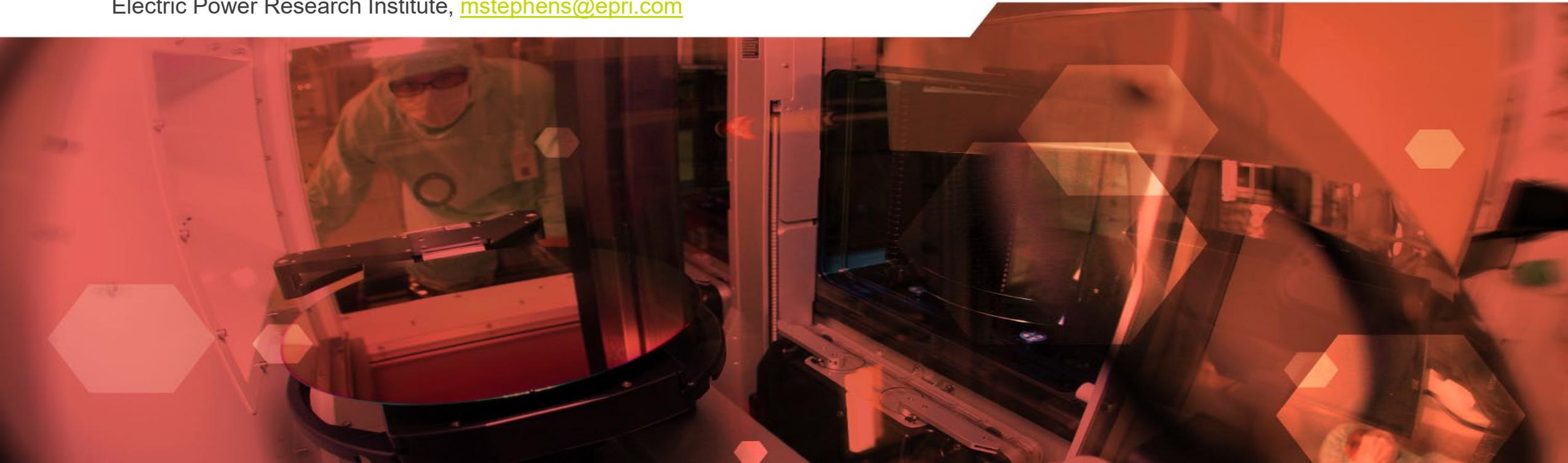


SEMI Voltage Sag Immunity Task Force: Task Force Report

“Addressing Continued Voltage Sag Induced Downtime”
March 29, 2022

Task Force Leader, Mark Stephens, PE

Electric Power Research Institute, mstephens@epri.com



Task Force Objectives

- Determine the characteristics of the power quality events that are still causing semiconductor plant process downtime
- Take a new look at the sensitivities in the process equipment
- To determine any required adjustments to equipment design or standards to further reduce voltage sag induced losses by the semiconductor industry.



Task Force and Research Project Participants and Company Types (01/13/2022)

- **Fabs**
 - GF Fishkill
 - GF Malta
 - GF Burlington
 - Intel
 - NXP
 - Samsung Austin
 - Samsung Korea
 - TI
 - **X-Fab**
- **Tool OEMs**
 - AMAT
 - ASML
 - Cymer LLC (ASML Division)
 - Lam Research
 - Nikon
 - SEMI
 - Tokyo Electron
- **Testing Entities**
 - TUV
 - Powerside
 - EPRI
- **Consultants**
 - *Safety Maven Co*
- **Utilities**
 - APS
 - **Austin Energy**
 - **Central Hudson**
 - CPS Energy
 - EPB
 - Green Mountain Power
 - **National Grid**
 - **Salt River Project**
 - **PNM**
- **Other OEMs**
 - AMSC
 - Powerside
 - Omniverter
 - Rockwell
 - Schneider Electric
 - Mega Fluid Systems
- **Researchers**
 - EPRI

Related EPRI Research Project Funders



TF Meeting 10 Structure Update – Stakeholder Co-Leader's Elected

- Overall Task Force Leader
 - Mark Stephens, EPRI, mstephens@epri.com
- Co-Leader from Utility Stakeholders
 - Clay Burns, National Grid, Clayton.Burns@nationalgrid.com
- Co-Leader from OEM Stakeholders
 - Giel Croonen, AMSL, giel.croonen@asml.com
- Co-Leader from Semiconductor Fab Stakeholders
 - Greg Rieder, Global Foundries, gregory.rieder@globalfoundries.com

Related Ongoing SEMI VS TF Meetings and Activities

- SEMI Approved Voltage Sag Immunity Task Force Effort - November 6, 2018
- Mtg. 1: Task Force Kickoff WebEx - February 22, 2019
- Mtg. 2: Task 1 Working WebEx Meeting 1 - March 15, 2019
- Mtg. 3: Task 1 Working WebEx Meeting 2 - April 18, 2019
- SEMI F47 Voltage Sag Task Force Update, EPRI Grid Analytics and PQ Conference, St. Louis, MO, May 8, 2019
- Mtg. 4: Task 1 Report Out, Task 2 Begin – May 28, 2019
- SEMI F47 Voltage Sag Task Force Update, Guangzhou, China PQ Week 2019, June 18, 2019
- Mtg 5: SEMICON West July 8, 2019
- Mtg 6: Task 2 Progress Update, September 9, 2019
- Task 2 Breakout Meetings with Utilities and Fabs (WebEx 10/1, 11/15, At Fab Site: 12/09/2019)
- Mtg 7: TF Update WebEx Meeting/Reboot , 10/1/2020
- Mtg 8: TF Update Meeting Task 2 and Task 3, 12/1/2020
- Mtg 9: TF Planning Meeting, 1/14/2021
- Voltage Sags for Manufacturing Fabs Workshop, April 21, 2021
- Task 2 and 3 Breakout Meetings with Utilities and Fabs May 3-7, 2021
- Mtg 10: Progress Update, Tuesday, May 18, 2021 - 3:30 PM-5:00 PM (UTC-05:00) Eastern Time
- Mtg 11: Task 2 and 3 Progress Update, August 17,2021 - 3:30 PM-5:00 PM (UTC-05:00) Eastern Time
- Mtg 12: Task 2 and 3 Progress Update, October 7,2021 - 3:30 PM-5:00 PM (UTC-05:00) Eastern Time
- ***Semiconductor Tool Testing – Through Q4 2022***
- ***Mtg 13: Task 2 and Task 3 Progress Update, January 13, 2022 - 3:30 PM-5:00 PM (UTC-05:00) Eastern Time***

SEMI F47 VS Task Force Schedule and Tasks*

ID	Task Name	Duration	Start	Finish	Timeline																							
					2018				2019				2020				2021				2022							
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
1																												
2	SEMI Task Force Approval	1 day	Mon 10/29/18	Mon 10/29/18																								
3	Pre-Work: Task Force Membership Recruitment	2 mons	Tue 10/30/18	Mon 12/24/18																								
4	Begin Work - TF Kick Off Webcast	1 day	Fri 2/22/19	Fri 2/22/19																								
5	Task 1: Review Existing SEMI F47-0706 Requirements with respect to three-phase voltage sags.	1.95 mons	Mon 2/25/19	Thu 4/18/19																								
6	Task 2: Baseline Voltage Sags Causing Downtime at Semiconductor Fabs	21 mons	Fri 5/24/19	Thu 12/31/20																								
7	Task 3: Baseline Type III Sag Immunity of Select Tools	18 mons	Fri 1/1/21	Thu 5/19/22																								
8	Task 4: Determine Viable Mitigation Strategies	2 mons	Fri 5/20/22	Thu 7/14/22																								
9	Task 5: Communicate Findings of Task Force	2 mons	Fri 7/15/22	Thu 9/8/22																								
10	Task 6: Provide Recommendations to update SEMI F47 standard accordingly to reflect findings of the Task Force.	2 mons	Fri 9/9/22	Thu 11/3/22																								
11	Task 7: EPRI Research Project Final Report	2 mons	Fri 11/4/22	Thu 12/29/22																								

*Latest Revision 10/7/2021

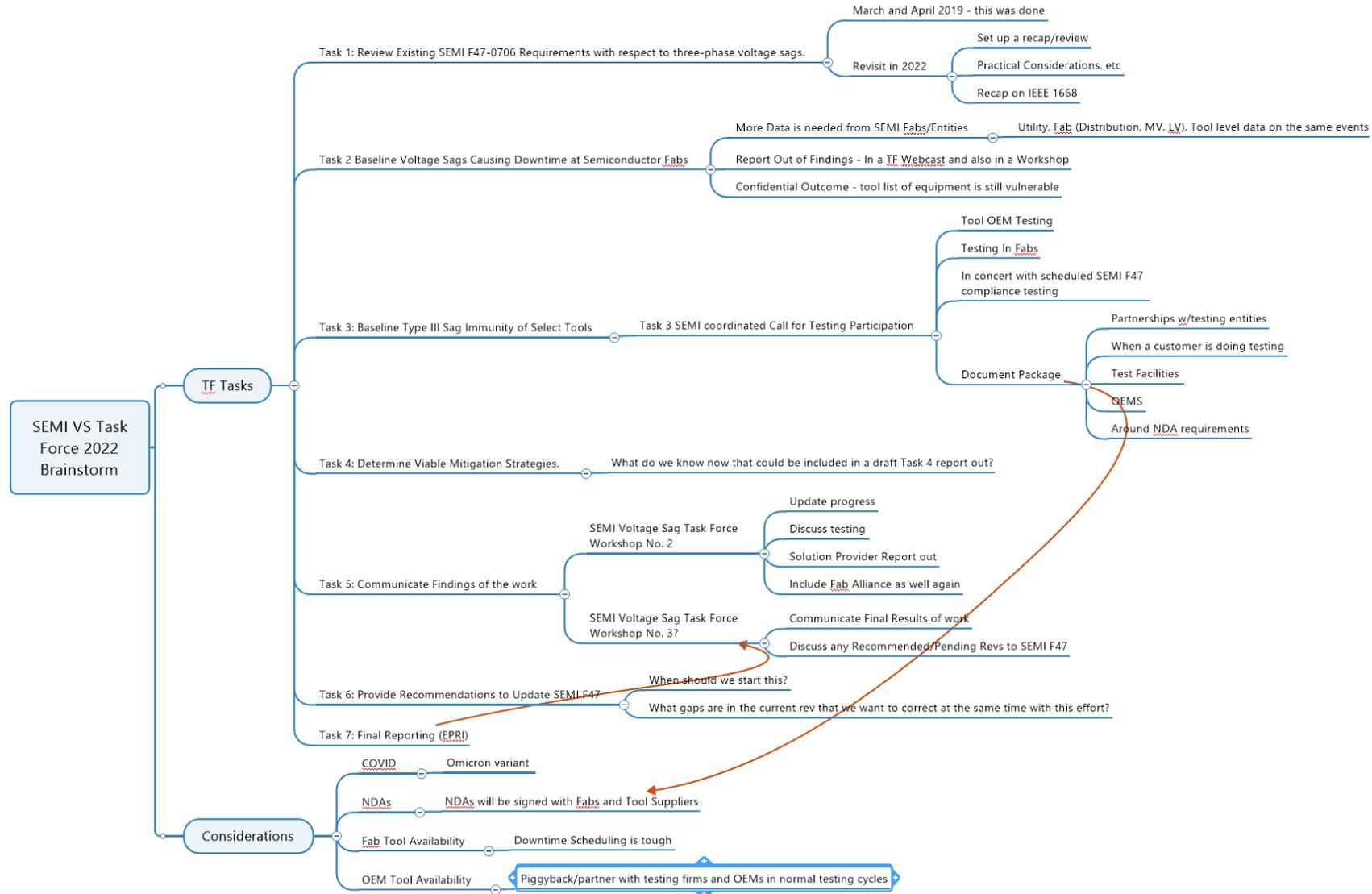
Technical Project Steps (Task 2 and Task 3) (Some portions will be confidential to Fabs and Tool OEMS)

1. Continue to gather PQ and Tool Downtime Data from Fabs
2. Refine information to confidentially understand which specific equipment is still an issue
3. NDAs with Fabs/OEMS are required
4. Visits to FABs/Tool OEMS to conduct on-site review and testing of tool sets
5. General Progress Reports to Task Force

Beginning to work with Tool Suppliers...

- TF has gathered some common Tool Makes and Models that are known to be presenting voltage sag issues still.
- TF is Working with Fabs leading to approach OEMs and encourage participation.
 - Still Actively Seeking input from Fabs on list of tools to include.
- Task Force has discussed a SEMI led “Call for Participation” in the Task 3 Voltage Sag Testing in this effort.
- Task Force is currently coordinating with Tool Suppliers and starting the process
 - Lining up 2022 tests to be done at OEM Locations

2022 Plans & Brainstorming



Near Team Proposed TF Meeting Plan

- Mtg 14: Task 2 and 3 Progress Update, May 5, 2022: 3:30 PM-5:00 PM (UTC-05:00) Eastern Time
- Semiconductor Tool Testing – Ongoing
- To be a part of this effort or learn more, contact:
 - Mark Stephens, mstephens@epri.com
 - Laura Nguyen, lnguyen@semi.org