides the required planning margin above the MECT. The scenario of a prior outage of line X-16 followed by a 3-phase transformer fault with protection system failure was not tested because it is an even lower probability event.

Appendix A: Contingencies Studied

All contingencies were studied in both the pre- and post-G527 models

Prior Outage	Contingency	Fault Type
Nelson Dewey 161/138-kV Transformer	3-P fault at Nelson Dewey end of Nelson Dewey – Lancaster – Eden line	NERC Category C.3
	3-P fault at Nelson Dewey end of Nelson Dewey – Potosi – Hillman line	NERC Category C.3
	SLG fault at Lancaster on Nelson Dewey – Lancaster – Eden line Remote end (Lancaster – Eden) clearing in 5-cycles Near end (Nelson Dewey – Lancaster) clearing in 30-cycles	Beyond Category C: Prior outage combined with communications failure.
	SLG fault at Potosi on Nelson Dewey – Potosi – Hillman line Remote end (Potosi – Hillman) clearing in 5-cycles Near end (Nelson Dewey – Potosi) clearing in 30-cycles	Beyond Category C: Prior outage combined with communications failure.
Nelson Dewey – Lancaster 138-kV line segment	3-P fault at Nelson Dewey end of Nelson Dewey – Potosi – Hillman line	NERC Category C.3
	3-P fault on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer	NERC Category C.3
	SLG fault at Potosi on Nelson Dewey – Potosi – Hillman line Remote end (Potosi – Hillman) clearing in 5-cycles Near end (Nelson Dewey – Potosi) clearing in 30-cycles	Beyond Category C: Prior outage combined with communications failure.
	SLG fault on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer, with relay failure.	Beyond NERC Category C.7
Lancaster – Eden 138-kV line segment	3-P fault on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer	NERC Category C.3
	SLG fault on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer, with relay failure.	Beyond NERC Category C.7
Nelson Dewey – Potosi 138-kV line segment	3-P fault at Nelson Dewey end of Nelson Dewey – Lancaster – Eden line	NERC Category C.3
	3-P fault on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer	NERC Category C.3
	SLG fault at Lancaster on Nelson Dewey – Lancaster – Eden line Remote end (Lancaster – Eden) clearing in 5-cycles Near end (Nelson Dewey – Lancaster) clearing in 30-cycles	Beyond Category C: Prior outage combined with communications failure.

Notes:
1) 3-P signifies a three-phase fault
2) SLG indicates a single-line-to-ground fault

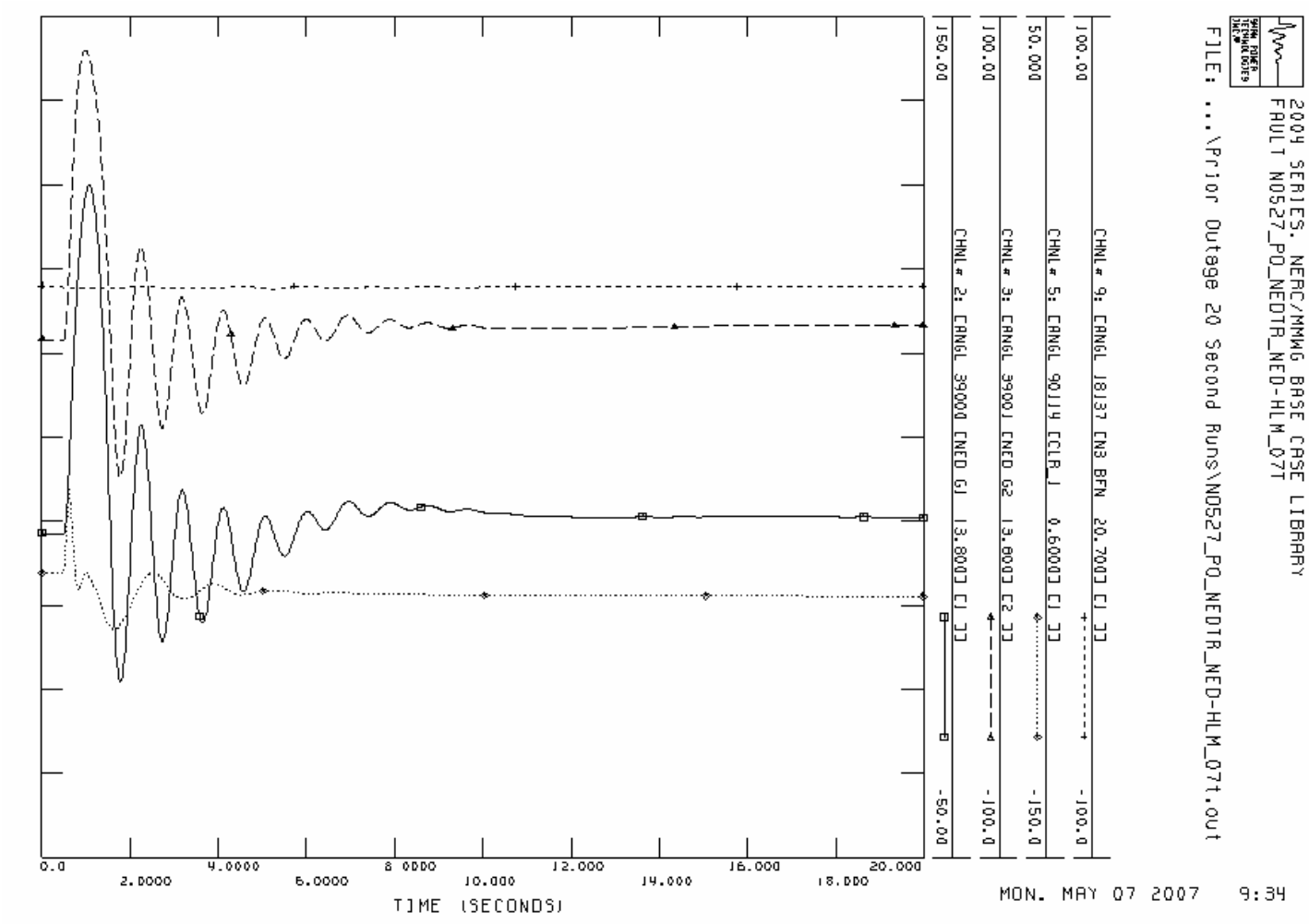
Appendix B: Results – No G527

G527 and related upgrades omitted from models

NERC Category C.3 Faults – G527 omitted

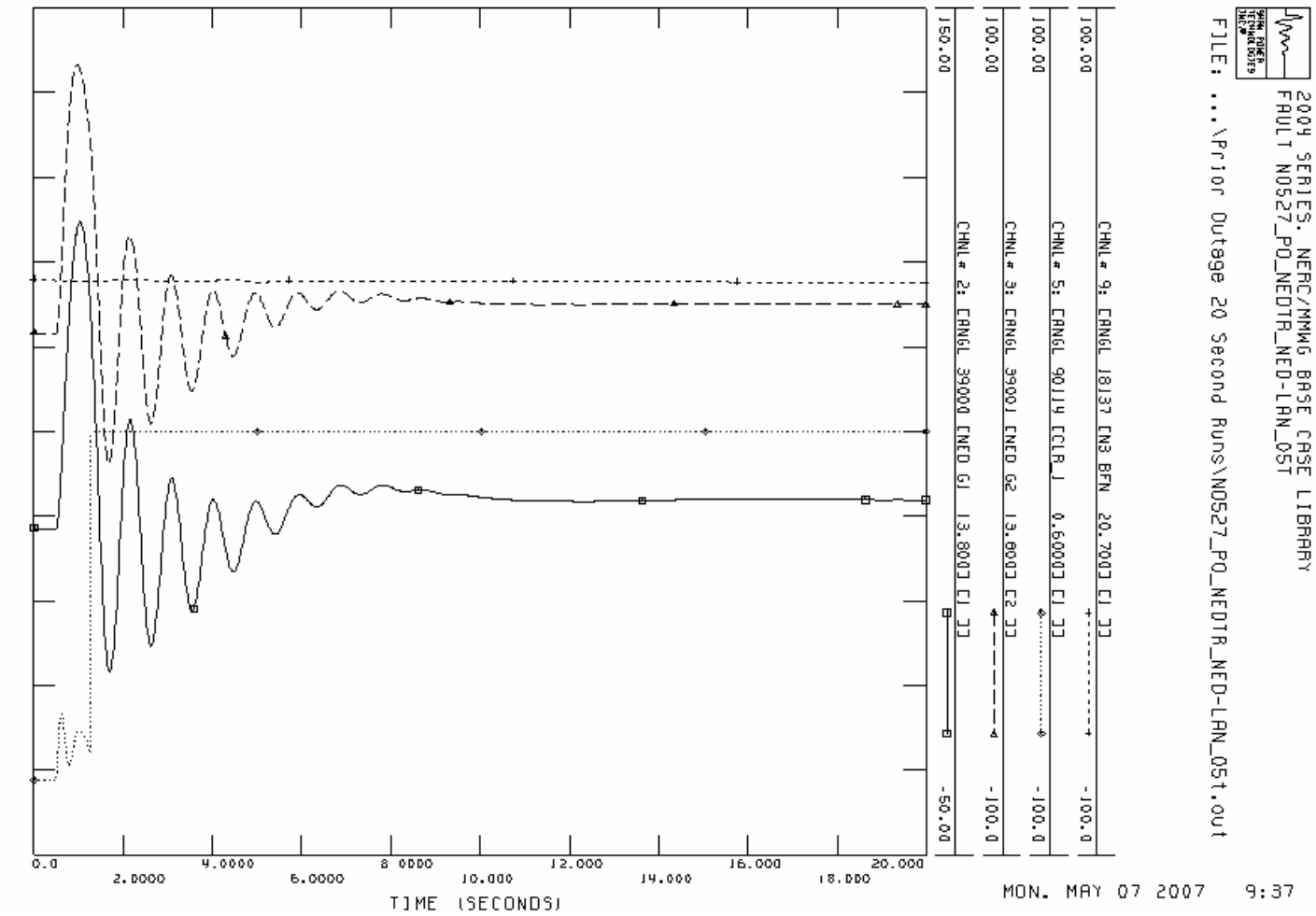
Prior outage of Nelson Dewey 161/138-kV transformer

Fault Category: NERC Category C.3
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
3-phase fault applied at Nelson Dewey to Nelson Dewey – Potosi – Hillman 138-kV line for 7 cycles
Maximum Expected Clearing Time (MECT) for this scenario = 5.5 cycles (estimated)



Prior outage of Nelson Dewey 161/138-kV transformer

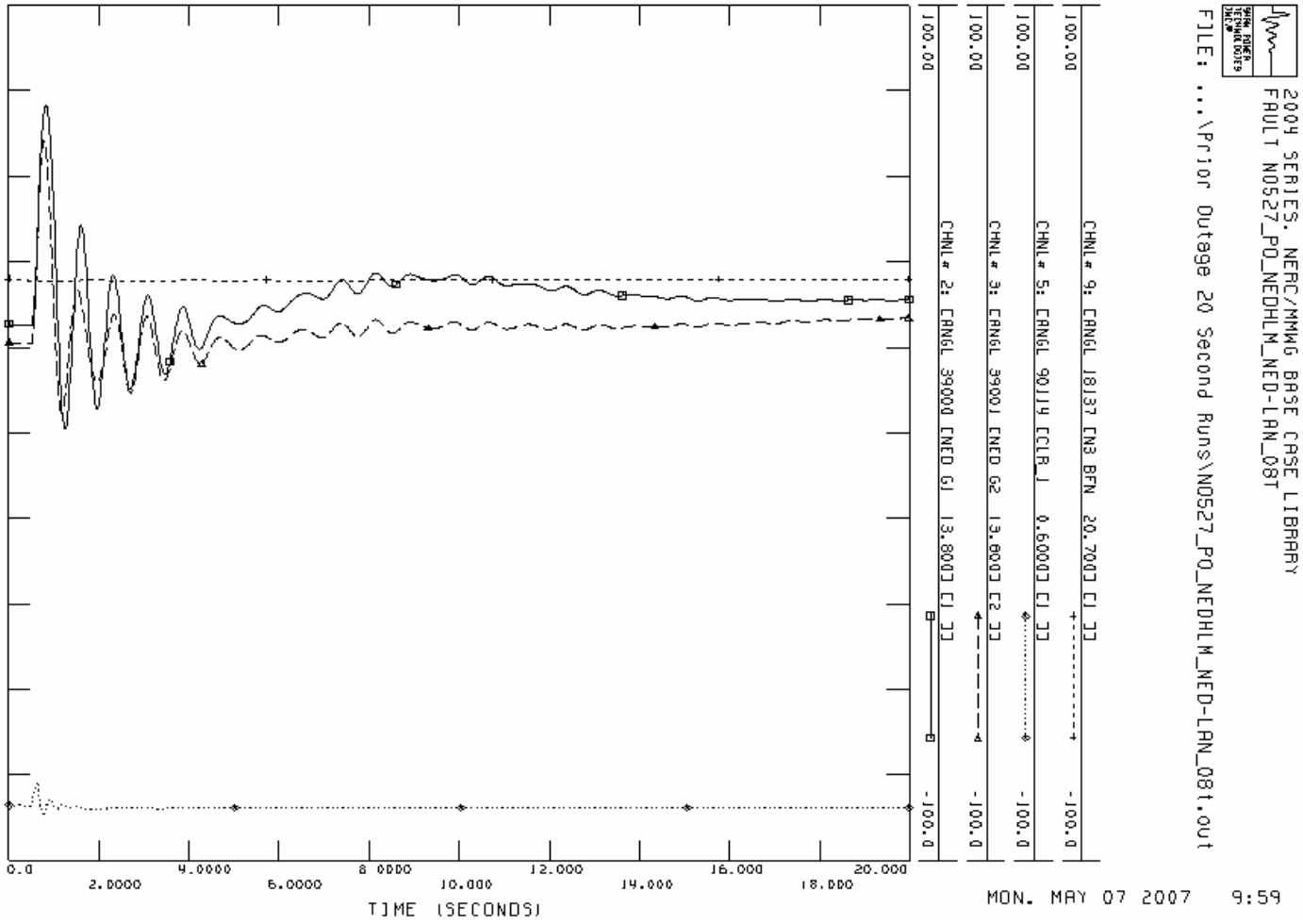
Fault Category: NERC Category C.3
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
3-phase fault applied at Nelson Dewey to Nelson Dewey – Lancaster – Eden 138-kV line for 5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 3.6 cycles (calculated)



* Darlington Wind Farm (Bus 90114) trips off-line for faults of 4-cycles and longer under this scenario.

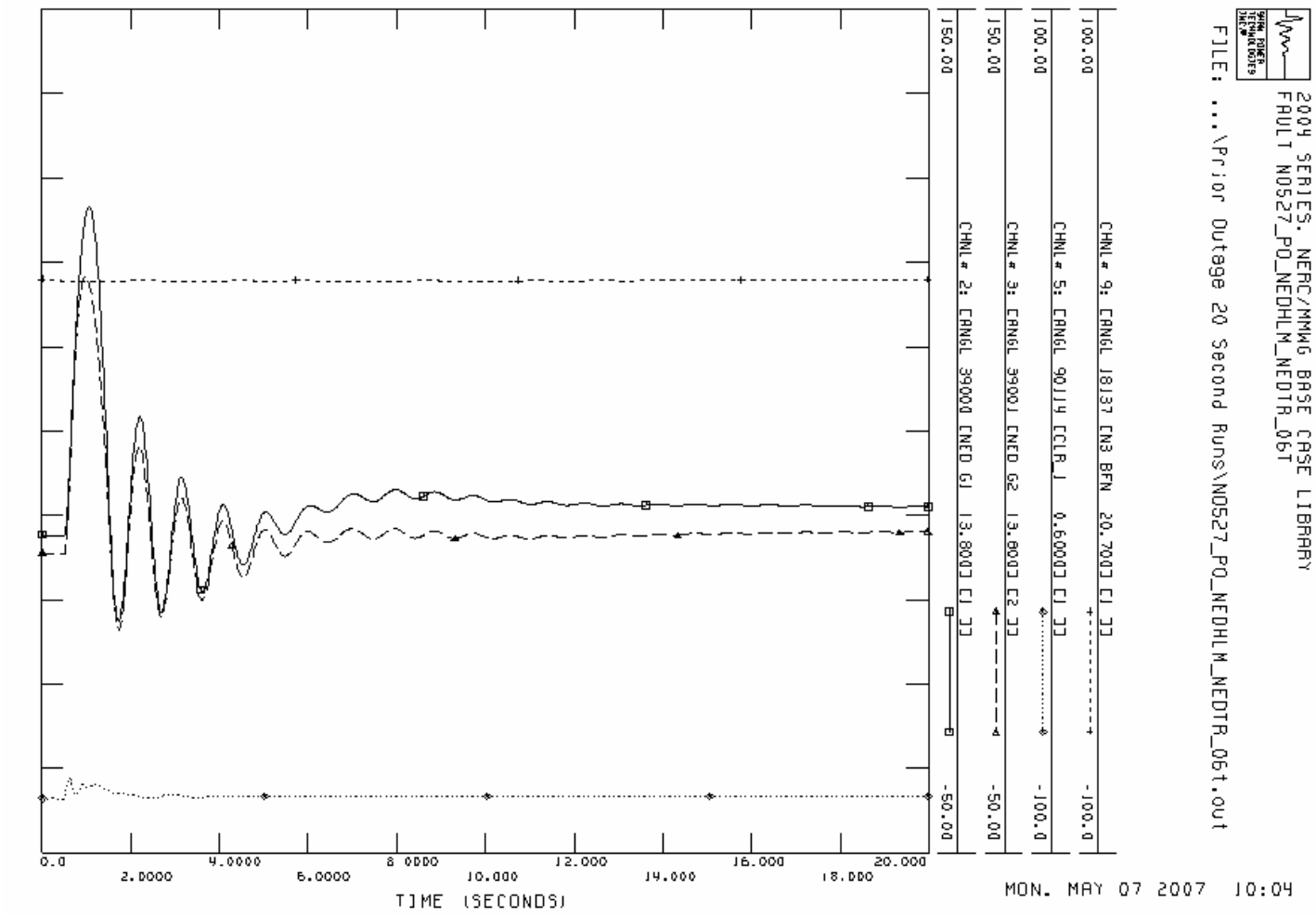
Prior outage of Nelson Dewey – Potosi 138-kV line segment

Fault Category: NERC Category C.3
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
3-phase fault applied at Nelson Dewey to Nelson Dewey – Lancaster – Eden 138-kV line for 8 cycles
Maximum Expected Clearing Time (MECT) for this scenario = 5.5 cycles (estimated)



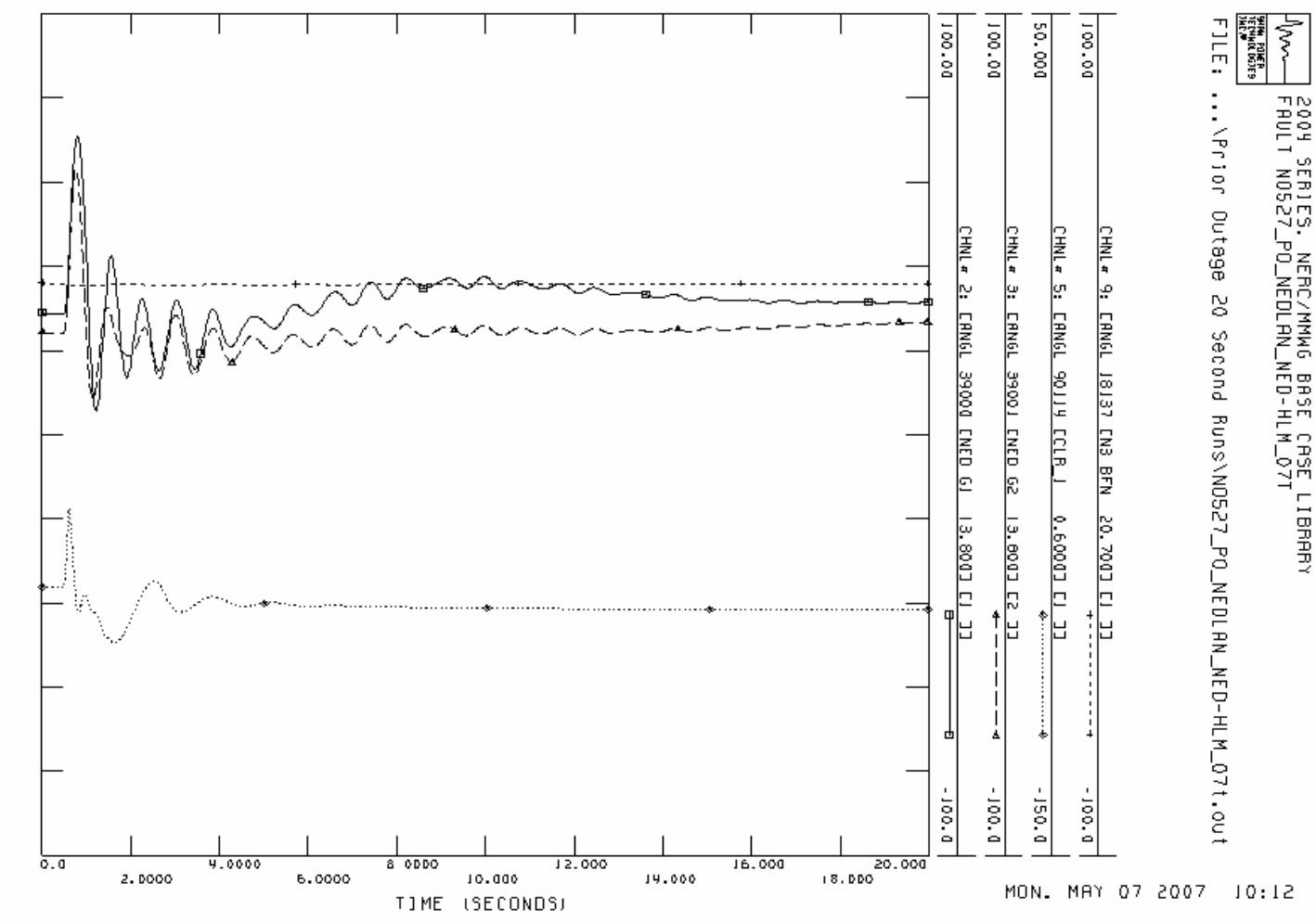
Prior outage of Nelson Dewey – Potosi 138-kV line segment

Fault Category: NERC Category C.3
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6 cycles
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



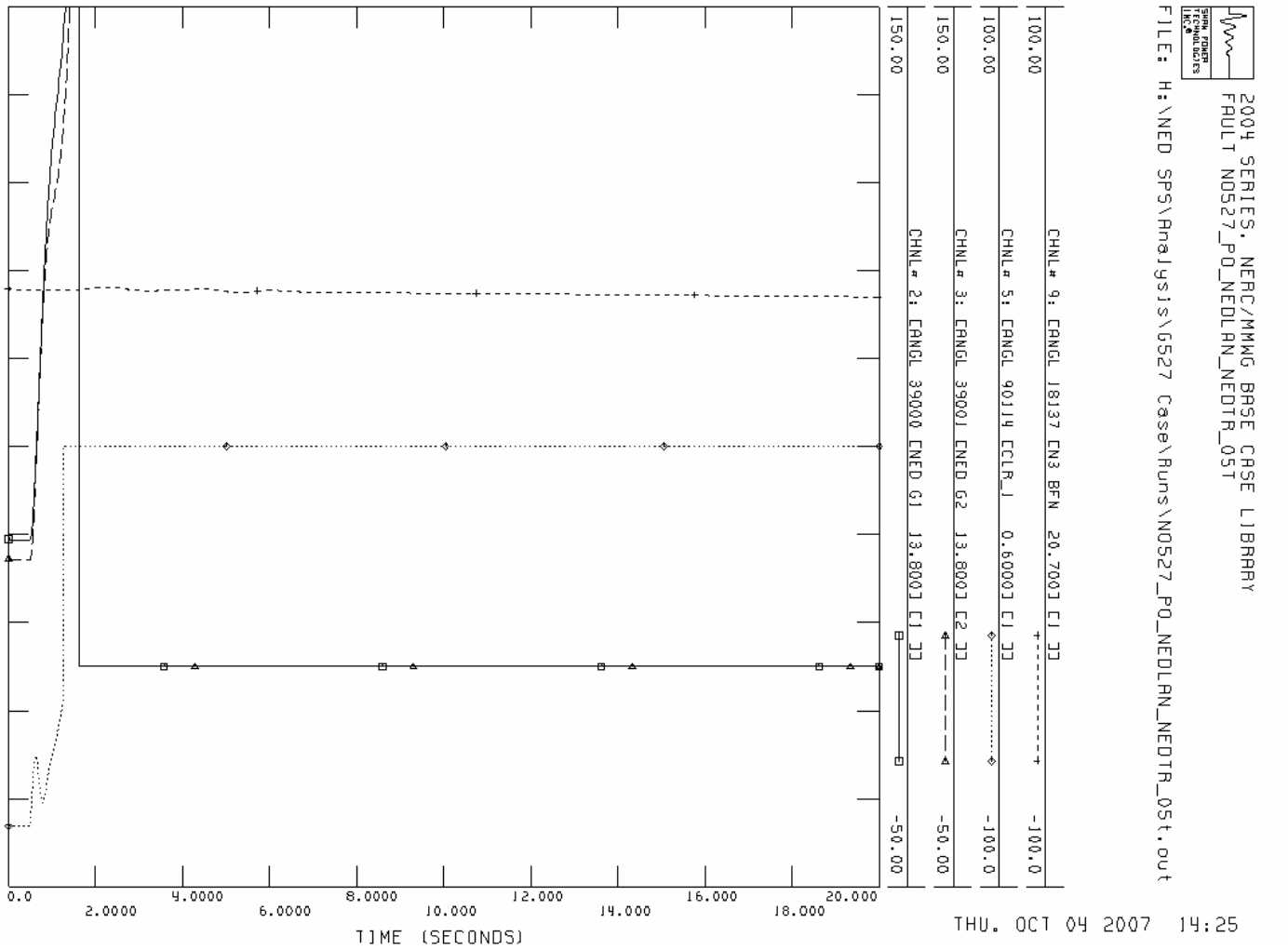
Prior outage of Nelson Dewey – Lancaster 138-kV line segment

Fault Category: NERC Category C.3
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
3-phase fault applied at Nelson Dewey to Nelson Dewey – Potosi – Hillman 138-kV line for 7 cycles
Maximum Expected Clearing Time (MECT) for this scenario = 5.5 cycles (estimated)



Prior outage of Nelson Dewey – Lancaster 138-kV line segment

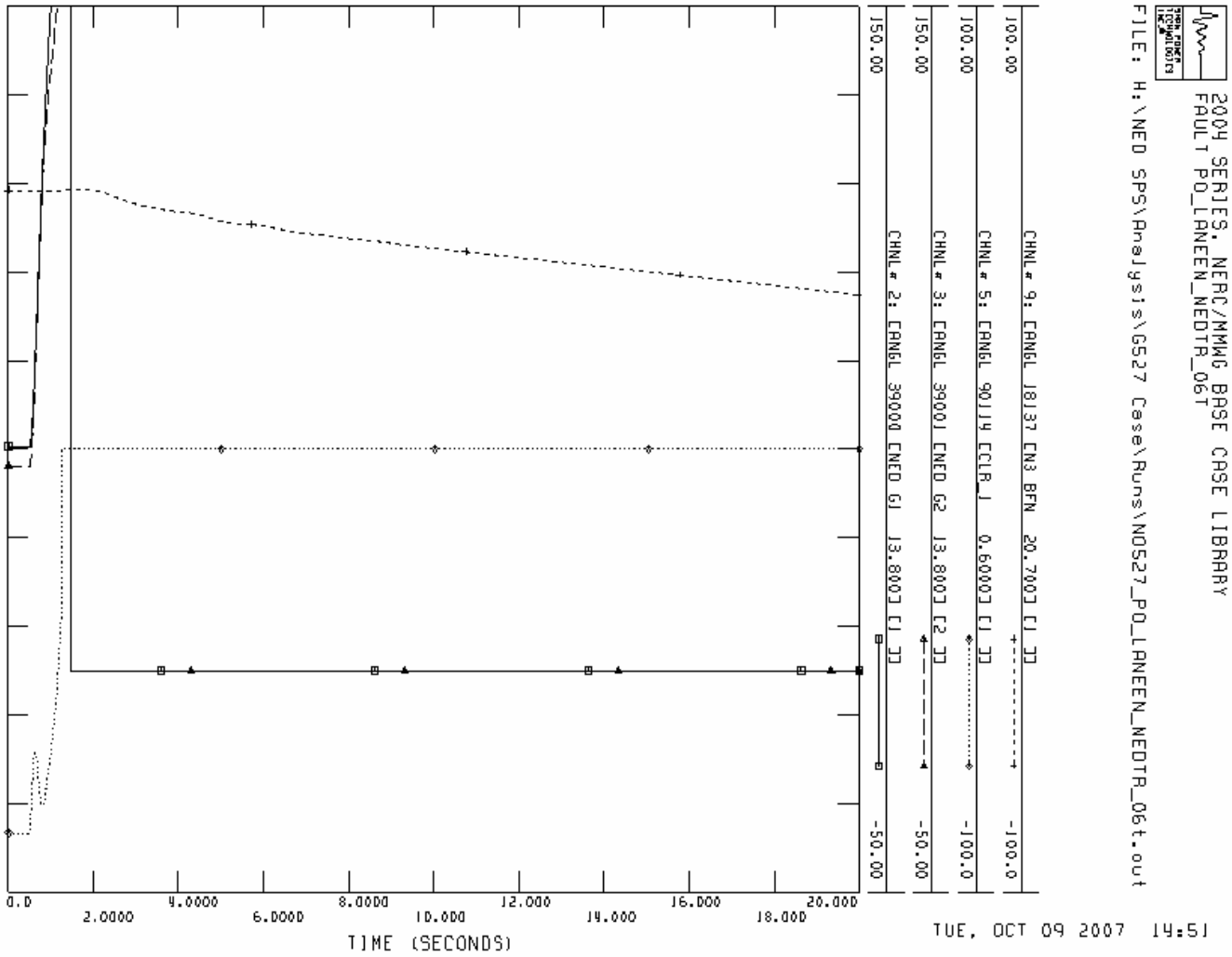
Fault Category: NERC Category C.3
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)**



* Darlington Wind Farm (Bus 90114) trips off-line for faults of 4-cycles and longer under this scenario.
** See Appendix E for operating restrictions that address this inadequate clearing time issue.

Prior outage of Lancaster – Eden 138-kV line segment

Fault Category: NERC Category C.3
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)**

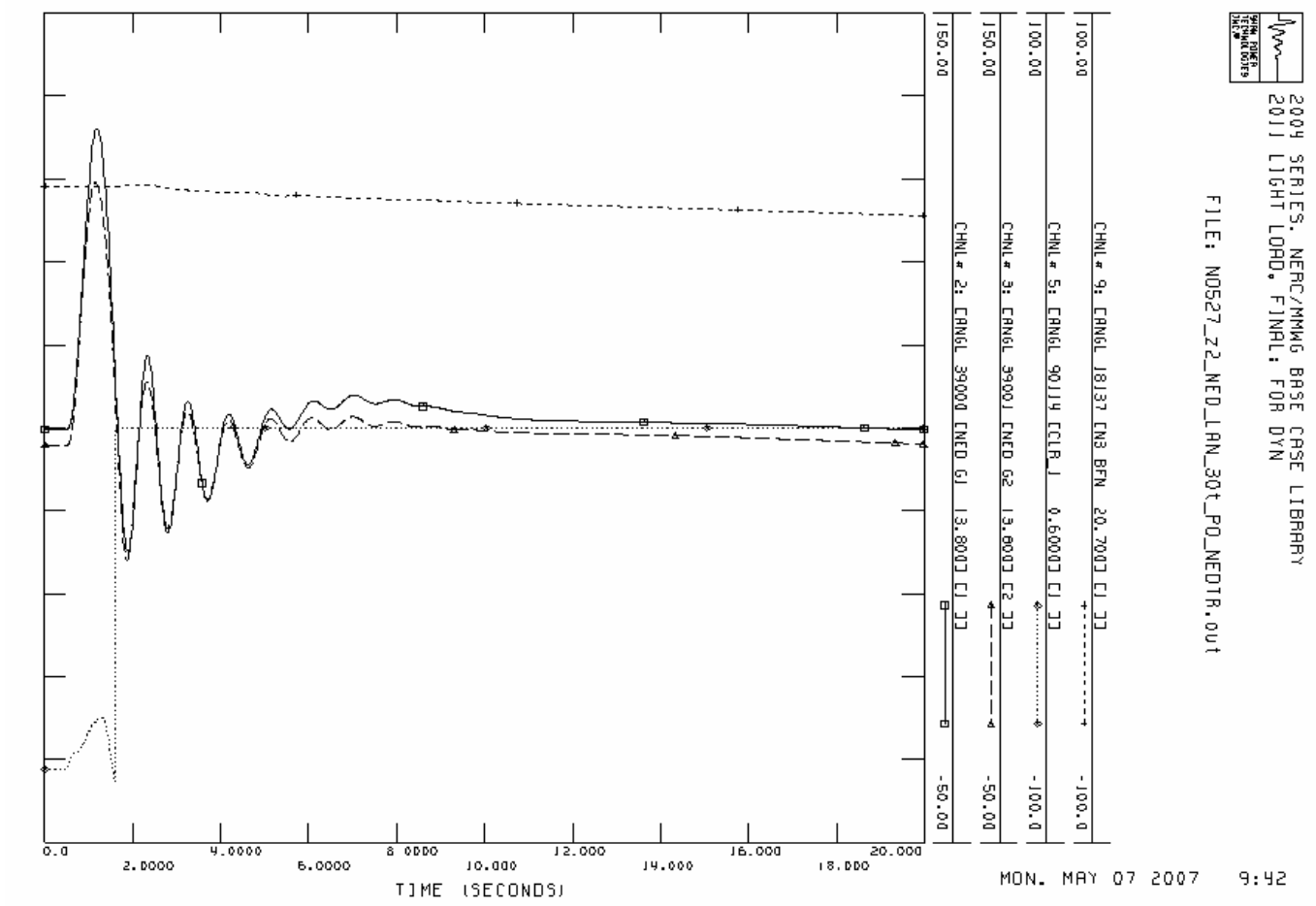


* Darlington Wind Farm (Bus 90114) trips off-line for faults of 4-cycles and longer under this scenario.
** See Appendix E for operating restrictions that address this inadequate clearing time issue.

Faults beyond NERC Category C – G527 omitted

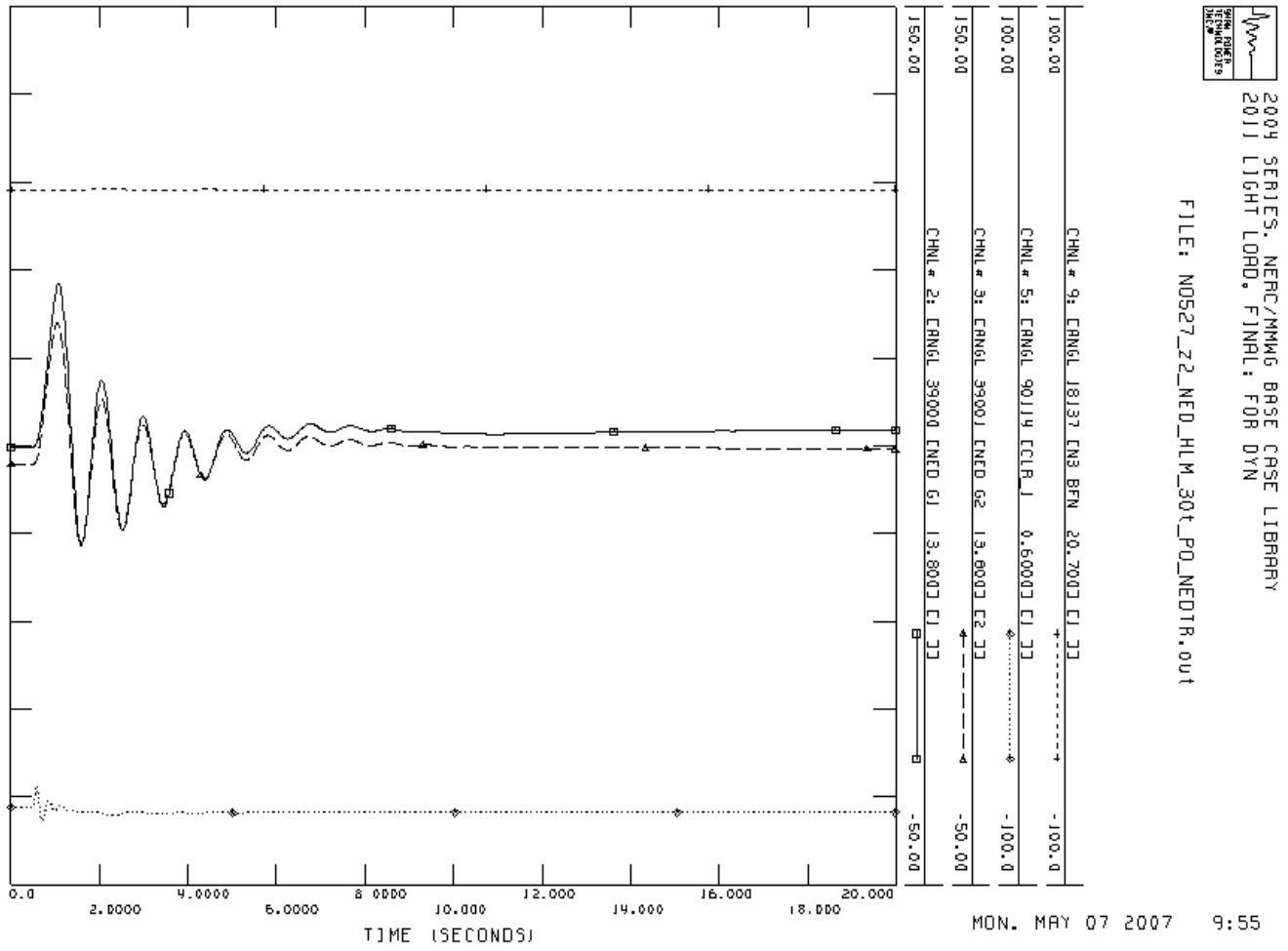
Prior outage of Nelson Dewey 161/138-kV transformer

Fault Category: Beyond NERC Category C (prior outage combined with communications failure)
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
Single-line-to-ground fault applied at Lancaster on Nelson Dewey –Lancaster – Eden 138-kV line
Remote end (Eden) clearing in 5cycles, Nelson Dewey end clearing in 30 cycles



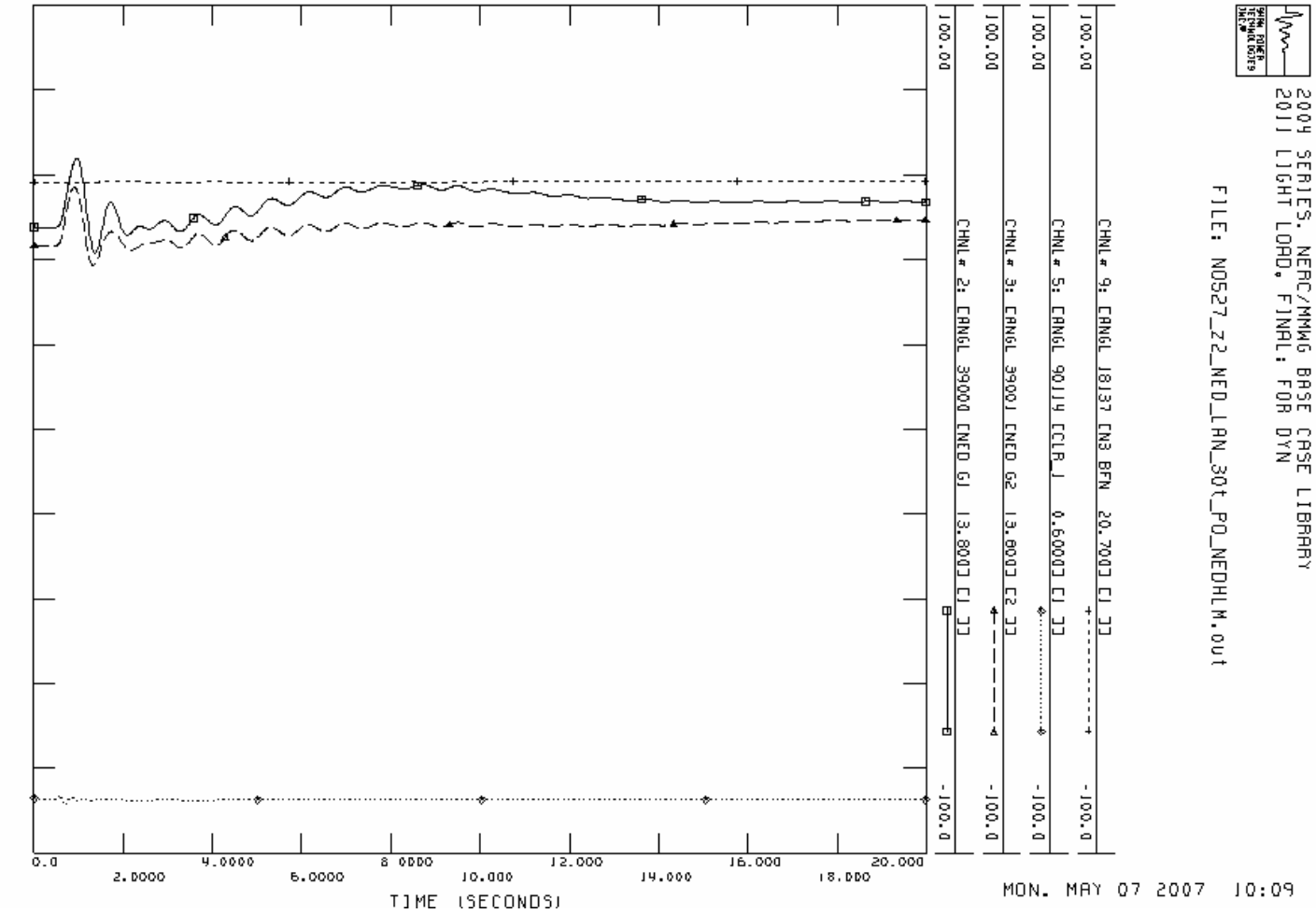
Prior outage of Nelson Dewey 161/138-kV transformer

Fault Category: Beyond NERC Category C (prior outage combined with communications failure)
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
Single-line-to-ground fault applied at Potosi on Nelson Dewey –Potosi – Hillman 138-kV line
Remote end (Hillman) clearing in 5cycles, Nelson Dewey end clearing in 30 cycles



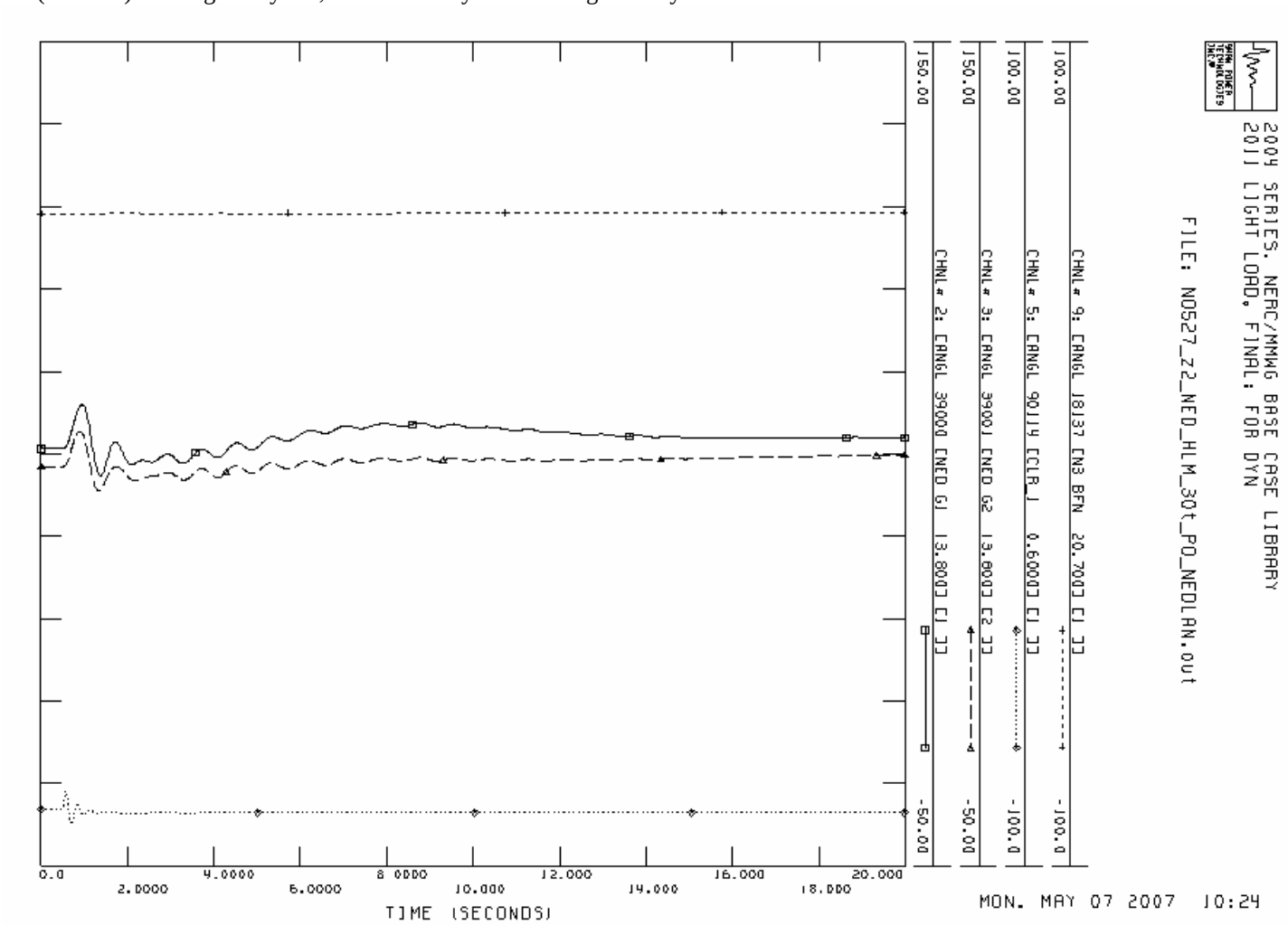
Prior outage of Nelson Dewey – Potosi 138-kV line segment

Fault Category: Beyond NERC Category C (prior outage combined with communications failure)
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
Single-line-to-ground fault applied at Lancaster on Nelson Dewey –Lancaster – Eden
Remote end (Eden) clearing in 5cycles, Nelson Dewey end clearing in 30 cycles



Prior outage of Nelson Dewey – Lancaster 138-kV line segment

Fault Category: Beyond NERC Category C (prior outage combined with communications failure)
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
Single-line-to-ground fault applied at Potosi on Nelson Dewey –Potosi – Hillman
Remote end (Hillman) clearing in 5cycles, Nelson Dewey end clearing in 30 cycles



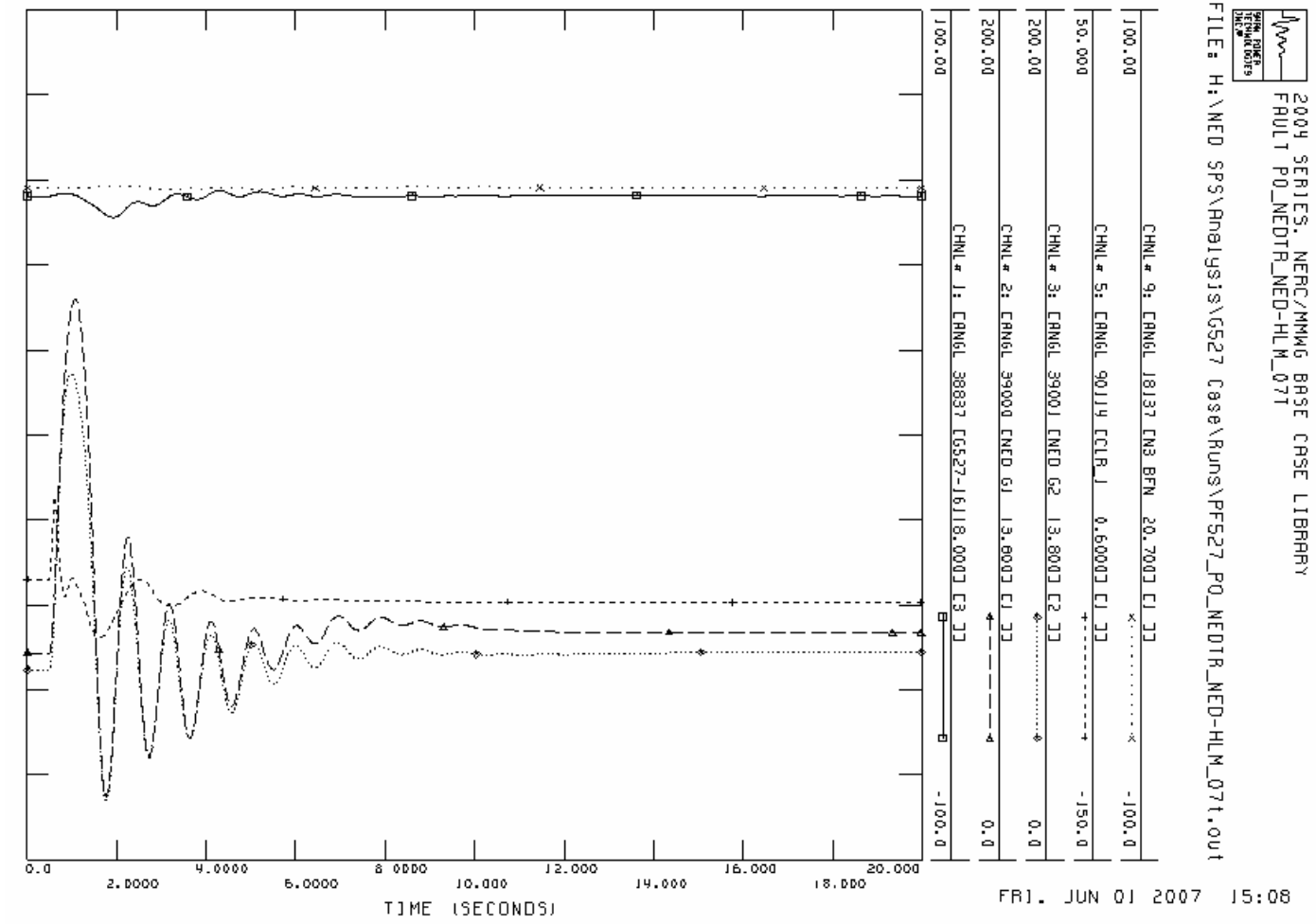
Appendix C: Results – G527 Included

G527 and related interconnection upgrades included in models

NERC Category C.3 Faults – G527 included

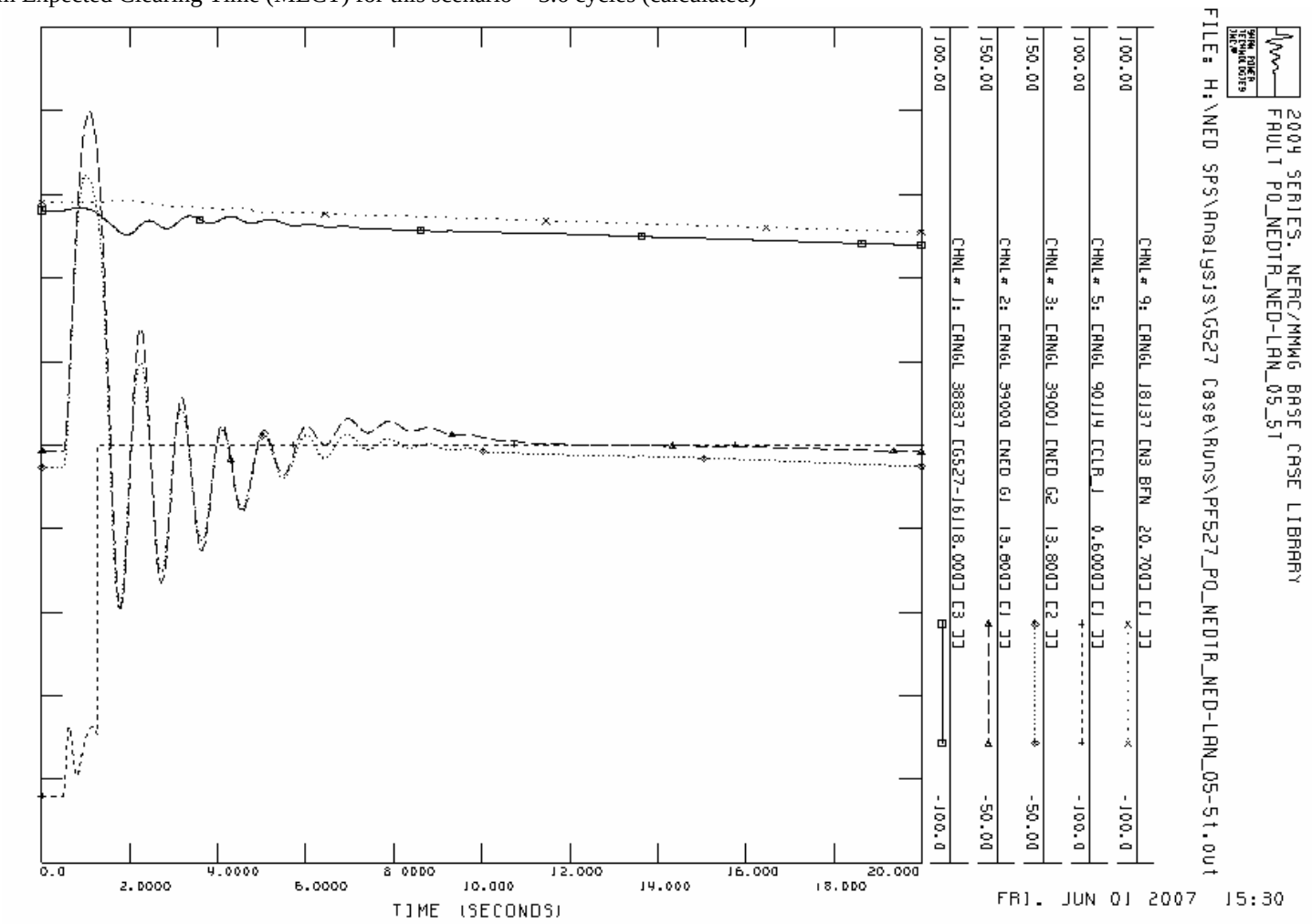
Prior outage of Nelson Dewey 161/138-kV transformer

Fault Category: NERC Category C.3
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
3-phase fault applied at Nelson Dewey to Nelson Dewey –Potosi – Hillman for 7.0 cycles
Maximum Expected Clearing Time (MECT) for this scenario = 5.5 cycles (estimated)



Prior outage of Nelson Dewey 161/138-kV transformer

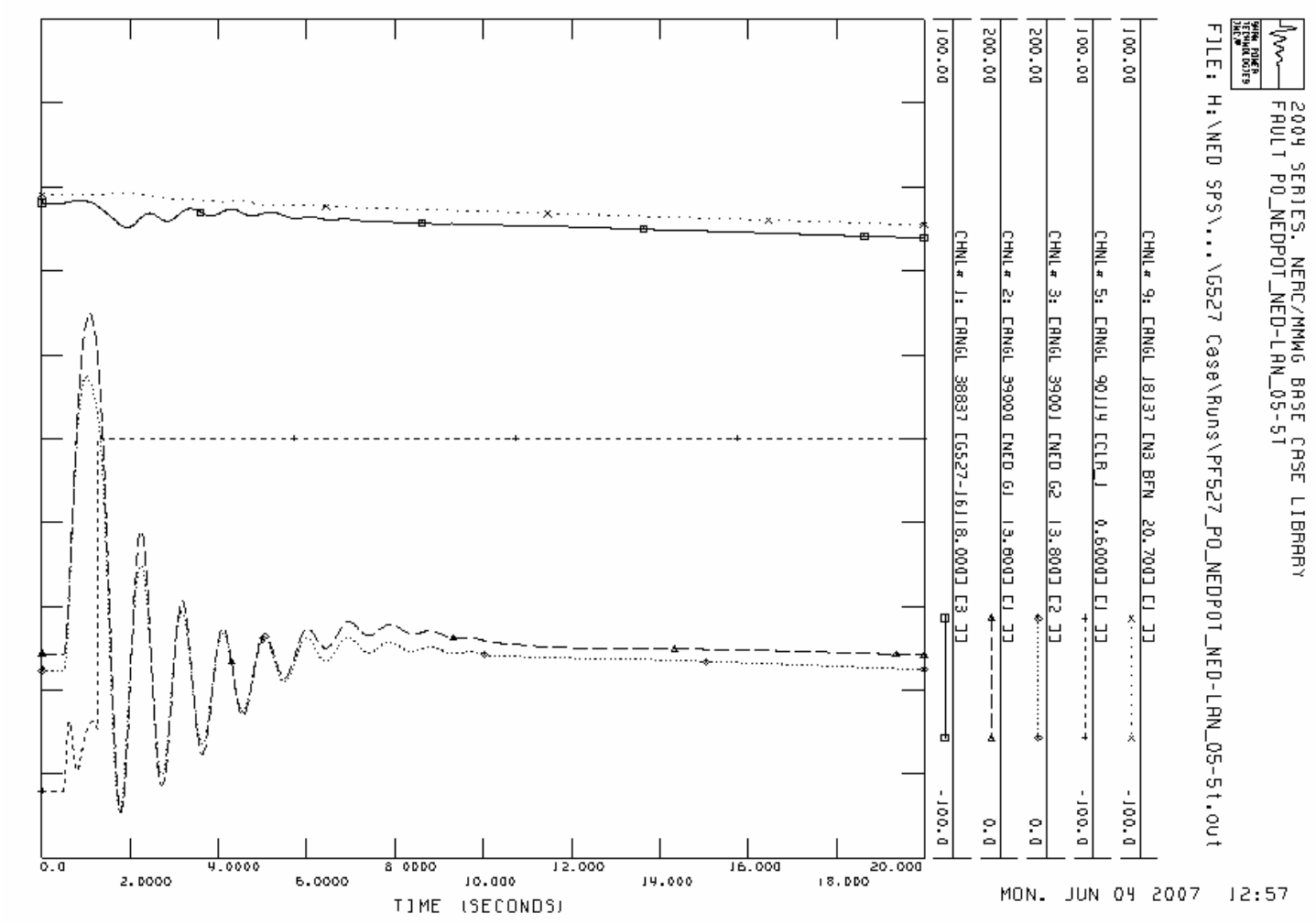
Fault Category: NERC Category C.3
G527 and related upgrades not included in power flow cases, Nelson Dewey units at full output
3-phase fault applied at Nelson Dewey to Nelson Dewey – Lancaster – Eden for 5.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 3.6 cycles (calculated)



*Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

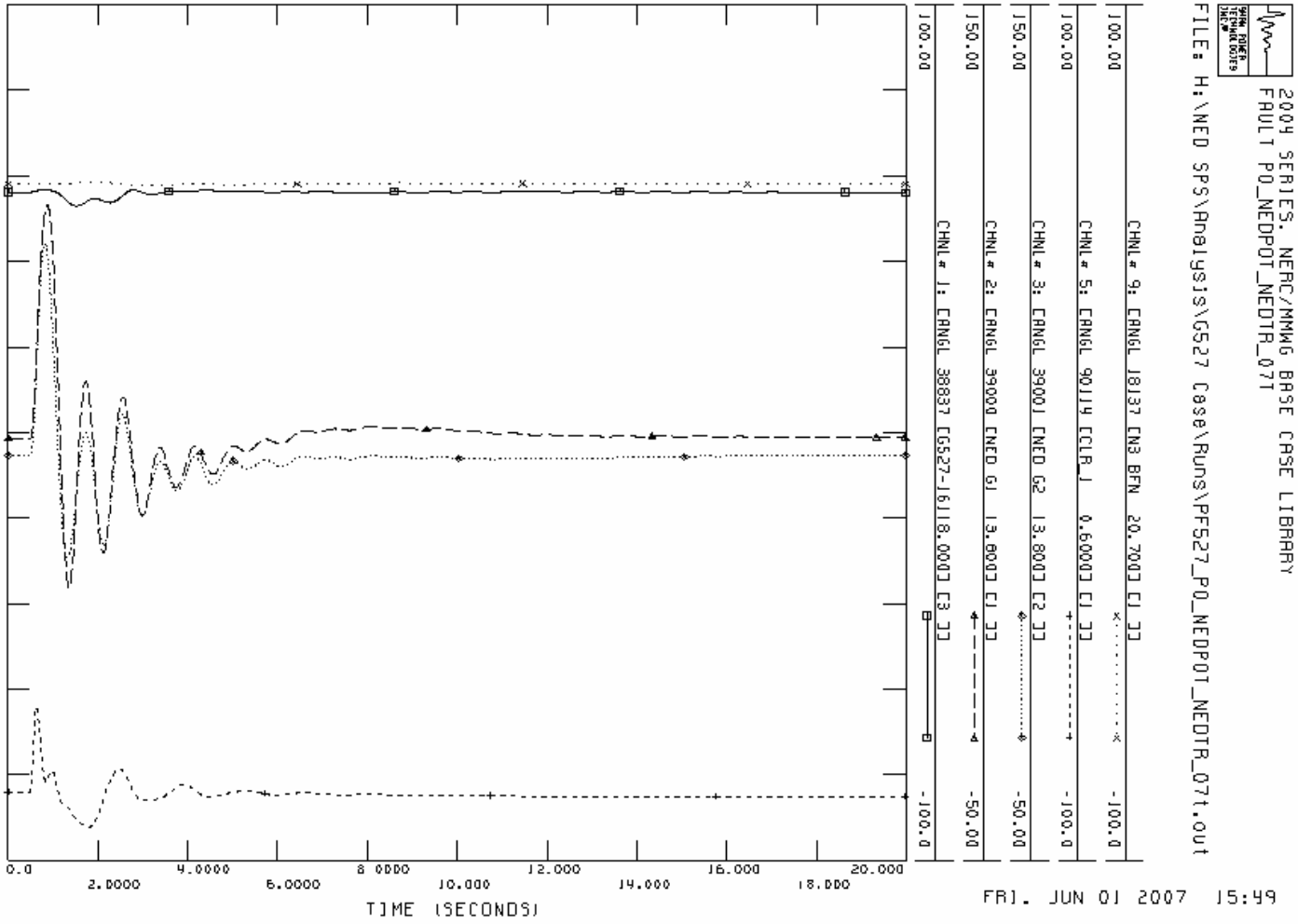
Prior outage of Nelson Dewey – Potosi 138-kV line segment

Fault Category: NERC Category C.3
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
3-phase fault applied at Nelson Dewey to Nelson Dewey – Lancaster – Eden for 5.5 cycles
Maximum Expected Clearing Time (MECT) for this scenario = 3.6 cycles (calculated)



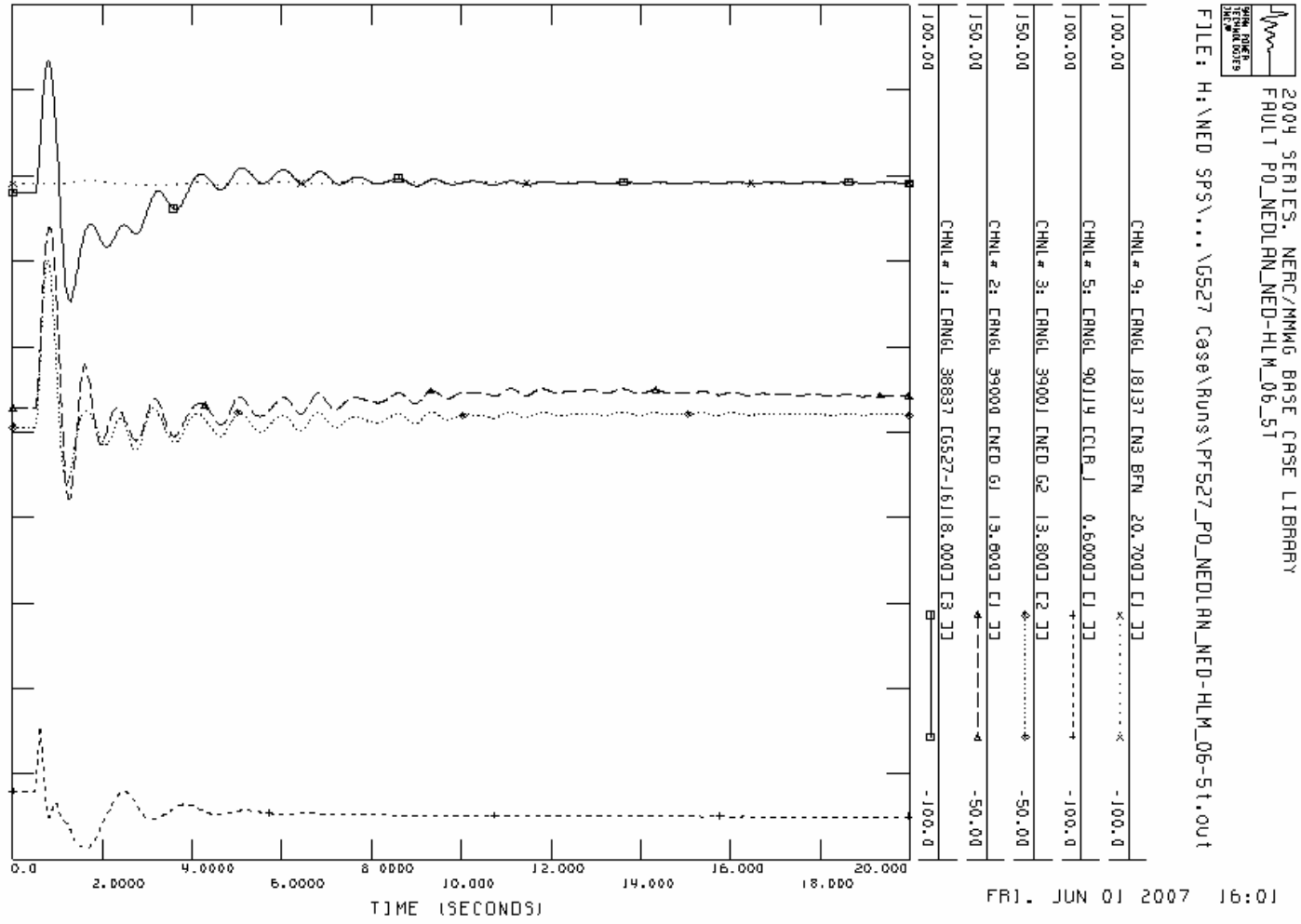
Prior outage of Nelson Dewey – Potosi 138-kV line segment

Fault Category: NERC Category C.3
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 7.0 cycles
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



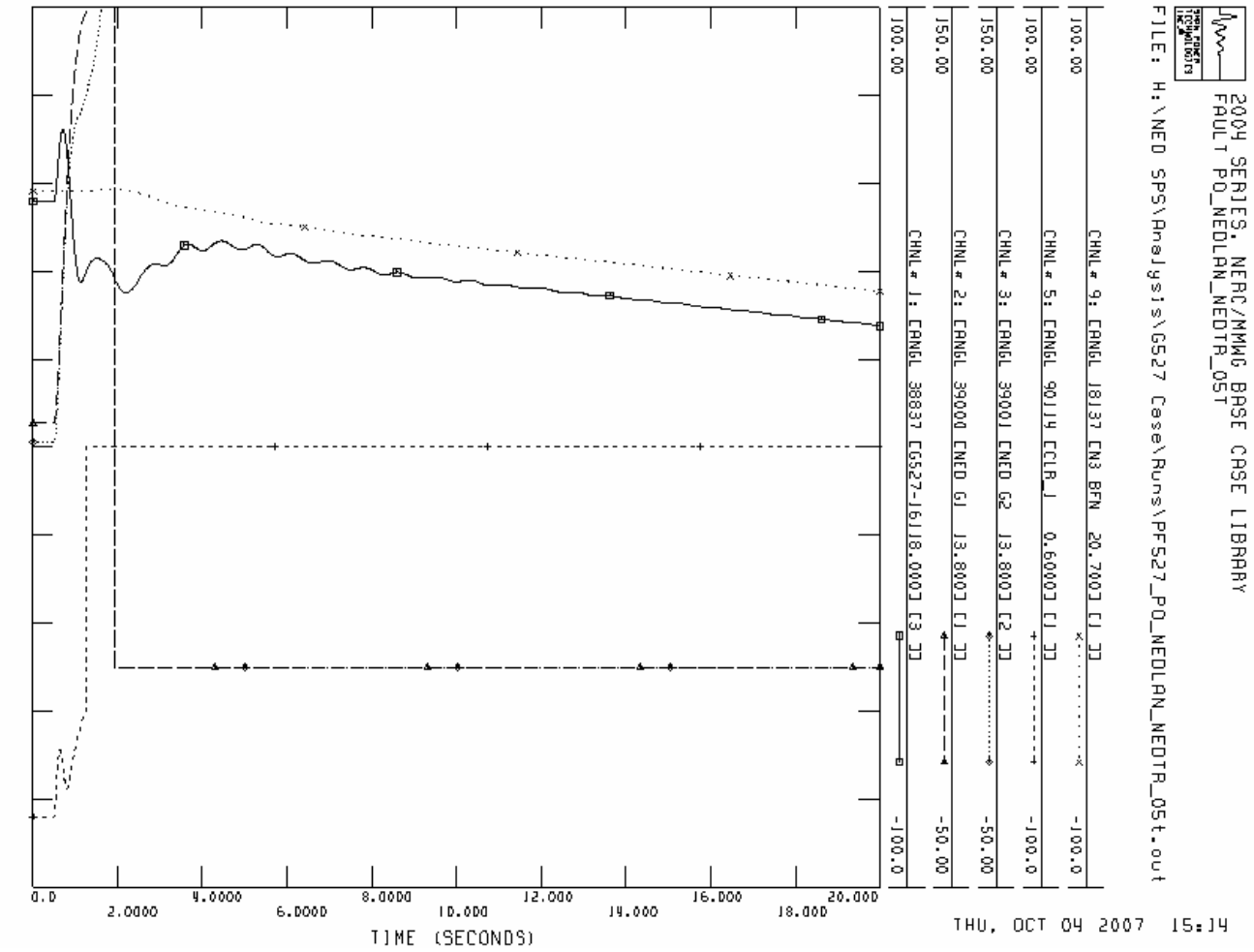
Prior outage of Nelson Dewey – Lancaster 138-kV line segment

Fault Category: NERC Category C.3
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
3-phase fault applied at Nelson Dewey to Nelson Dewey – Potosi –Hillman for 6.5 cycles
Maximum Expected Clearing Time (MECT) for this scenario = 5.5 cycles (estimated)



Prior outage of Nelson Dewey – Lancaster 138-kV line segment

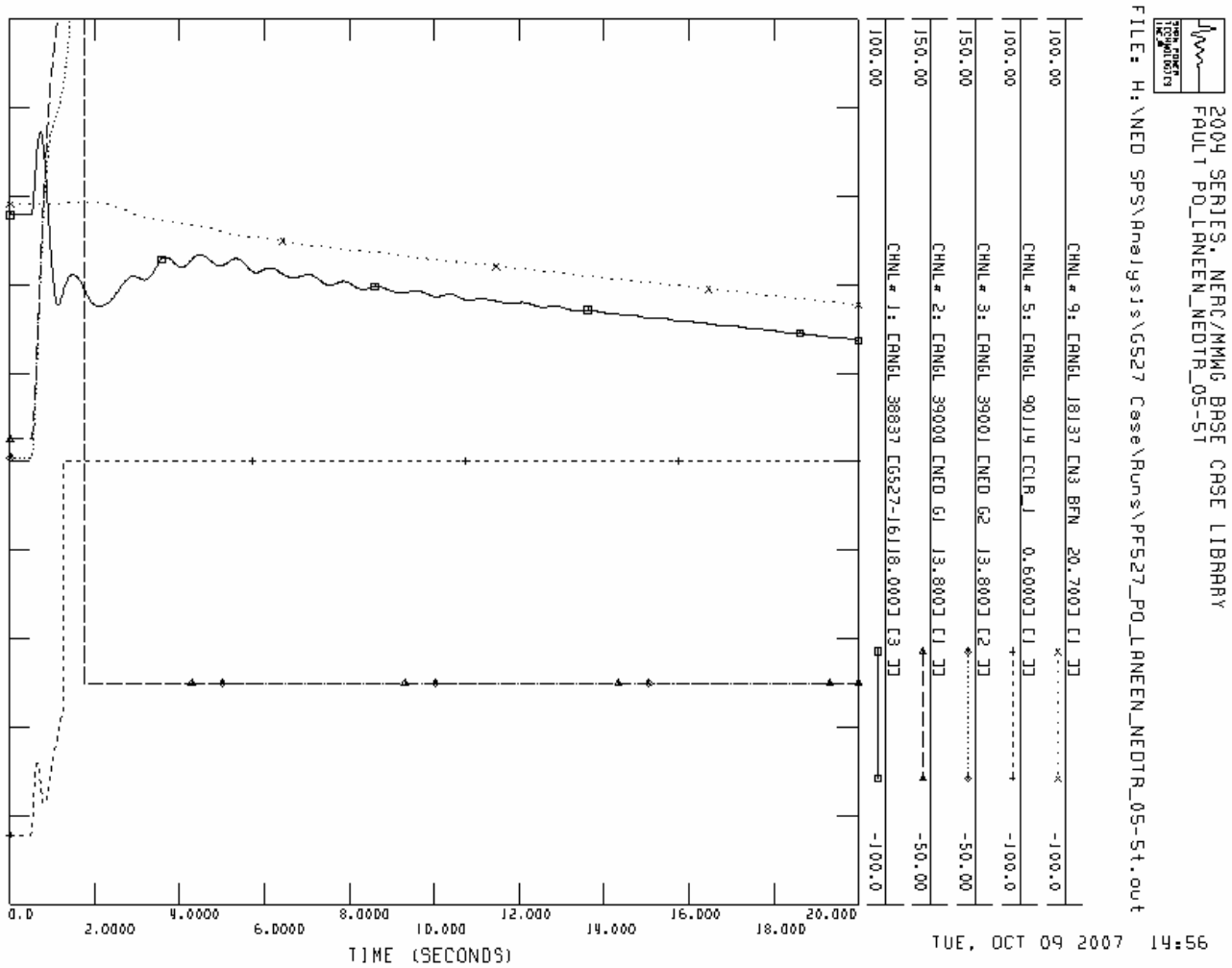
Fault Category: NERC Category C.3
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)*



* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.
** See Appendix E for operating restrictions that address this inadequate clearing time issue.

Prior outage of Lancaster – Eden 138-kV line segment

Fault Category: NERC Category C.3
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 5.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)**

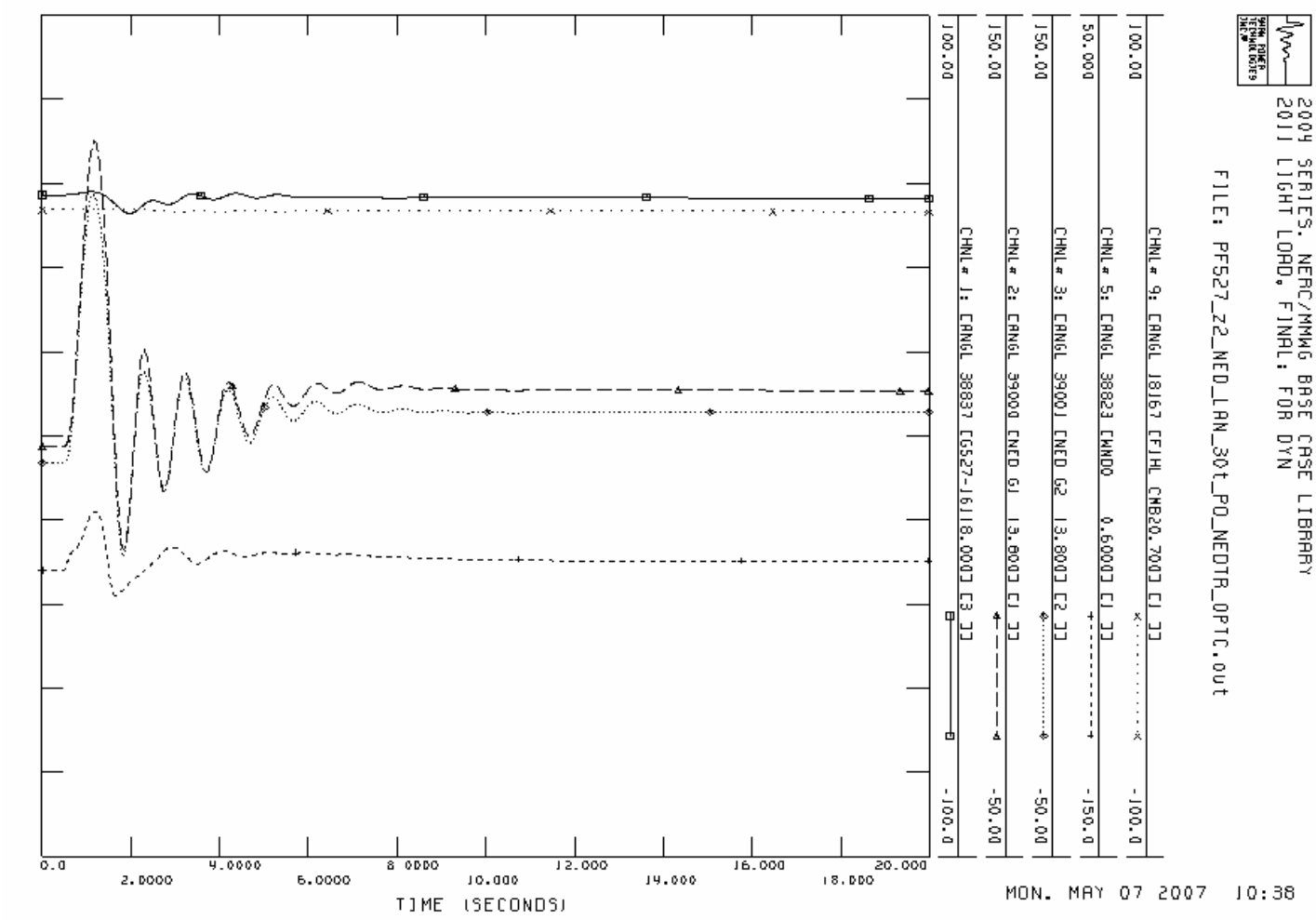


* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.
** See Appendix E for operating restrictions that address this inadequate clearing time issue.

Faults Beyond NERC Category C – G527 included

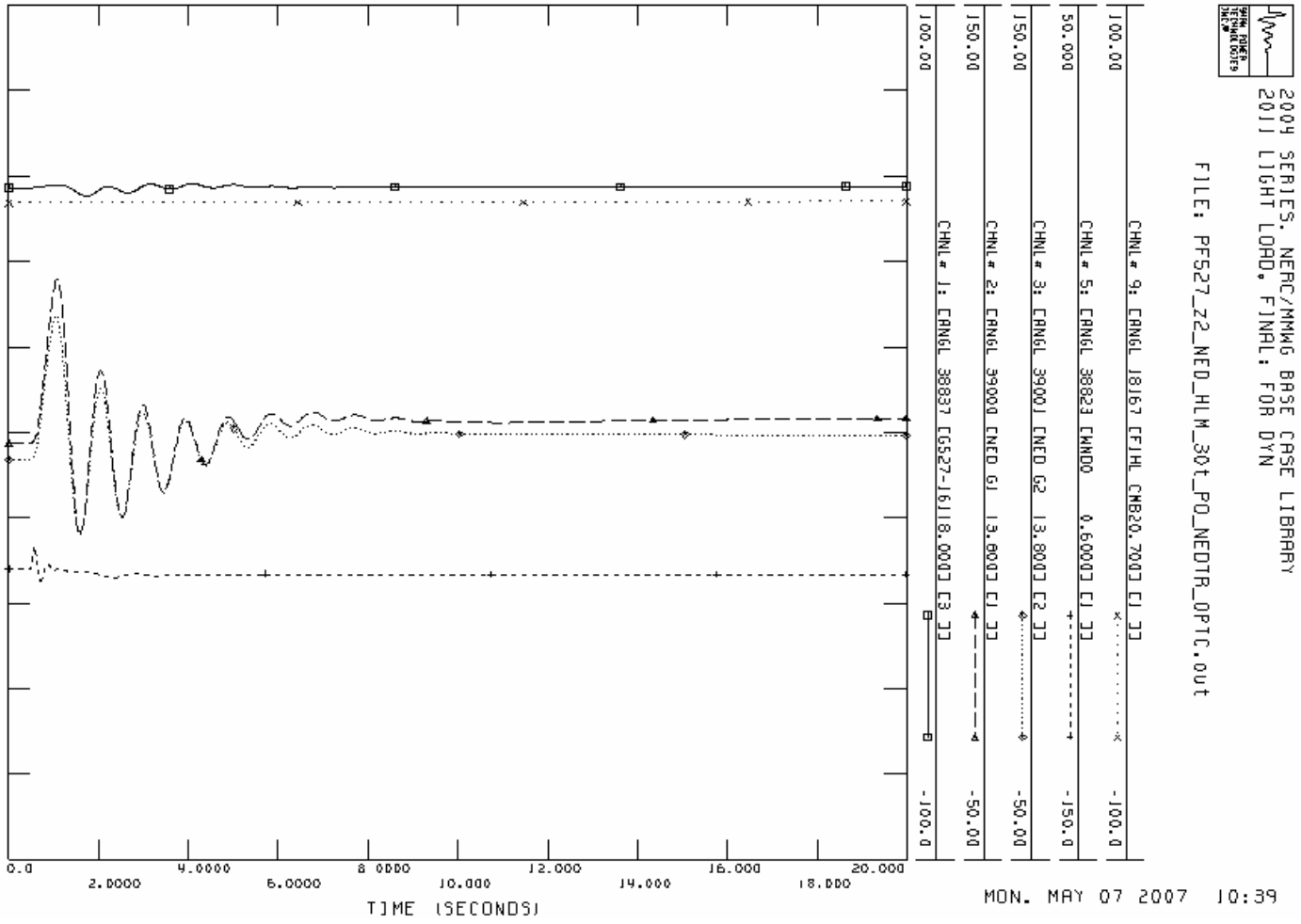
Prior outage of Nelson Dewey 161/138-kV transformer

Fault Category: Beyond NERC Category C (prior outage combined with communications failure)
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
Single-phase fault applied at Lancaster on Nelson Dewey – Lancaster – Eden
Remote end (Eden) clearing in 5cycles, Nelson Dewey end clearing in 30 cycles



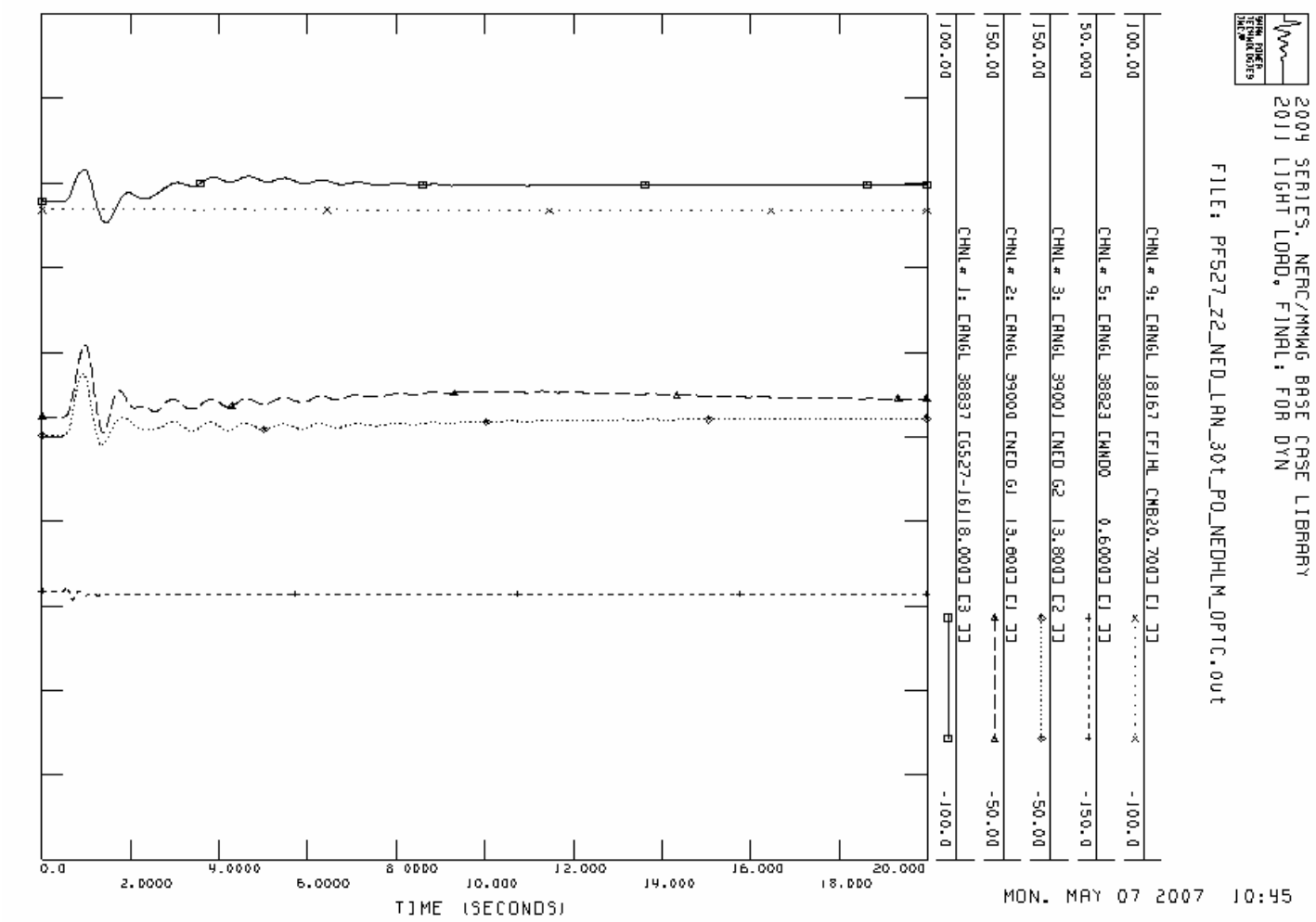
Prior outage of Nelson Dewey 161/138-kV transformer

Fault Category: Beyond NERC Category C (prior outage combined with communications failure)
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
Single-phase fault applied at Potosi on Nelson Dewey – Potosi – Hillman
Remote end (Hillman) clearing in 5cycles, Nelson Dewey end clearing in 30 cycles



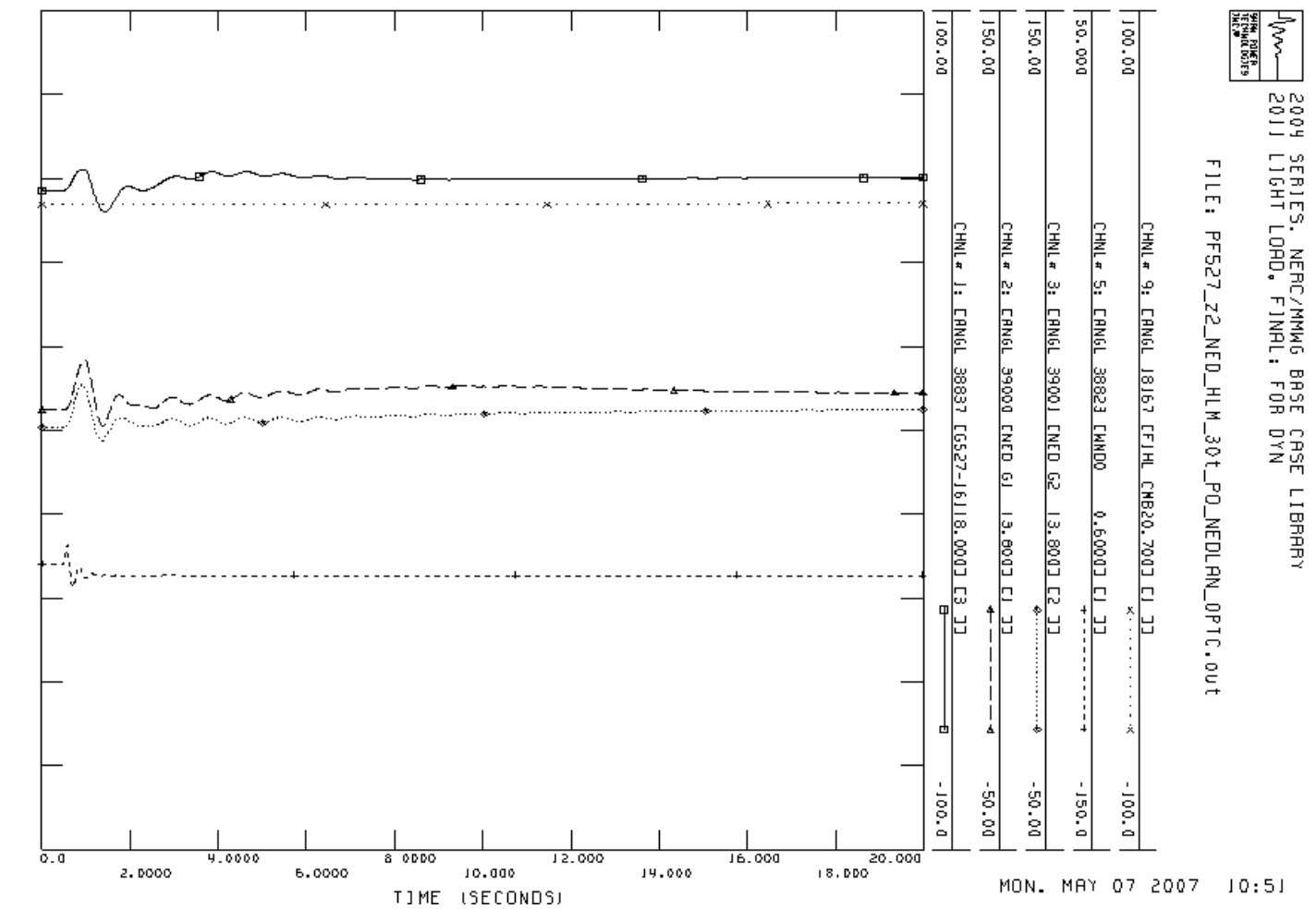
Prior outage of Nelson Dewey – Potosi138-kV line segment

Fault Category: Beyond NERC Category C (prior outage combined with communications failure)
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
Single-phase fault applied at Lancaster on Nelson Dewey – Lancaster – Eden
Remote end (Eden) clearing in 5cycles, Nelson Dewey end clearing in 30 cycles



Prior outage of Nelson Dewey – Lancaster 138-kV line segment

Fault Category: Beyond NERC Category C (prior outage combined with communications failure)
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
Single-phase fault applied at Potosi on Nelson Dewey –Potosi – Hillman
Remote end (Hillman) clearing in 5cycles, Nelson Dewey end clearing in 30 cycles



Appendix D: G527 Transmission Upgrade

Assumptions for upgrade required for interconnection of G527 at Nelson Dewey substation

The interconnection of a proposed 280 MW coal-fired unit on the 161-kV bus at Nelson Dewey (G527) requires a new 161-kV outlet from the station. The preferred option determined in the G527 interconnection system impact study involves building a new 161-kV line from Nelson Dewey to a new 161-kV substation located about 5 miles east of Liberty on the Liberty – Lore 161-kV line.

The distance of this new line is assumed to be 18 miles for this study. This approximation allows for building the line adjacent to existing right-of-way from Nelson Dewey to a point near the Turkey River substation and then following new right-of-way south to the new 161-kV substation. ATC standard 161-kV steel towers were assumed and the conductor assumed was 477.0 kcmil ACSR 26/7 T2 Hawk.

Table D.1 – Calculated values for new 161-kV line from Nelson Dewey to new sub on Liberty/Lore line

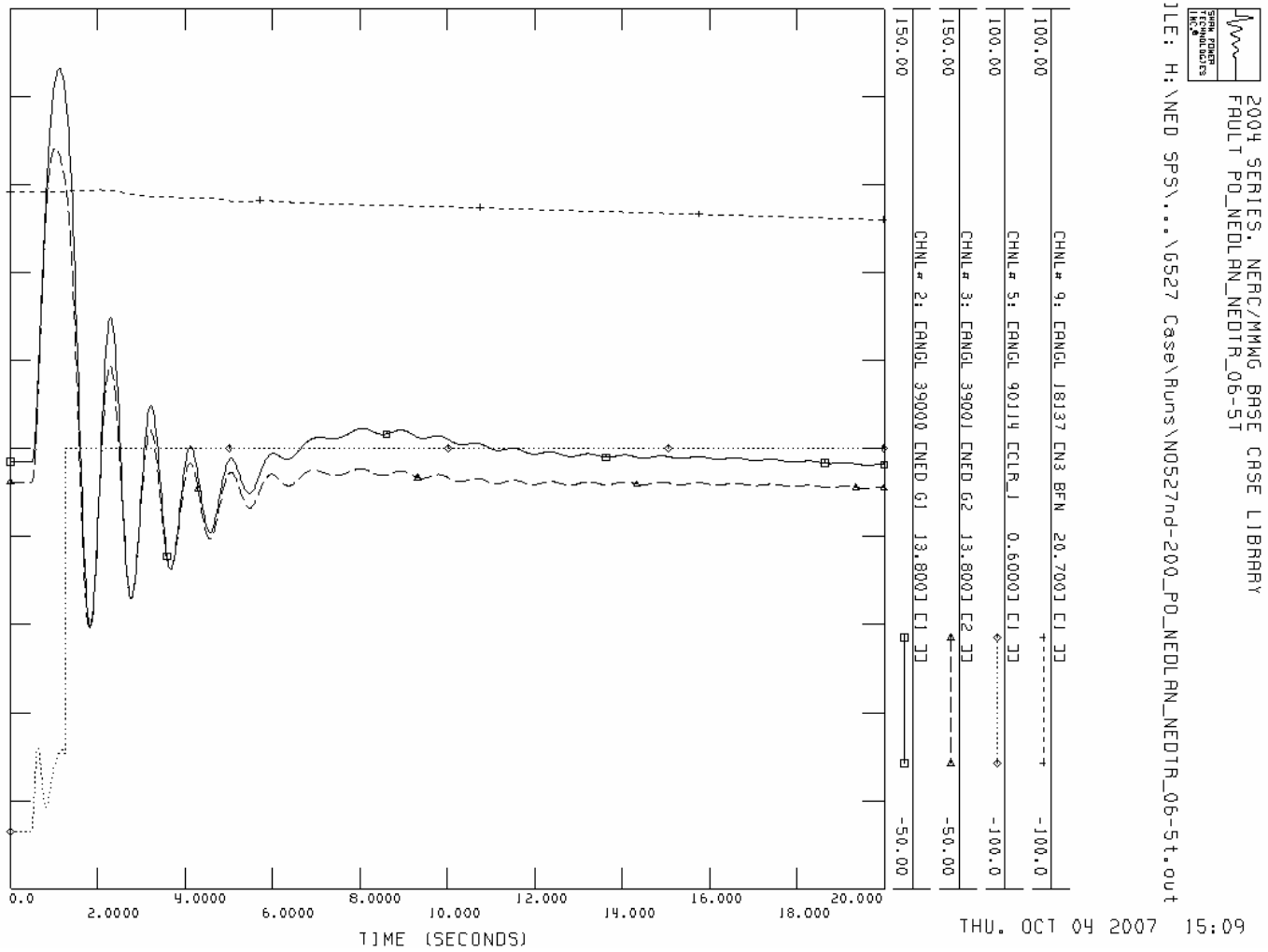
Line description	Voltage	Conductor	Miles	Resistance (p.u.)	Reactance (p.u.)	Charging (p.u.)
Nelson Dewey to New Sub in Iowa (Five miles east of ALTW Liberty sub)	161-kV	ACSR T2 477 26/7	18	0.006715	0.051154	0.026361

Appendix E: Nelson Dewey Operating Restrictions Analysis

Restrictions on MW output or voltage schedules for Nelson Dewey units 1 and 2

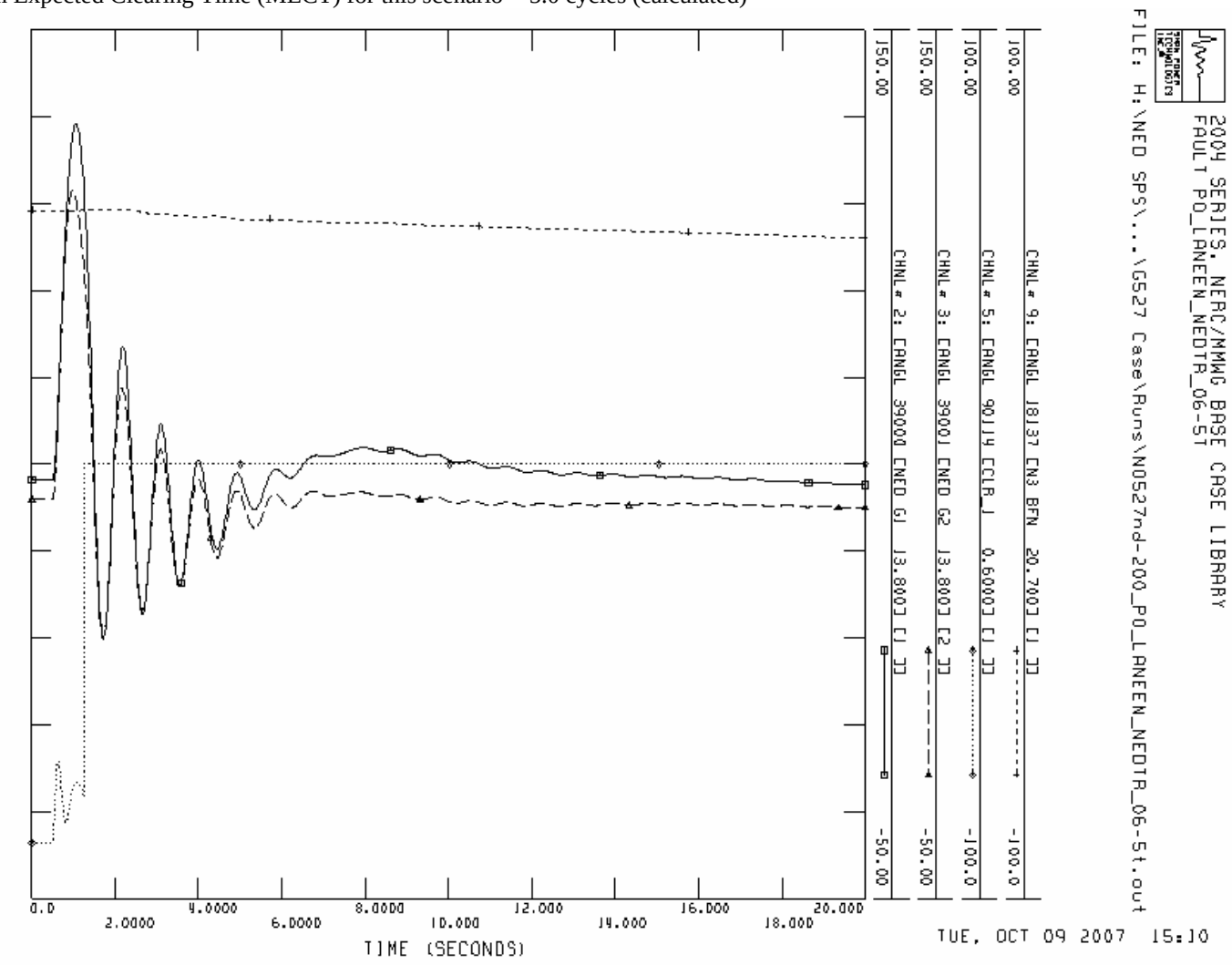
Potential Operating Restrictions Analysis – G527 omitted

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (100 MW each)
G527 and related upgrades omitted from power flow cases
Fault Category: NERC Category C.3
Prior outage of Nelson Dewey – Lancaster 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



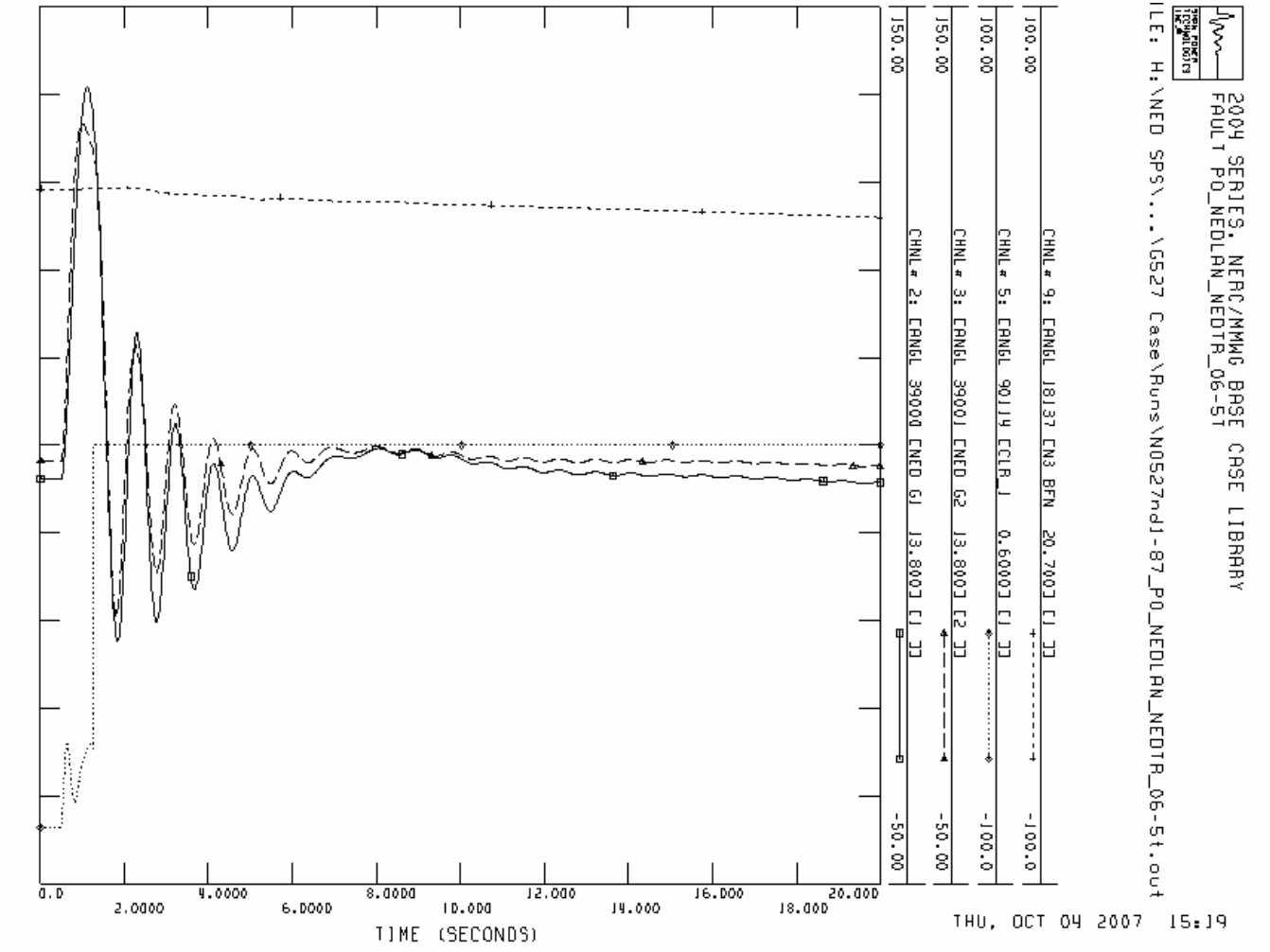
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (100 MW each)
G527 and related upgrades omitted from power flow cases
Fault Category: NERC Category C.3
Prior outage of Lancaster – Eden138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



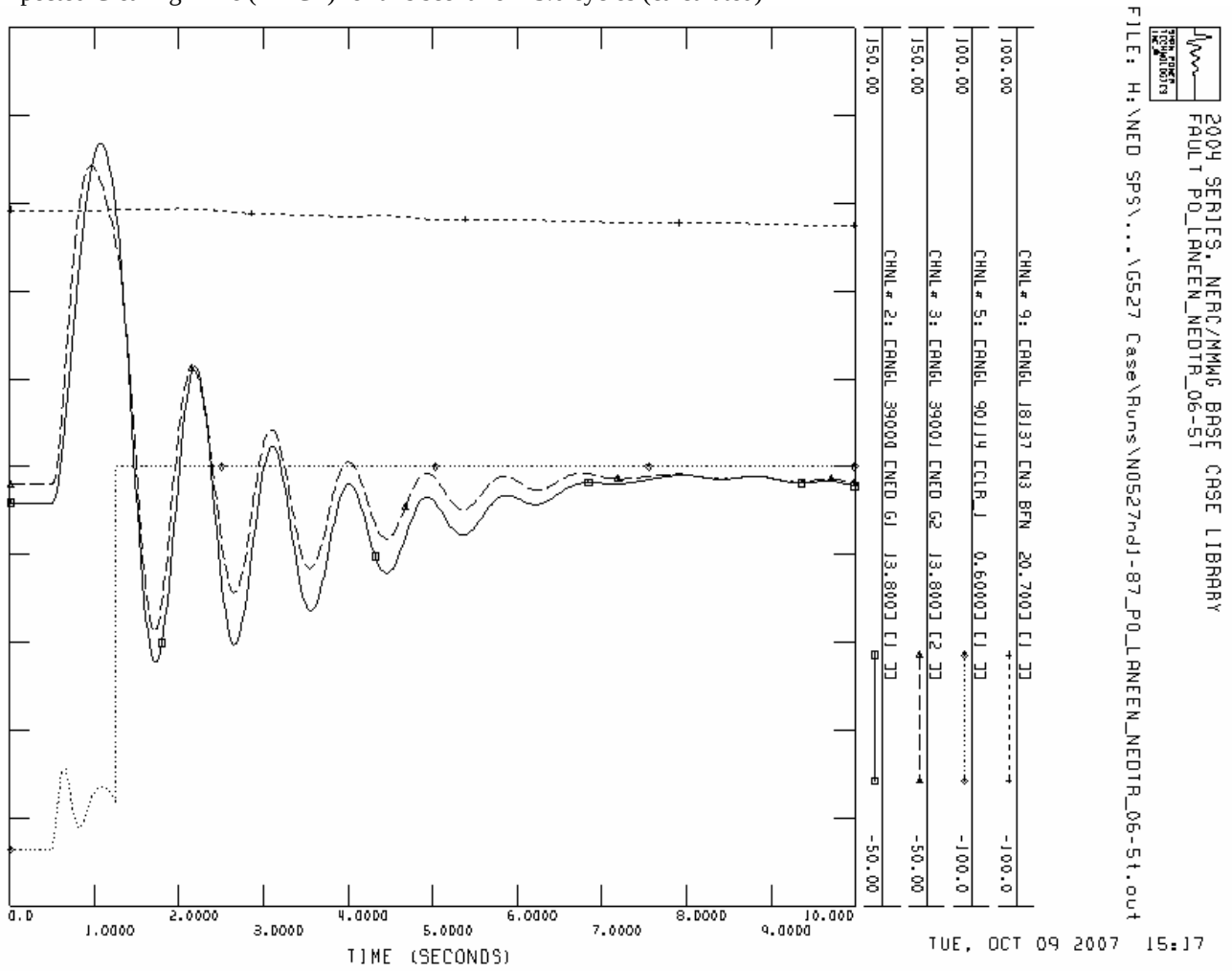
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (Nelson Dewey 1 = 87 MW, Nelson Dewey 2 = 113 MW)
G527 and related upgrades omitted from power flow cases
Fault Category: NERC Category C.3
Prior outage of Nelson Dewey – Lancaster 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



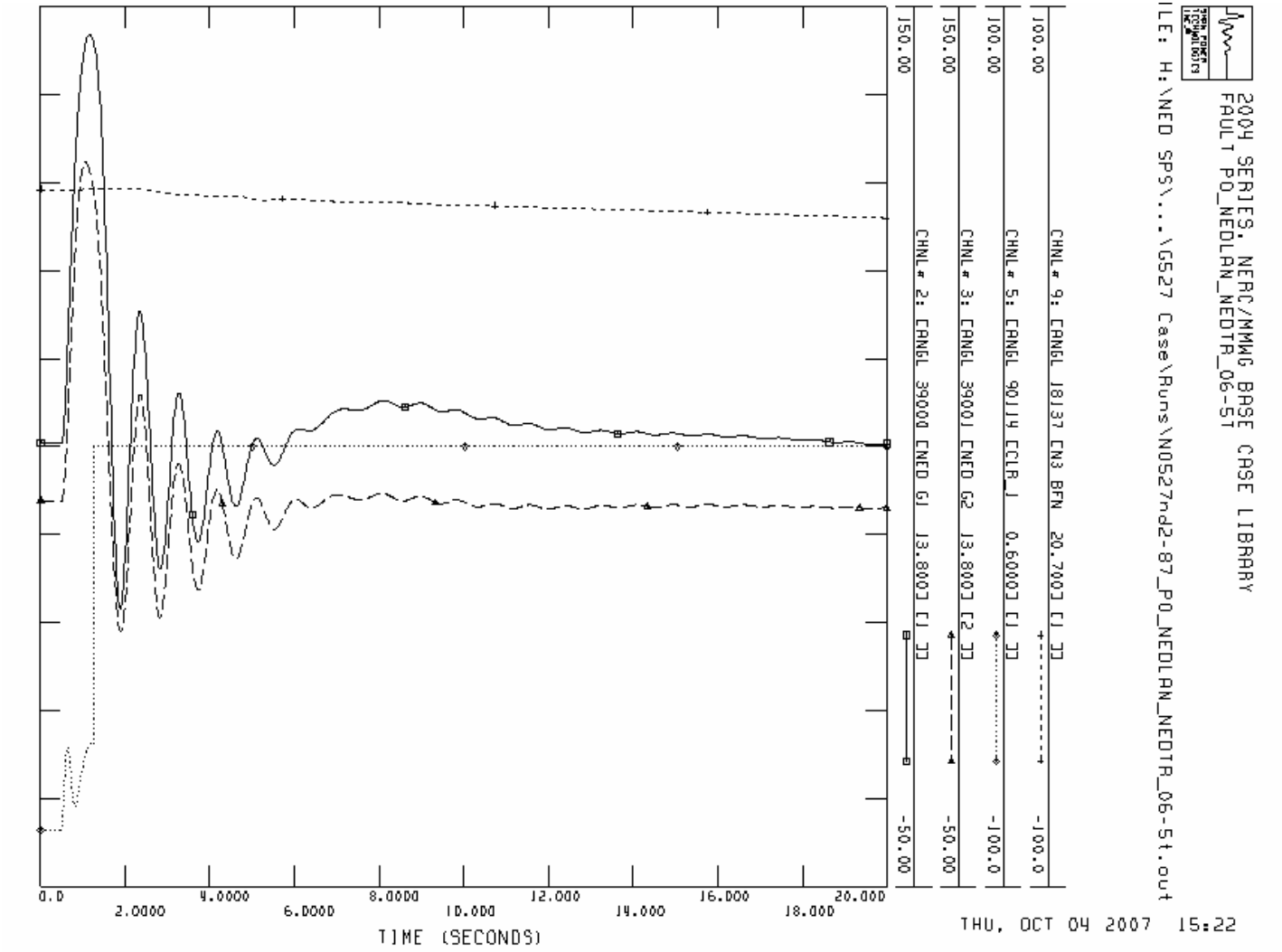
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (Nelson Dewey 1 = 87 MW, Nelson Dewey 2 = 113 MW)
G527 and related upgrades omitted from power flow cases
Fault Category: NERC Category C.3
Prior outage of Lancaster – Eden 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



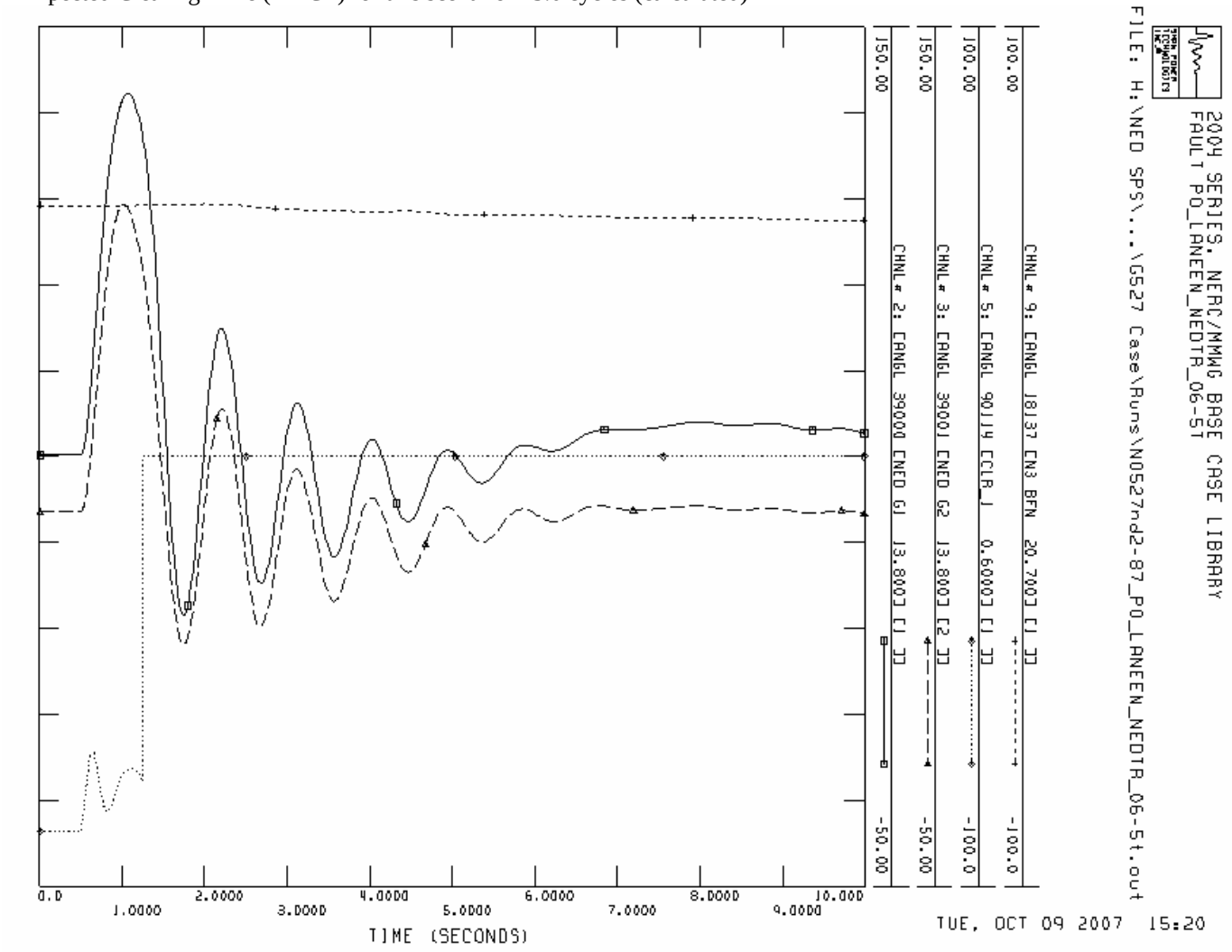
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (Nelson Dewey 1 = 113 MW, Nelson Dewey 2 = 87 MW)
G527 and related upgrades omitted from power flow cases
Fault Category: NERC Category C.3
Prior outage of Nelson Dewey – Lancaster 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



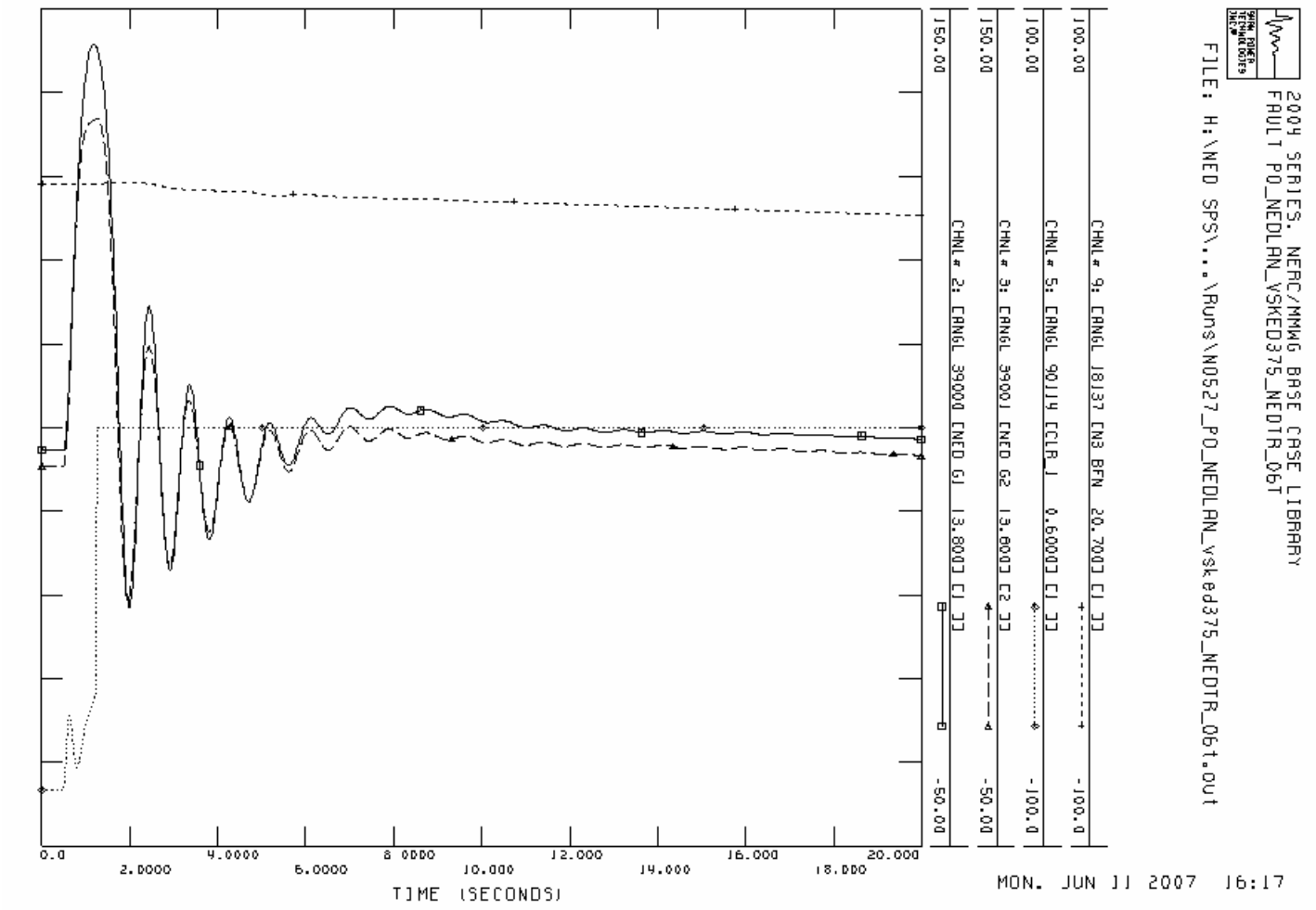
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (Nelson Dewey 1 = 113 MW, Nelson Dewey 2 = 87 MW)
G527 and related upgrades omitted from power flow cases
Fault Category: NERC Category C.3
Prior outage of Lancaster – Eden 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

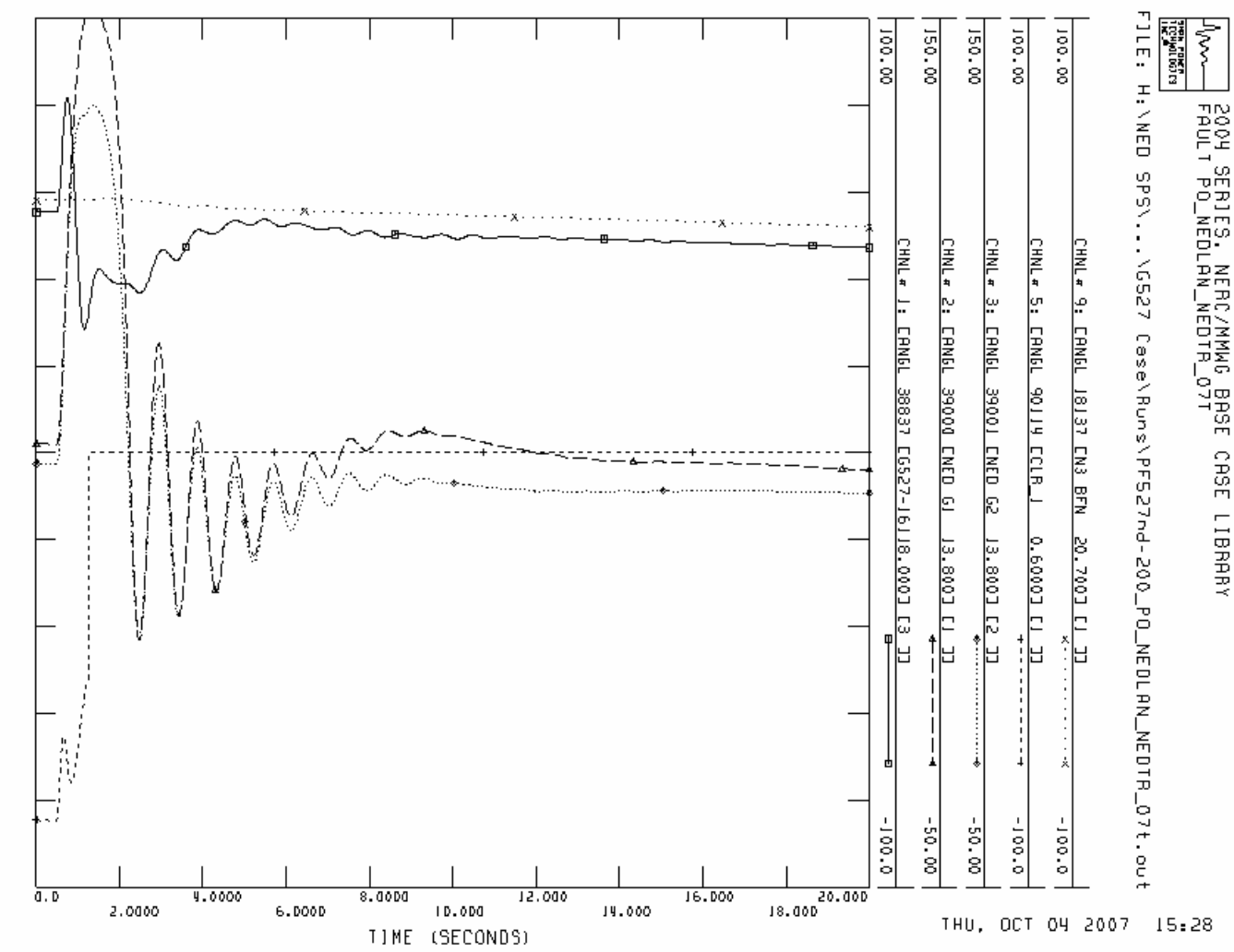
Alternate Nelson Dewey voltage schedule – Nelson Dewey units 1 and 2 set to control Nelson Dewey 138-kV voltage to 1.0375 p.u.
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
Fault Category: NERC Category C.3
Prior outage of Nelson Dewey – Lancaster 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.0 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

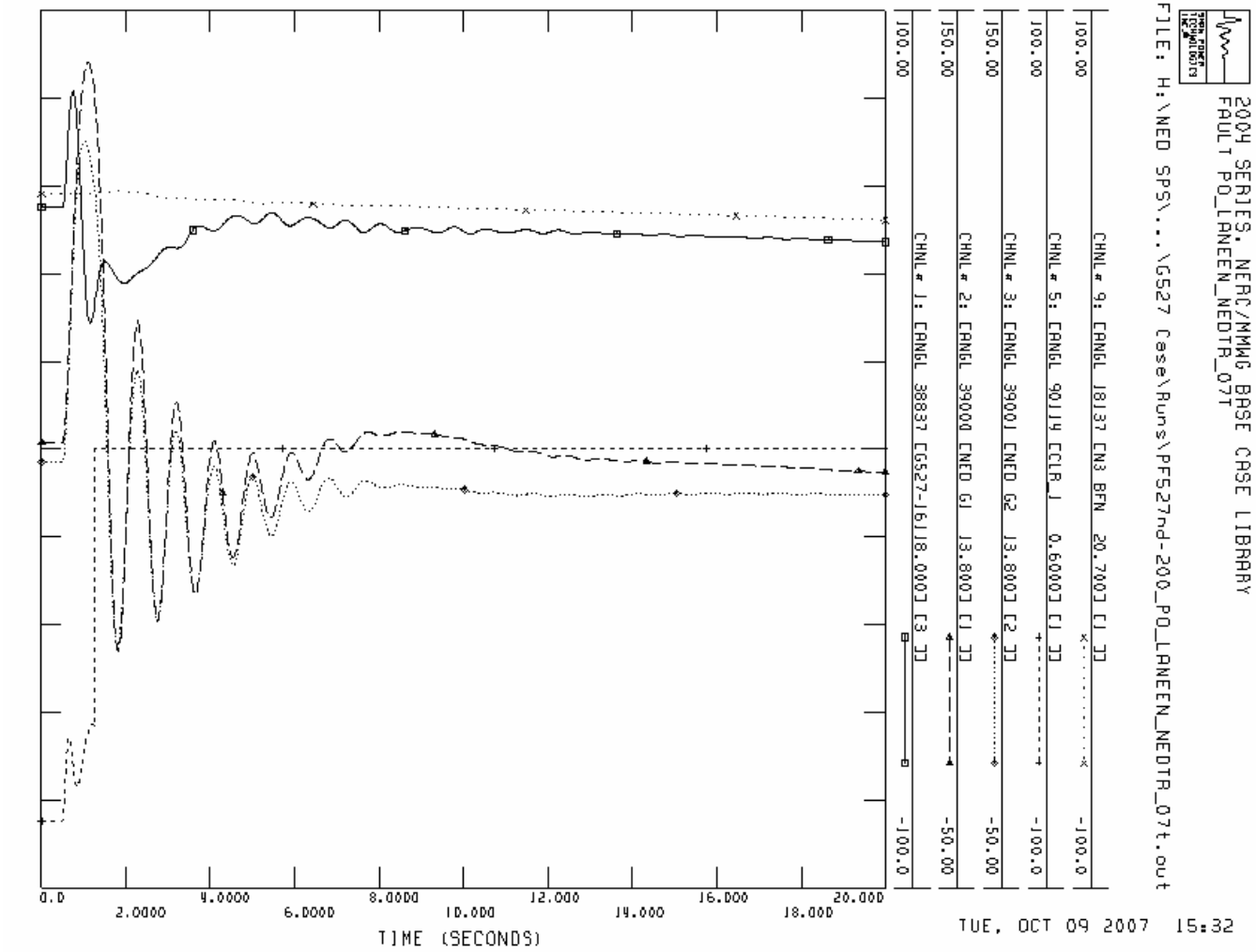
Potential Operating Restrictions Analysis – G527 included

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (100 MW each)
G527 and related upgrades included in power flow cases
Fault Category: NERC Category C.3
Prior outage of Nelson Dewey – Lancaster 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 7.0 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



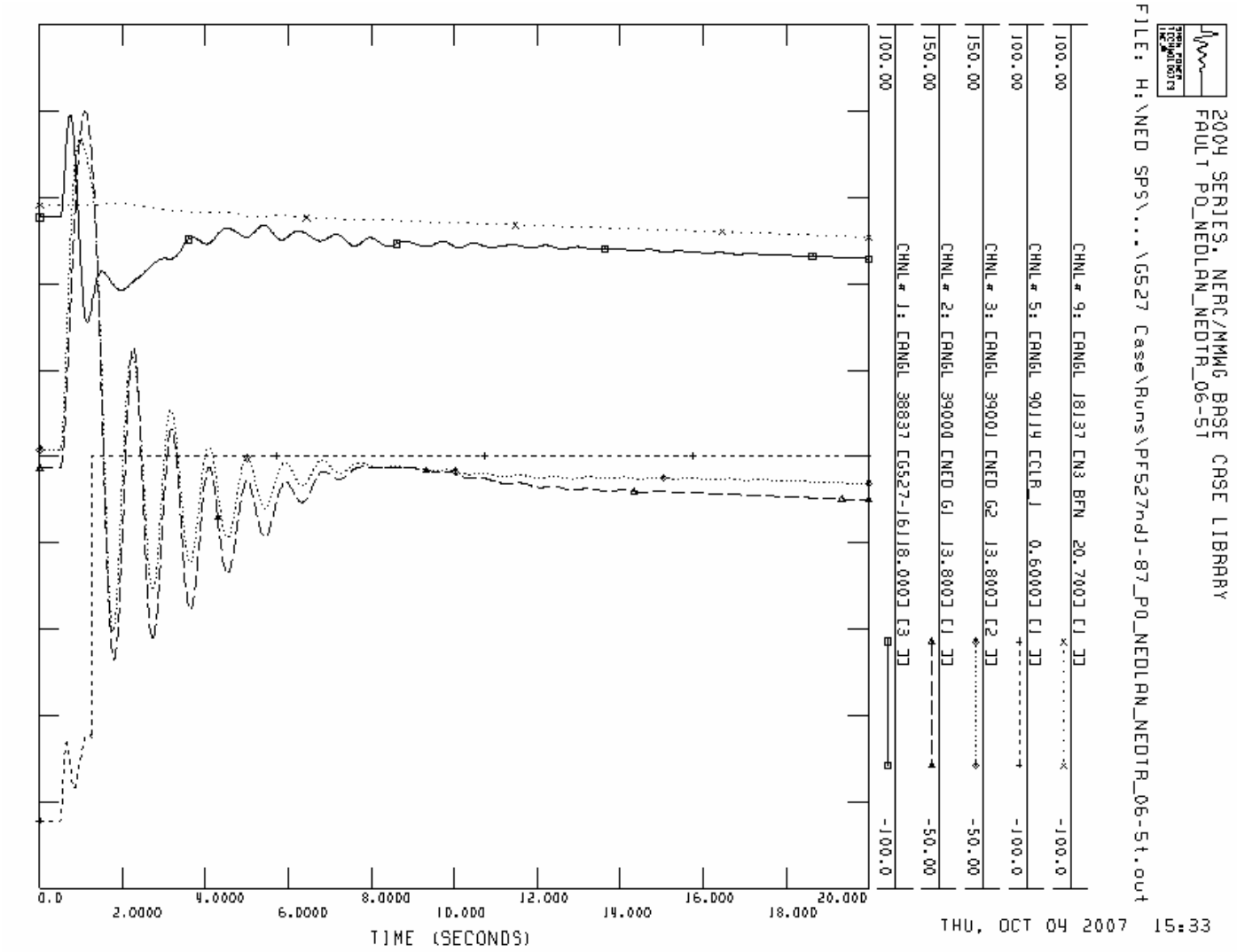
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (100 MW each)
G527 and related upgrades included in power flow cases
Fault Category: NERC Category C.3
Prior outage of Lancaster – Eden 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 7.0 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



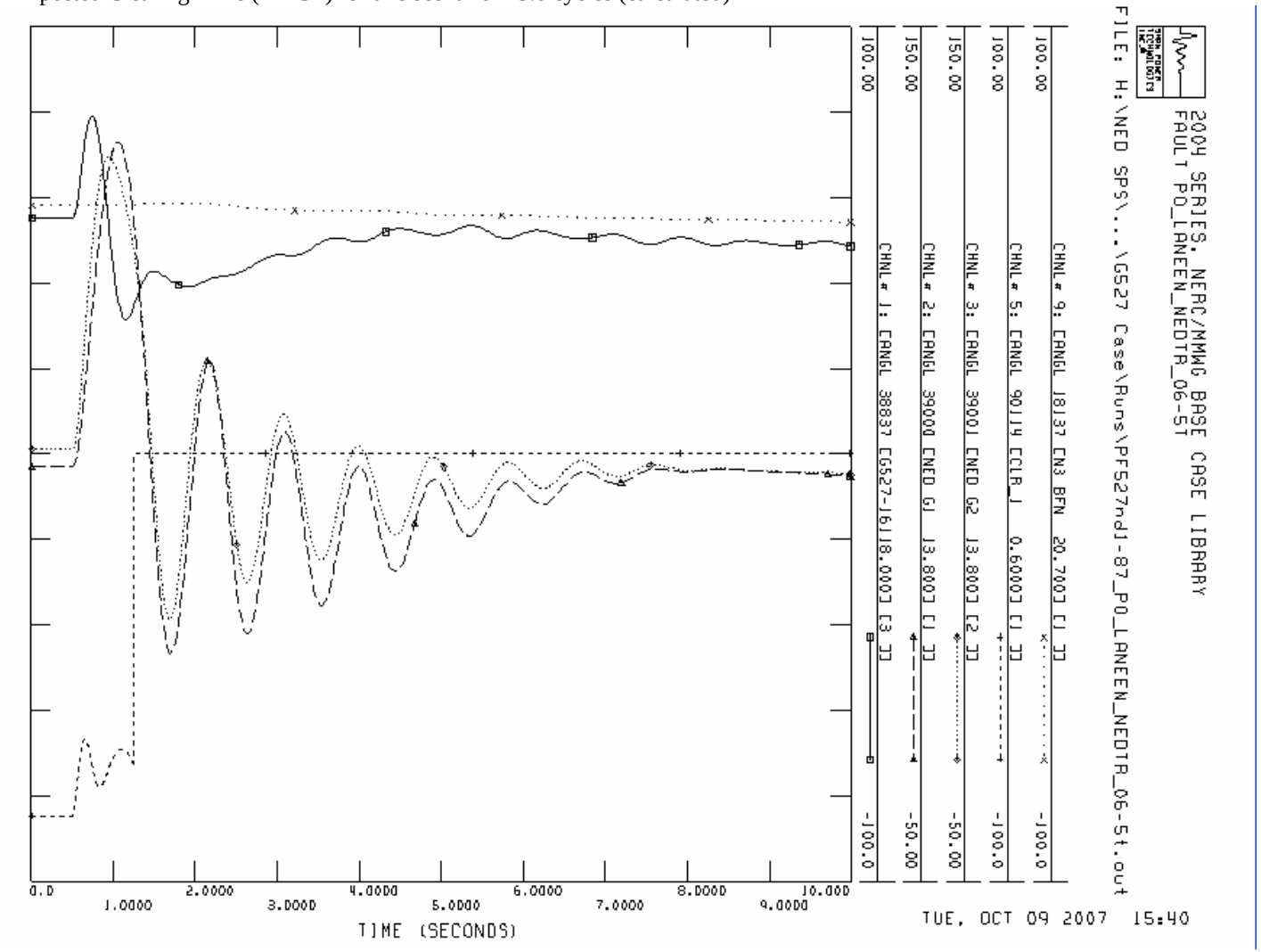
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (Nelson Dewey 1 = 87 MW, Nelson Dewey 2 = 113 MW)
G527 and related upgrades included in power flow cases
Fault Category: NERC Category C.3
Prior outage of Nelson Dewey – Lancaster 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



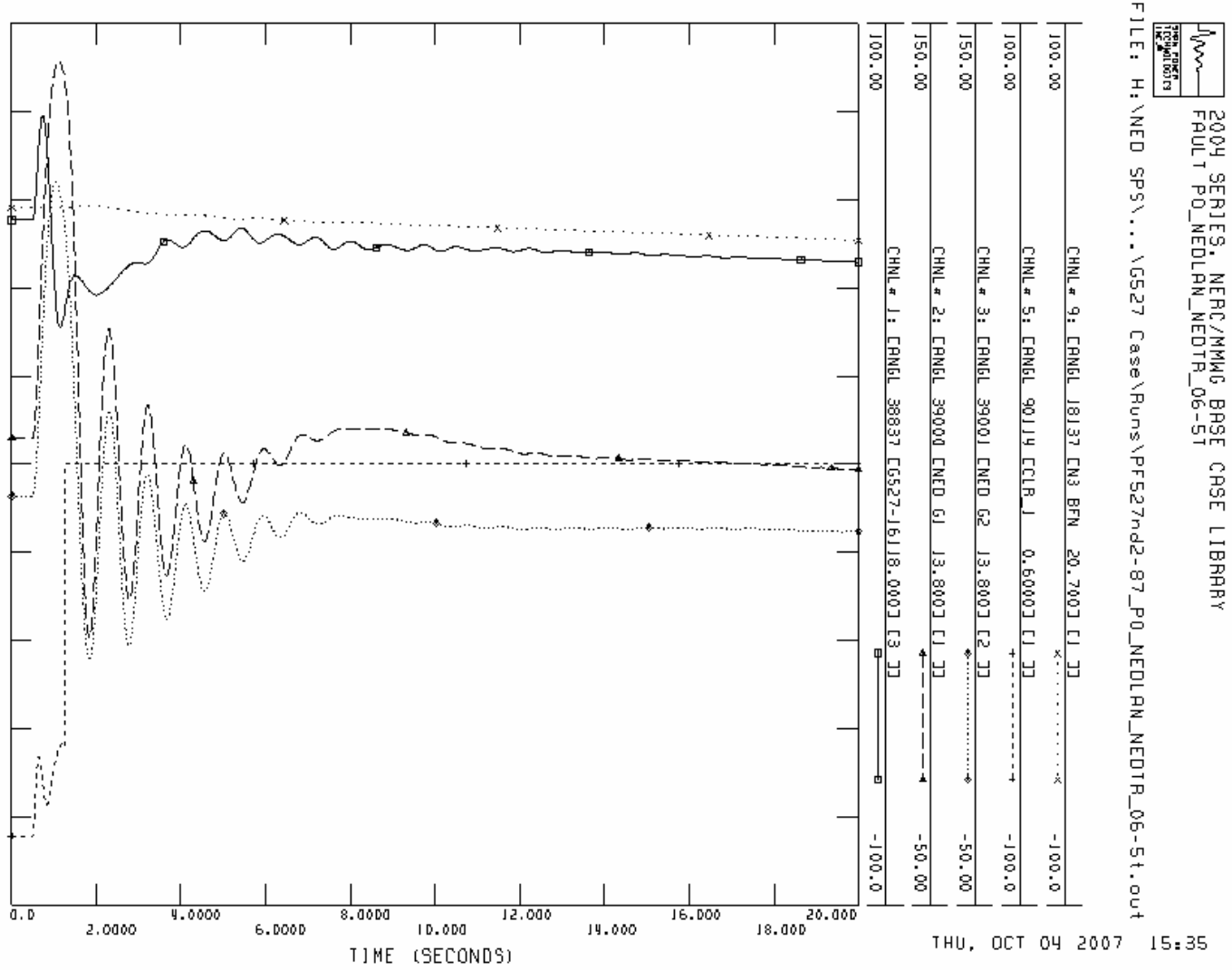
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (Nelson Dewey 1 = 87 MW, Nelson Dewey 2 = 113 MW)
G527 and related upgrades included in power flow cases
Fault Category: NERC Category C.3
Prior outage of Lancaster-Eden 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



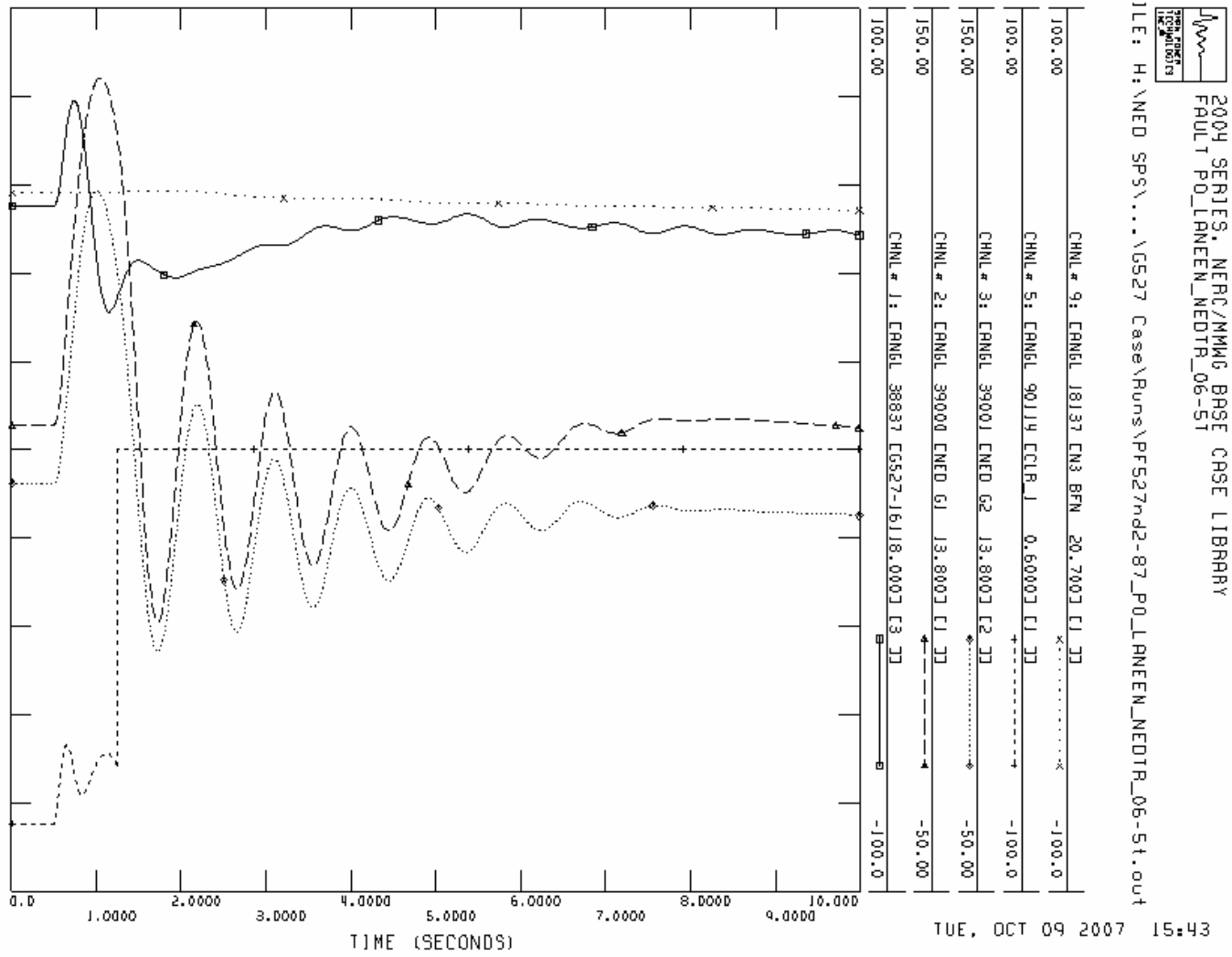
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (Nelson Dewey 1 = 113 MW, Nelson Dewey 2 = 87 MW)
G527 and related upgrades included in power flow cases
Fault Category: NERC Category C.3
Prior outage of Nelson Dewey – Lancaster 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



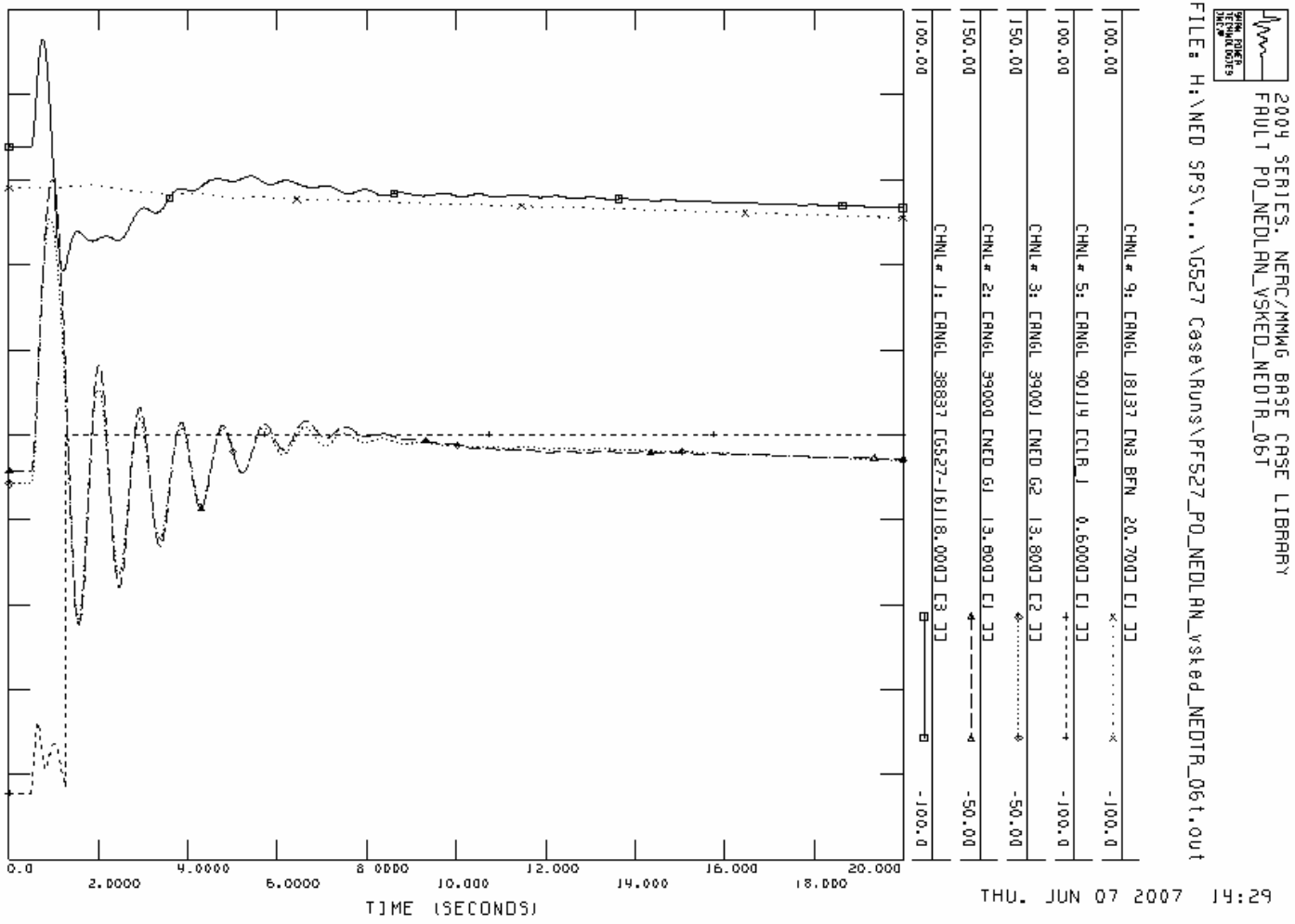
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Reduced MW Output – Nelson Dewey units 1 and 2 set to 200 MW combined (Nelson Dewey 1 = 113 MW, Nelson Dewey 2 = 87 MW)
G527 and related upgrades included in power flow cases
Fault Category: NERC Category C.3
Prior outage of Lancaster – Eden 138-kV line segment
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



* Darlington Wind Farm (Bus 90114) trips off-line for faults of 5-cycles and longer under this scenario.

Alternate Nelson Dewey voltage schedule – Nelson Dewey units 1 and 2 set to control Nelson Dewey 138-kV voltage to 1.0350 p.u.
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
Fault Category: NERC Category C.3
Prior outage of Nelson Dewey – Lancaster 138-kV line
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.0 cycles
Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



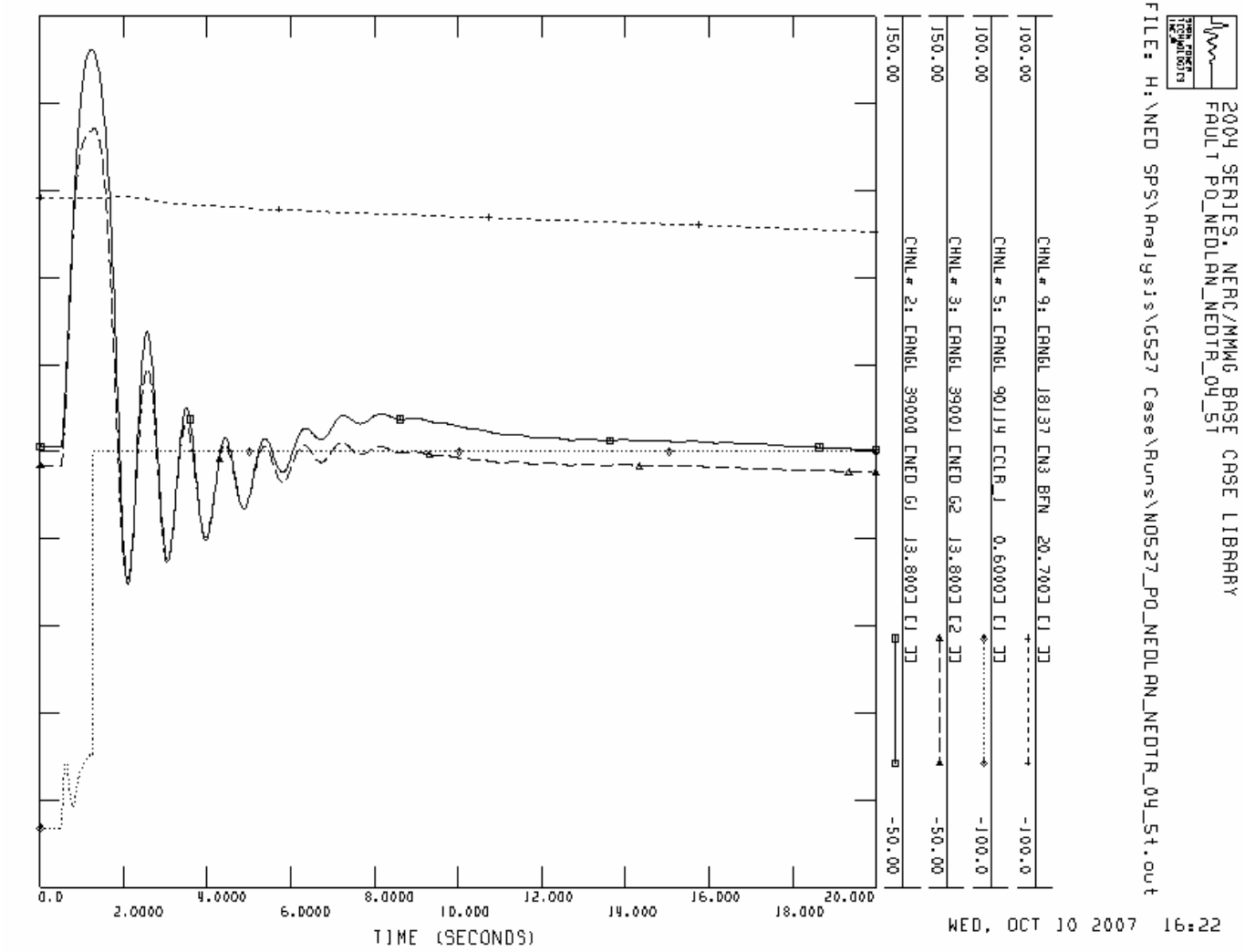
* Darlington Wind Farm (Bus 90114) trips off-line for faults of 6-cycles and longer under this scenario.

Appendix F: Elimination of Operating Restrictions

Stability results following elimination of operating restrictions

Nelson Dewey Upgrades – No G527 – Prior outage of Nelson Dewey – Lancaster 138-kV line segment

Fault Category: NERC Category C.3
G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 4.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 3.5 cycles (calculated)



* Darlington Wind Farm (Bus 90114) trips off-line for faults of 4-cycles and longer under this scenario.

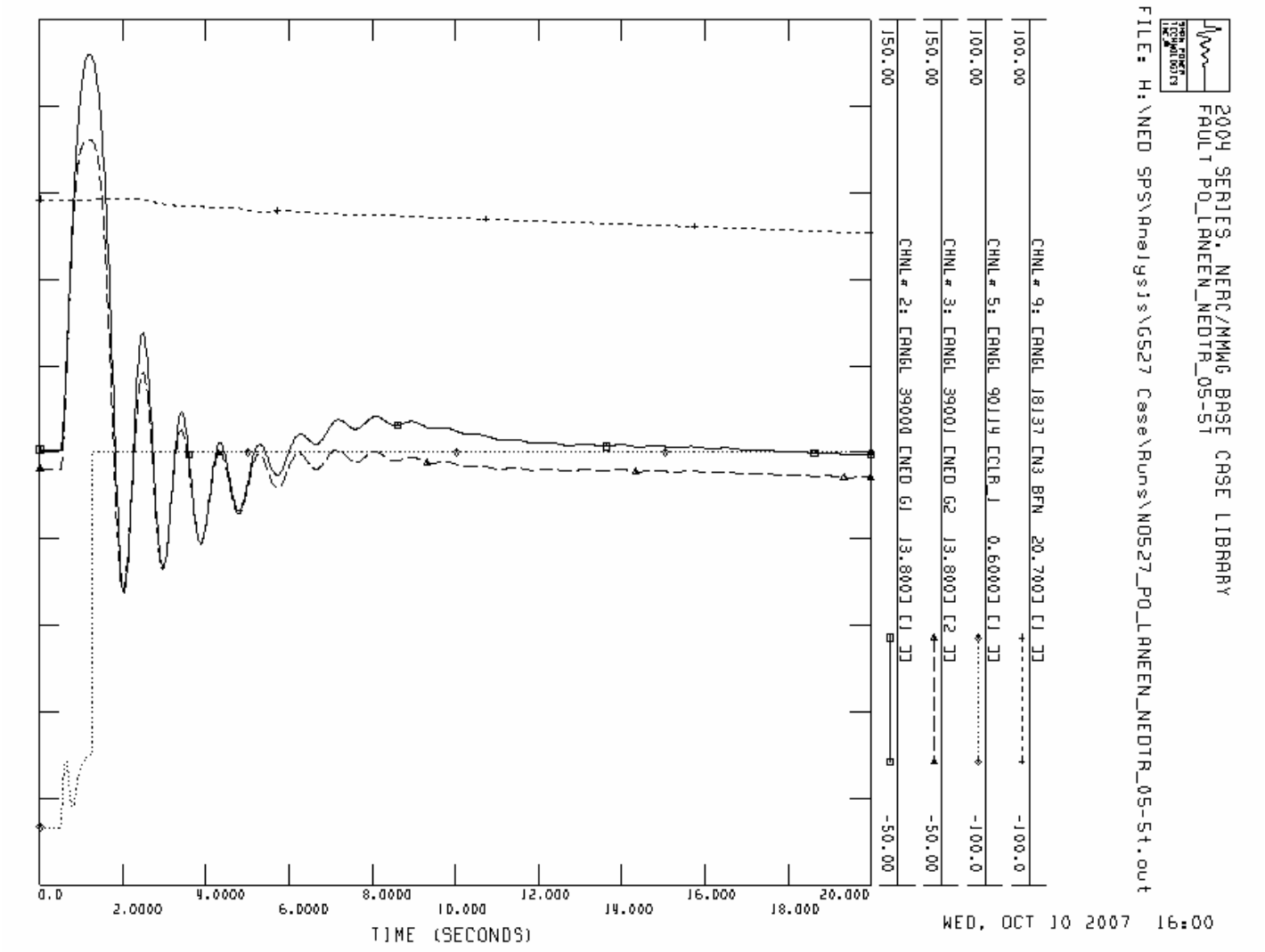
Nelson Dewey Upgrades – No G527 – Prior outage of Lancaster – Eden 138-kV line segment

Fault Category: NERC Category C.3

G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output

3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 5.5 cycles*

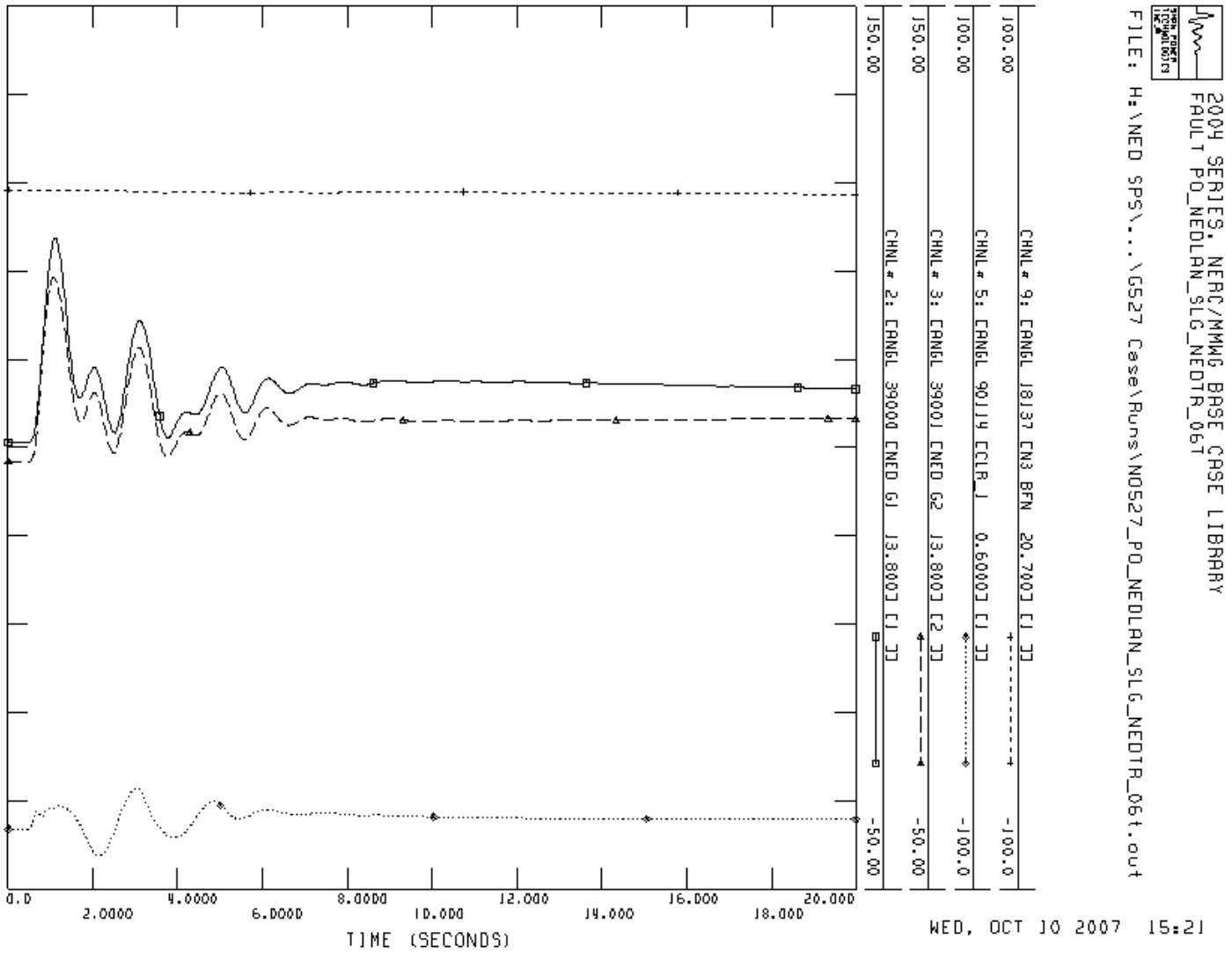
Maximum Expected Clearing Time (MECT) for this scenario = 3.5 cycles (calculated)



* Darlington Wind Farm (Bus 90114) trips off-line for faults of 4-cycles and longer under this scenario.

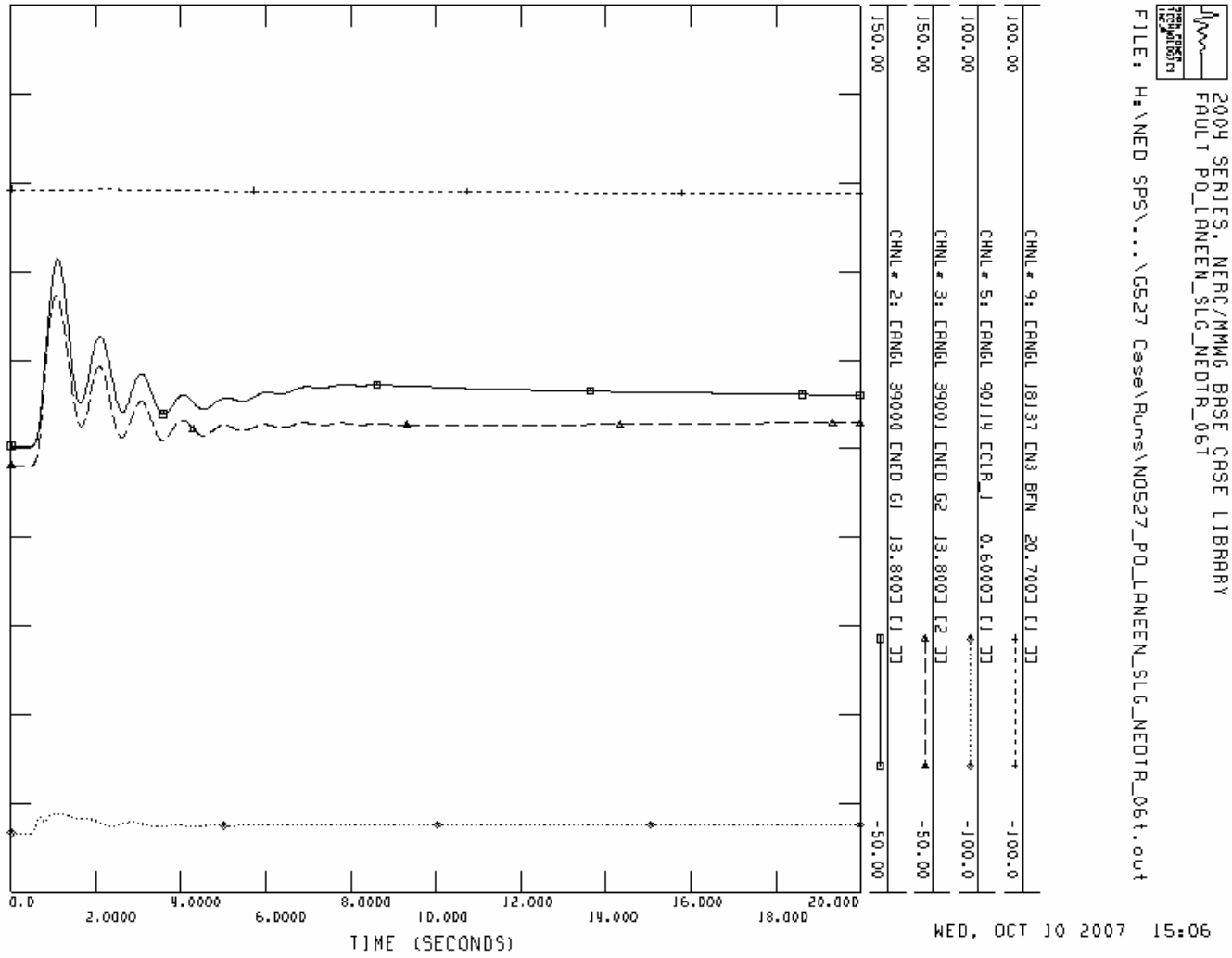
Nelson Dewey upgrades – No G527 – Protection system failure and prior outage

G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
Fault Category: Beyond NERC Category C.7
Prior outage of Nelson Dewey – Lancaster 138-kV line segment
Single-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.0 cycles
High-speed relaying fails to clear transformer - Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



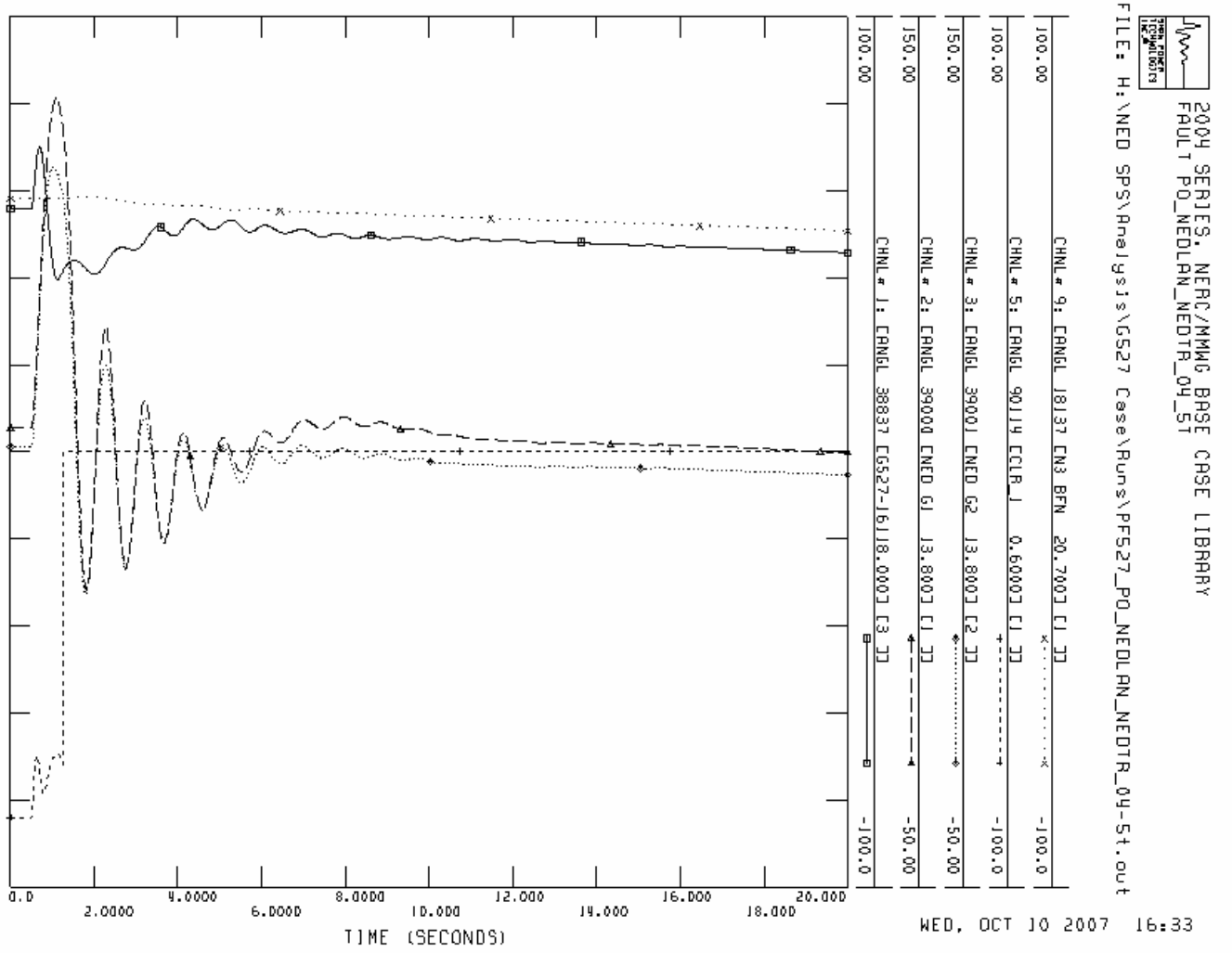
Nelson Dewey upgrades – No G527 – Protection system failure and prior outage

G527 and related upgrades omitted from power flow cases, Nelson Dewey units at full output
Fault Category: Beyond NERC Category C.7
Prior outage of Lancaster – Eden 138-kV line segment
Single-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.0 cycles
High-speed relaying fails to clear transformer - Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



Nelson Dewey Upgrades – G527 Included – Prior outage of Nelson Dewey – Lancaster 138-kV line segment

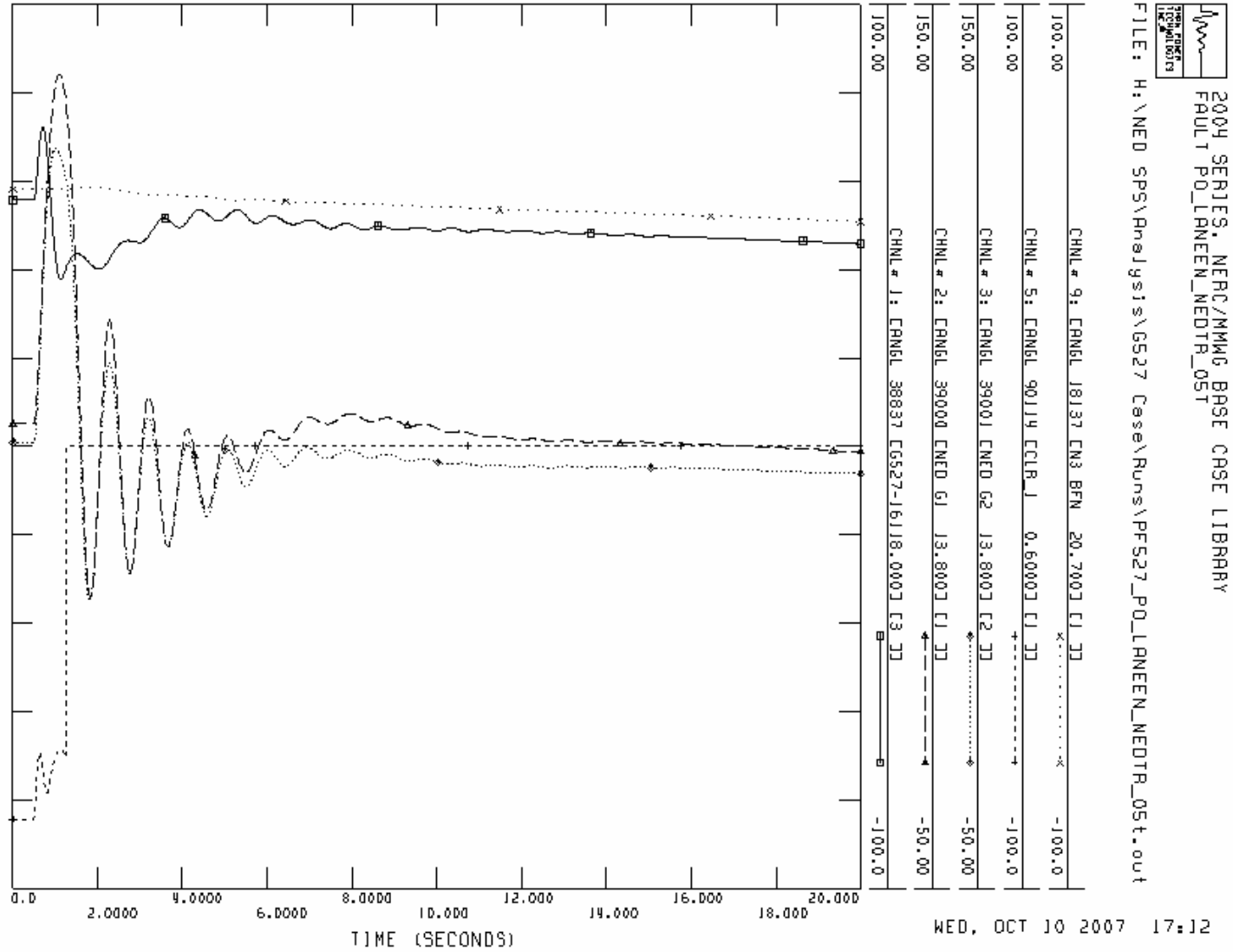
Fault Category: NERC Category C.3
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 4.5 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 3.5 cycles (calculated)



* Darlington Wind Farm (Bus 90114) trips off-line for faults of 4-cycles and longer under this scenario.

Nelson Dewey Upgrades – G527 Included – Prior outage of Lancaster – Eden 138-kV line segment

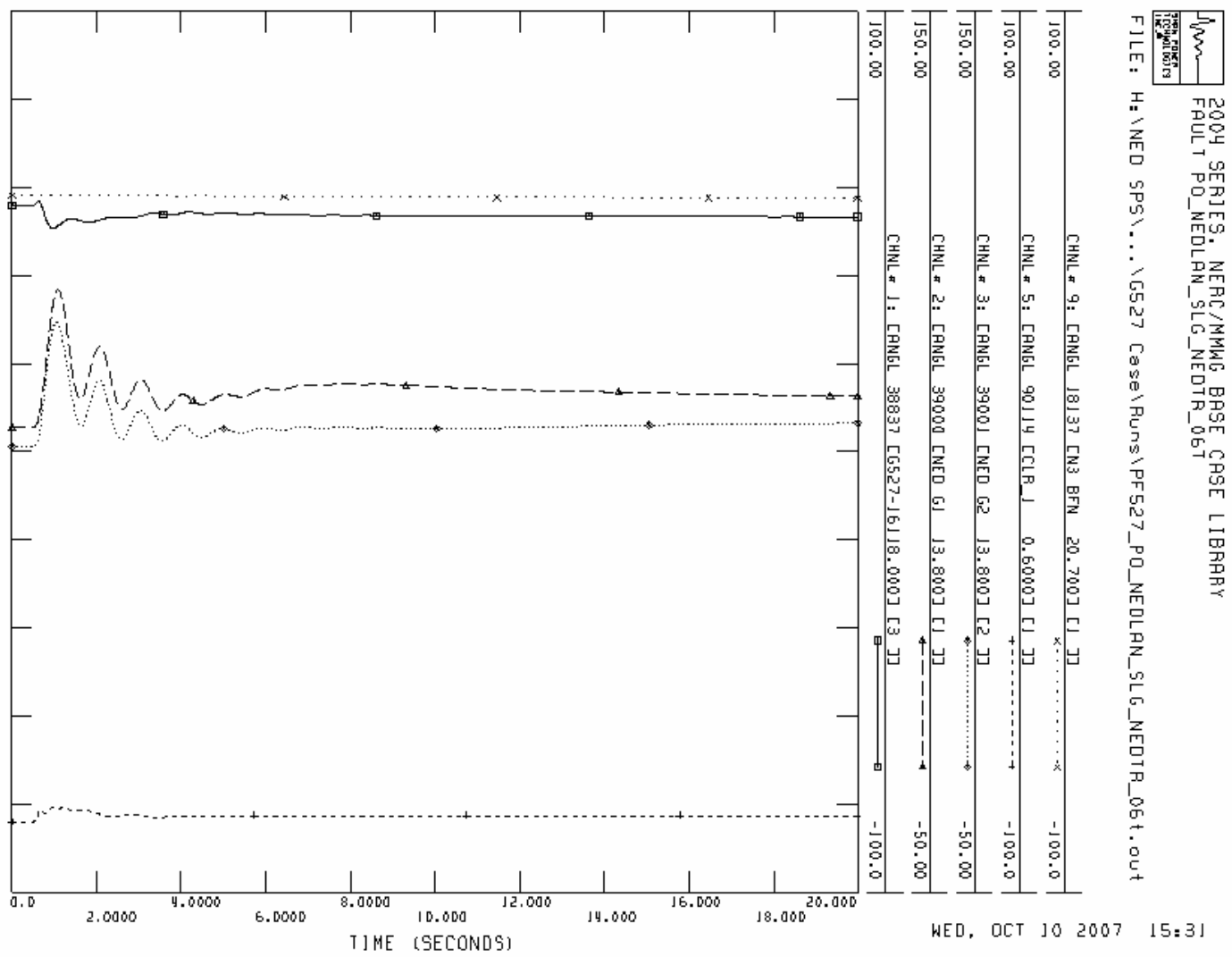
Fault Category: NERC Category C.3
G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
3-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 5.0 cycles*
Maximum Expected Clearing Time (MECT) for this scenario = 3.5 cycles (calculated)



* Darlington Wind Farm (Bus 90114) trips off-line for faults of 4-cycles and longer under this scenario.

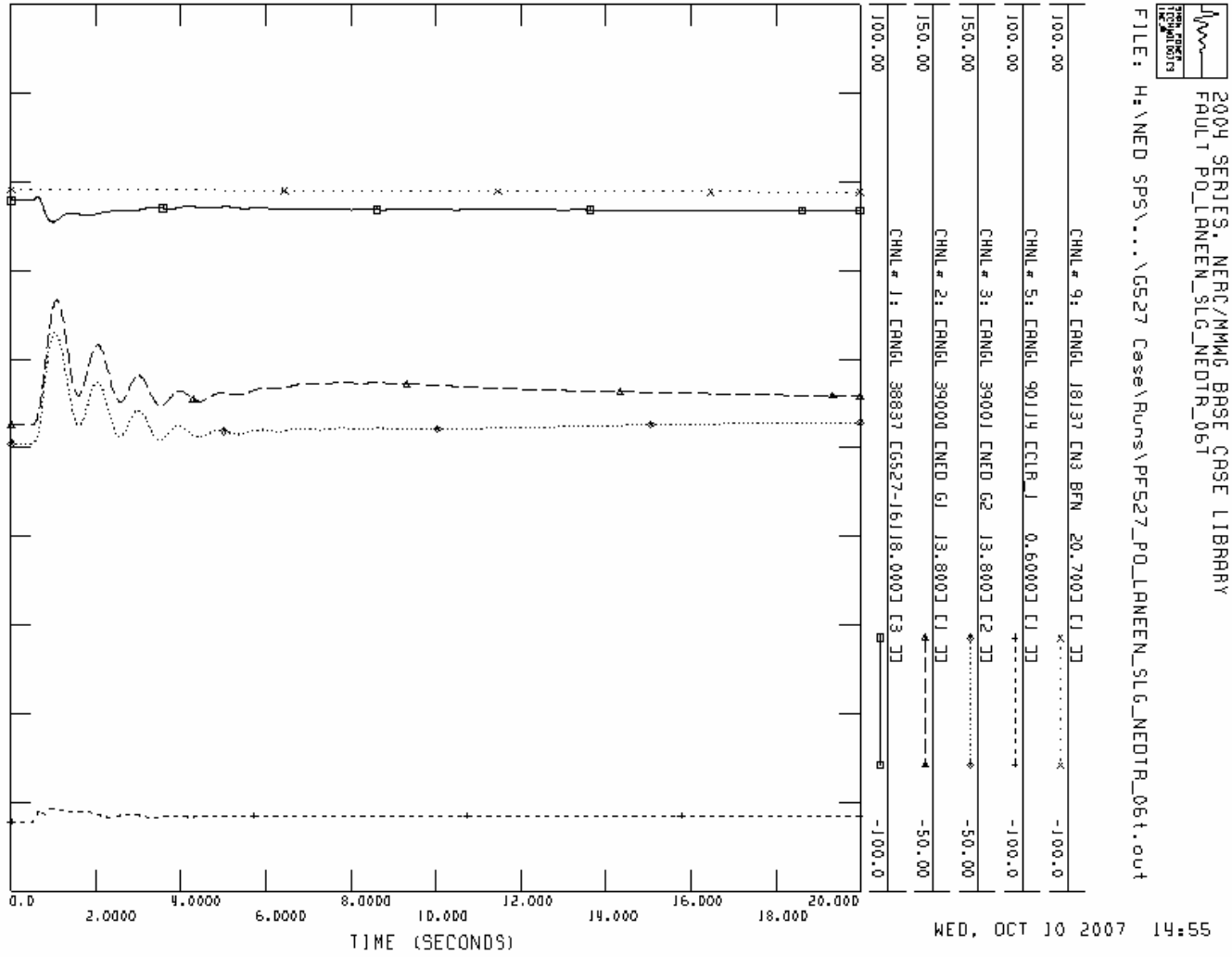
Nelson Dewey upgrades – G527 Included – Protection system failure and prior outage

G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
Fault Category: Beyond NERC Category C.7
Prior outage of Nelson Dewey – Lancaster 138-kV line segment
Single-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.0 cycles
High-speed relaying fails to clear transformer - Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



Nelson Dewey upgrades – G527 Included – Protection system failure and prior outage

G527 and related upgrades included in power flow cases, Nelson Dewey units at full output
Fault Category: Beyond NERC Category C.7
Prior outage of Lancaster – Eden 138-kV line segment
Single-phase fault applied on 138-kV side (between breaker and transformer) of Nelson Dewey 161/138-kV transformer for 6.0 cycles
High-speed relaying fails to clear transformer - Maximum Expected Clearing Time (MECT) for this scenario = 5.0 cycles (calculated)



Agenda 7.c.
Special Protection Systems
Procedural Review for SPS Retirements Review Process

Agenda 8.
Mis-Operations

Agenda 8.a.
Mis-Operations
2007 Yearly Review – Summary of 2007 Mis-Operations

Agenda 8.b.
Mis-Operations
2008 Preview – New Team and Updates Spreadsheet

Agenda 9.
Technical Reference Paper on Recommended Auto-Reclosing

Agenda 10.
Technical Reference Paper on Thermal Overload
vis a vis
Effect on CTs, Relays, Meters TRU Scales

Agenda 11.
Miscellaneous

Agenda 12.
Next Meetings

Agenda 12.a.
Next Meetings
Scheduled

May 22-23, 2008	12:00pm – 5:00pm	8:00am – 12:00pm
August 26, 2008	8:00am – 5:00pm	
November 13-14, 2008	12:00pm – 5:00pm	8:00am – 12:00pm

Agenda 12.b.
Next Meetings
Additional Meetings

Agenda 13.
Adjourn