



Markets Outage Modeling and Credit Risk Review

Joe Ciabattoni, et. al.
OC Special Session on Outage
Coordination
October 7, 2022

- FTR Outage Modeling
- Day-Ahead Outage Modeling
- Coordinated Outage Analysis
- Risk Analytics and Credit

FTR Outage Modeling

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OC Special Session Outage Coordination

October 7, 2022

One of the inputs to the Simultaneous Feasibility Test (SFT) is transmission outages

- Transmission line outage schedules, thermal operating limits for transmission lines, that are expected to last for 2 months or more will be included in the determination of simultaneous feasibility for the Annual FTR Auction and outages of five days or more shall be included in the determination of simultaneous feasibility for Monthly FTR Auctions as well as outages of shorter duration that are determined through PJM analysis to be likely to cause FTR revenue inadequacy if not modeled
- <https://www.pjm.com/-/media/documents/manuals/m06.ashx>

SFT Inputs

- Network model
- Outages
- Limits
- Loop flow
- Contingencies
- Bids
- Approved rights

Simultaneous Feasibility determinations shall take into account outages based on reasonable assumptions about the configuration and availability of transmission capability during the periods covered by FTR auction markets

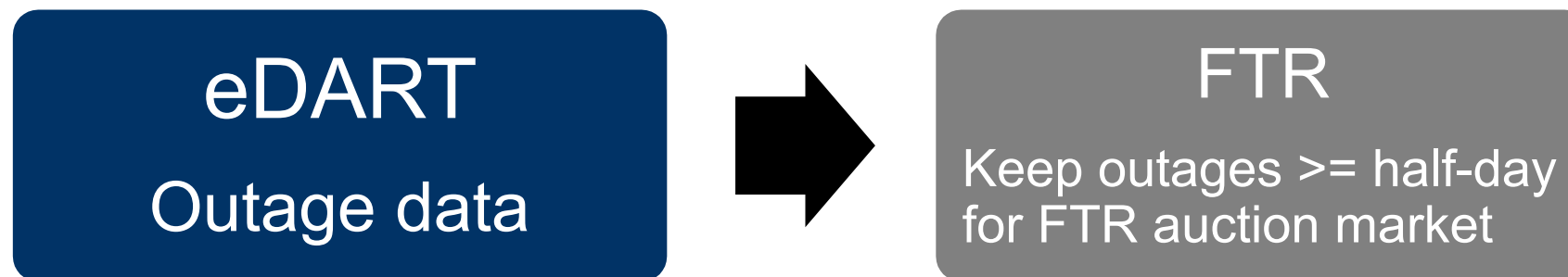
- The goal of the simultaneous feasibility determination shall be to ensure that there are sufficient revenues from Transmission Congestion Charges to satisfy all FTR obligations for the auction period under expected conditions and to ensure that there are sufficient revenues from the Annual FTR Auction to satisfy all Auction Revenue Rights (ARR) obligations
- <https://agreements.pjm.com/oatt/4512>

Outage modeling in FTR is binary

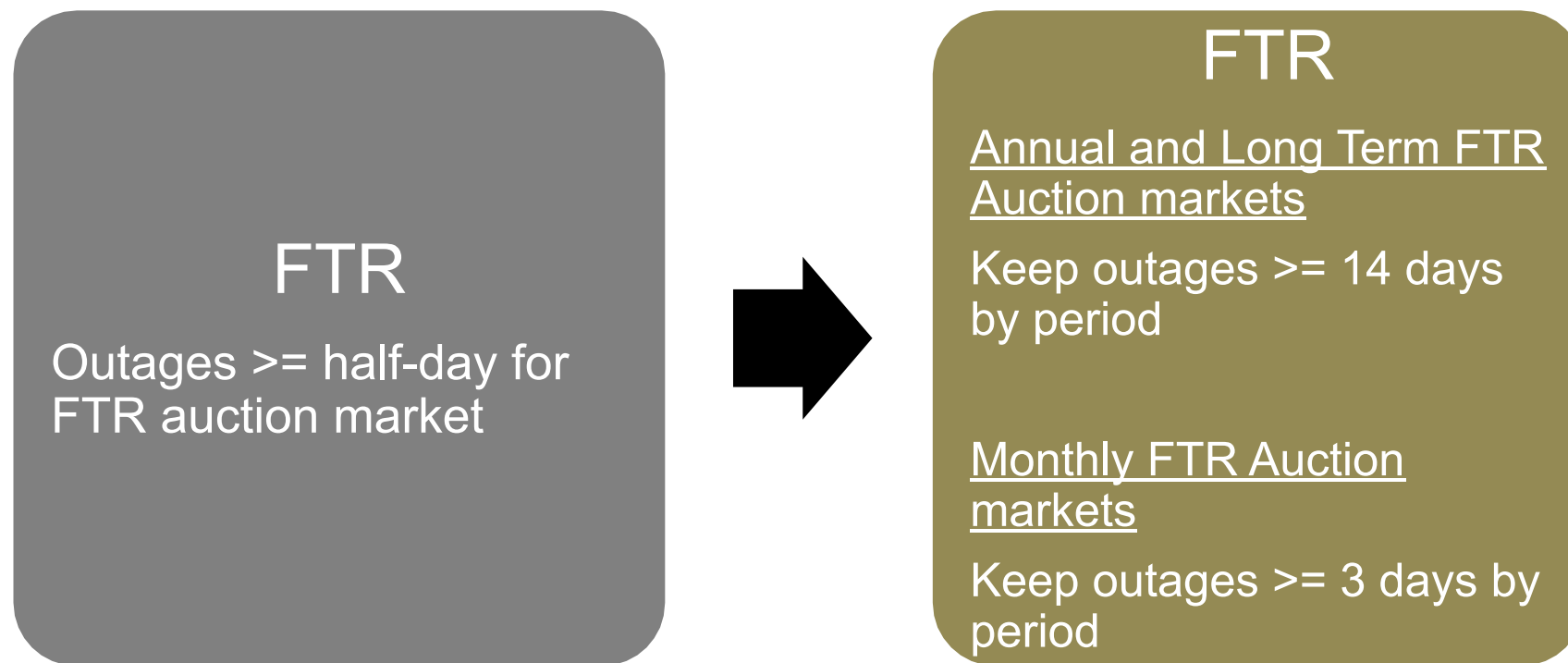
- Transmission lines and transformers are either modeled as in service or out of service for each period of an FTR auction market
 - Circuit breaker and disconnect configuration changes associated with modeled outage tickets are modeled for each applicable period of an FTR auction market
- The FTR software is not capable of modeling outages at a more granular level than the period of an FTR auction market

During the FTR auction market setup, outages of a duration of one-half day or greater are pulled from eDART for every day between the start day and end day of each period within the FTR auction market

- The outage start time must be equal to or earlier than noon to be pulled, while the outage end time must be later than noon to be pulled



- Outages are aggregated together by period
- Outages that do not meet the minimum lengths by FTR auction market type are dropped



- Outages are grouped into electrically connected clusters by period
- Clusters allow examining outages in a similar area

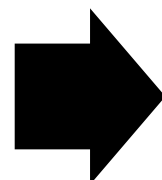
FTR

Annual and Long Term FTR Auction markets

Outages \geq 14 days by period

Monthly FTR Auction markets

Outages \geq 3 days by period



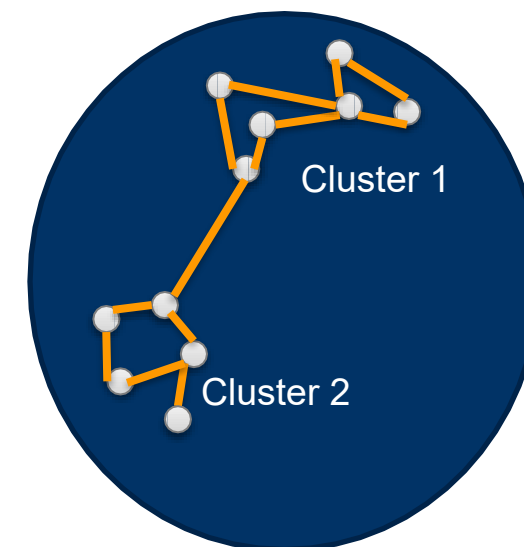
FTR

Annual and Long Term FTR Auction markets

Outages \geq 14 days by period are grouped into clusters

Monthly FTR Auction markets

Outages \geq 3 days by period are grouped into clusters



Example of Clusters

For each period and cluster, an outage selection algorithm is run for every day between the start day and end days of the outages to determine the day with the most impactful set of outages

Primary considerations

Historical revenue inadequacy
(Annual and Long Term \geq 14 days, Monthly \geq 3 days)



Congestion expected
(Annual and Long Term \geq 14 days, Monthly \geq 3 days)



500 and 765 kV EHV outages
(Annual and Long Term \geq 14 days, Monthly \geq 3 days)



Length of outages
(Annual and Long Term \geq 60 days, Monthly \geq 5 days)



Associated outages on the same outage tickets

Additional considerations

Total number of outages



Total length of outages



Outages previously modeled in same period

(Not applicable for Annual, Long Term RD 1 or June Monthly FTR Auction markets)



Tie-breaking logic

Final steps

Select outages based on the most impactful day from algorithm



Review outages with Operations and adjust selected outages as needed



Re-service outages as needed to fix dead buses



Post outage lists to pjm.com



Continue FTR auction market setup

- FTR outage postings for Annual, Long Term and Monthly FTR Auction markets are available at <https://www.pjm.com/markets-and-operations/fttr.aspx>
 - For Long Term and Monthly FTR Auction markets, there are preliminary outage lists posted prior to the bidding window and final outage lists posted during FTR auction approval
 - Annual FTR Auction market posted outage lists are considered final
- The Annual FTR Auction and corresponding Annual ARR Allocation market for the same planning period use the same outage modeling

Key Point: All FTR Final modeled Transmission Outages are posted on PJM.com

Day-Ahead Outage Modeling

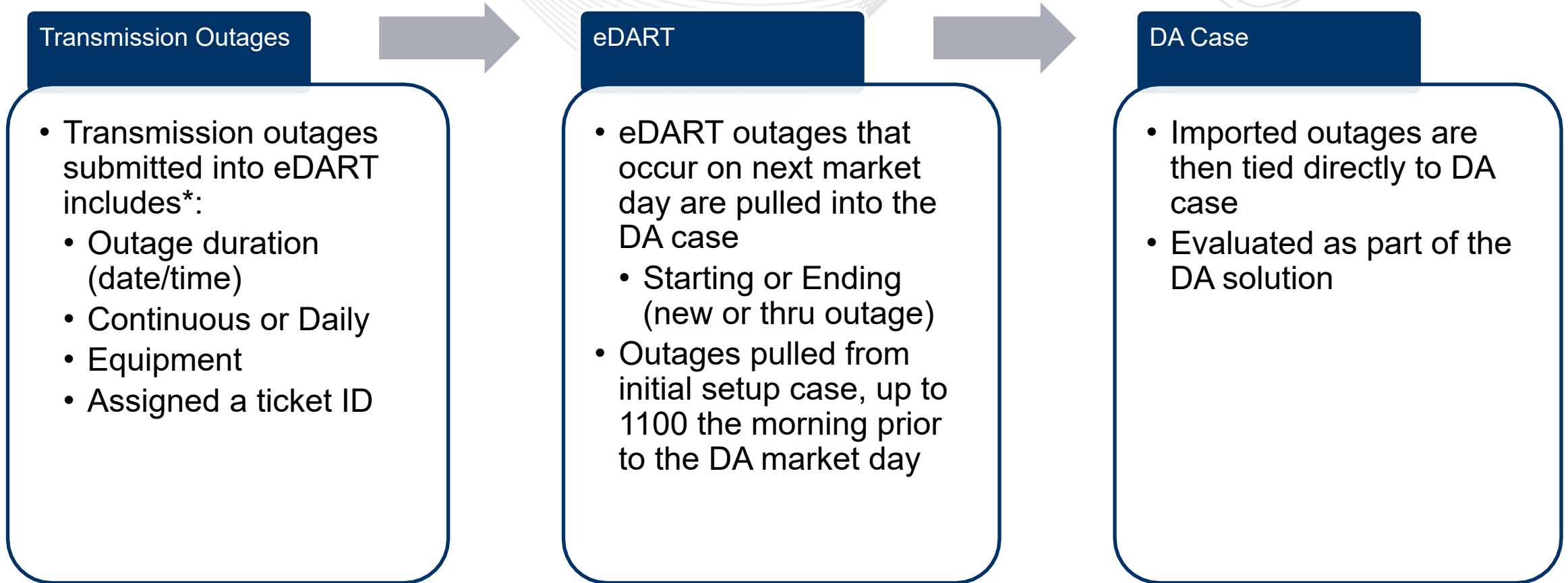
Stefan Starkov

Sr. Engineer I, Day-Ahead Market Operations

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Pulling Outages into Day-Ahead Case



*See presentation titled “Operations Planning Transmission Outage Analysis” at the below link for details of the review process to approve eDART outage tickets.

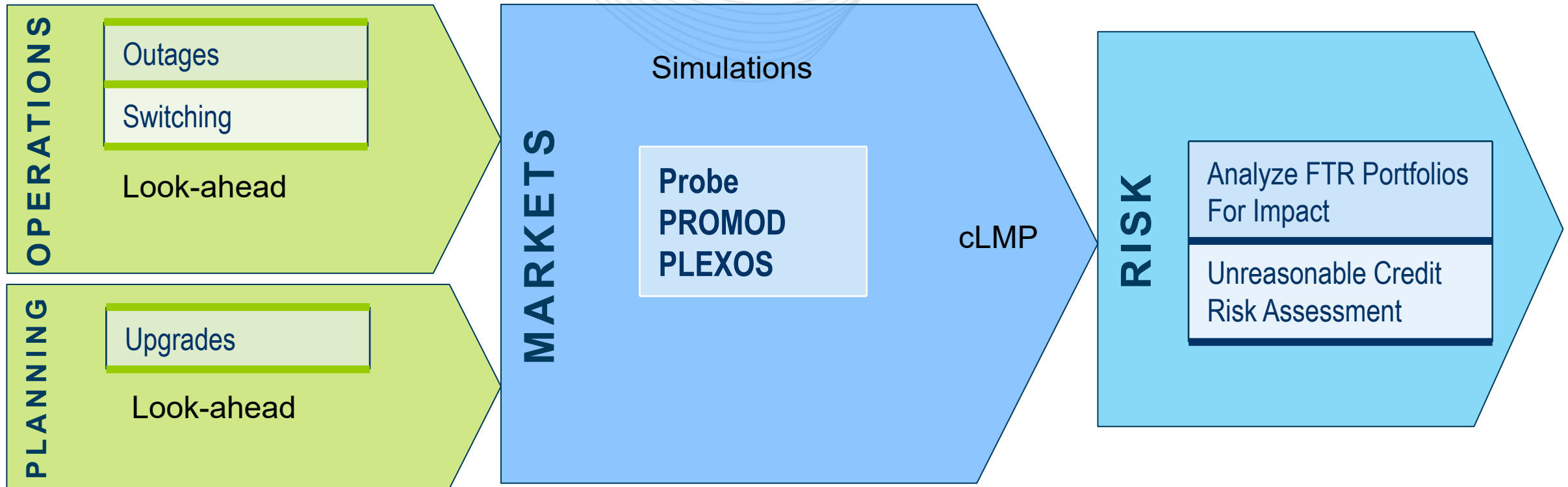
<https://www.pjm.com/-/media/committees-groups/committees/oc/2022/20220811-special/item-03---education---operations-planning-transmission-outage-analysis---20220811.ashx>

- Transmission Operations & Reliability Engineers evaluate and update outage tickets in Operational Planning Analysis Log (OPAL)
- Transmission outage tickets impacting the next DA market day study will display:
 - ticket ID, outage duration, company, equipment, outage notes, and RE comments
 - New outages sorted first, followed by Thru outages
- Comments reveal vital information used by DA Market Ops
 - Monitored contingencies, resource limitations, thermal/voltage issues, PAR controls, etc.

Coordinated Outage Analysis

Eric Hsia
Sr. Manager, Market Simulation
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Coordinated Outage Analysis



Key Point: Operations, Markets, and Risk groups routinely coordinate to determine potential risk impacts associated with outages and upgrades on FTR portfolios



Risk Analytics and Credit

Gwen Kelly
Sr. Director, Credit Risk & Collateral
Management
PJM Interconnection

Standard Operations

- Application of Attachment Q Credit standards (Eligibility, Capitalization, Financial evaluation)
- Credit scoring process
- Reservation of restricted collateral
- Participant conversations
- Behavioral indicators: Membership (ad-hoc conversation intelligence) & treasury (payments) discussions

Enhanced Analysis

- Situational awareness: Weather, Macroeconomic, Commodity pricing, Outages, constraints, other
- Communication with internal experts (first) generation, FTR, weather, capacity, planning, fuel pricing groups
- Trade analytics (second) estimate short term (cash & prompt LMP prices, stress FTR portfolios and identify potentially affected participants
- Future enhancement: forward LMP price simulation (PROMOD) for long term stress analysis

Active Management

- Participant investigations
- Narrowing by exposure vs liquidity
- Potential financial re-review with most recent statements
- Estimation (with trade risk) of potential collateral shortfall
- Participant conversations
- Legal discussion
- Unreasonable Credit Risk action (if necessary)

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Market Outage Modeling and Credit Risk



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