LESSONS LEARNED FROM AEGIS MEMBER CASE STUDIES

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CLAIM EXAMPLE

2000 MW Combined Cycle Plant

CLAIM EXAMPLE

2000 MW Combined Cycle Plant

- Steam turbine generator (STG) – mechanical breakdown
- 188 MW Siemens Westinghouse HE series (high pressure with combined intermediate pressure / low pressure), axial single flow, condensing steam turbine
- Last stage blade (LSB) failure – Unit experienced LSB liberation which caused significant damage to the HP turbine, IP/LP turbine, generator bearings and foundation

CLAIM EXAMPLE

2000 MW Combined Cycle Plant

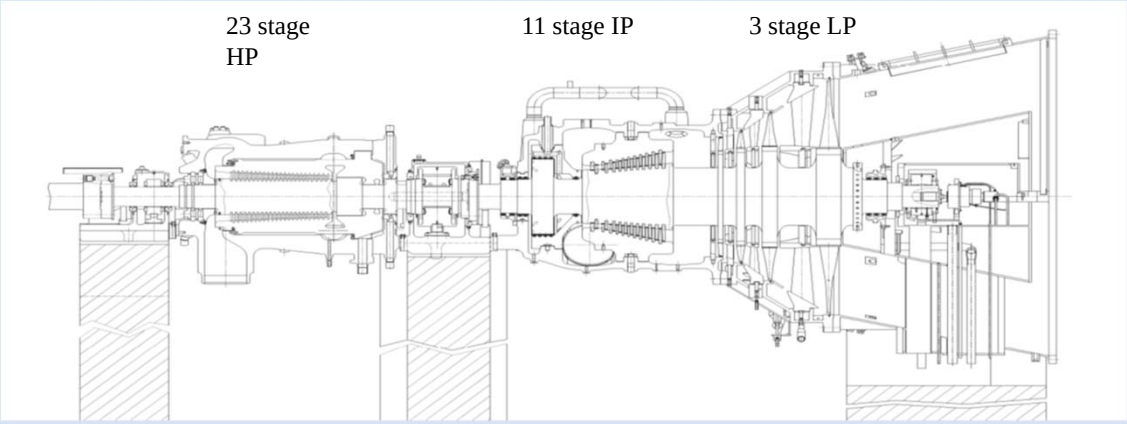
Coupling between HP and IP/LP turbine loosened, creating vibrations damaging and eventually liberating 42” LSB with ensuing fire

CLAIM EXAMPLE

2000 MW Combined Cycle Plant

CLAIM EXAMPLE

2000 MW Combined Cycle Plant



The HP turbine forging was replaced and the IP/LP turbine was rebladed. The new HP shaft was 5” too short and had an extension welded to the coupling
end. The bearing support pedestals were re-poured and new foundation studs installed as part of the foundation repair.

CLAIM EXAMPLE – EVENT DETAILS

2000 MW Combined Cycle Plant

July, 2014

STG mechanical failure event resulted in all coupling bolts failing in ductile tension overload (not fatigue), raised the stress levels on L-0 section that caused multiple blade failures, all instrument pickup mounts failed, damaged control valve, stop valve, and damaged multiple stationary devices. RCA identified most likely cause was that failed coupling bolts initiated the event, which allowed the L-0 dormant crack(s) to propagate.

Collateral damage – cold slug of hot reheat steam or condensate caused a water hammer event due to failed non-return valve on cold reheat line. As a result, water made it into the HP turbine where it flashed and stretched the HP bonnet bolts and caused them to fail in tensile overload.

Water hammer event also caused turbine movement and cracked bearing #2 housing, which allowed about ~1,300 gallons of turbine lube oil (~20% capacity) to be released and then catch fire.

CLAIM EXAMPLE – UNIT HISTORY

2000 MW Combined Cycle Plant

2003	Siemens 42-inch titanium last stage blades have known issues with tip and mid-span snubber losses. Operating exclusion zones were established with time limitations
2007	LSBs were replaced with new design (revision 2) as a fleet validation unit. After OEM testing, no restrictions on time in exclusion zone were required. Stress levels in exclusion zone were deemed acceptable
2011 /	Major (50khrs) outage; HP-IP / LP coupling re-assembled without data sheet or proper preload set screw setting
2012	Plant has always had back pressure challenges during summer months due to shallow cooling reservoir in hot environment. After ~ five years, LSBs started to show erosion at trailing edge near platform

CLAIM EXAMPLE – UNIT HISTORY

2000 MW Combined Cycle Plant

2013	Bearing #3 was raised to add more load to stabilize bearing from high vibrations with little success
2014	**March-April –** added a balance weight that changed slope of vibration increase ~5x
2014	**May 24 –** Loss of auxiliary power caused loss of cooling water and condenser back pressure increase during steam turbine trip, allowing STG speed >3600 rpm and vacuum >8 in HgA for approximately 450 seconds. This was the most likely cause for an existing erosion pit to grow from ~ 0.025" to 0.126" on the LSB blade and arrest. The crack remained dormant with exclusion zone running stresses
2014	**June –** OEM issued the first release of a detailed coupling assembly procedure as a result of other fleet coupling failures
2014	**July –** Last stage blade liberated

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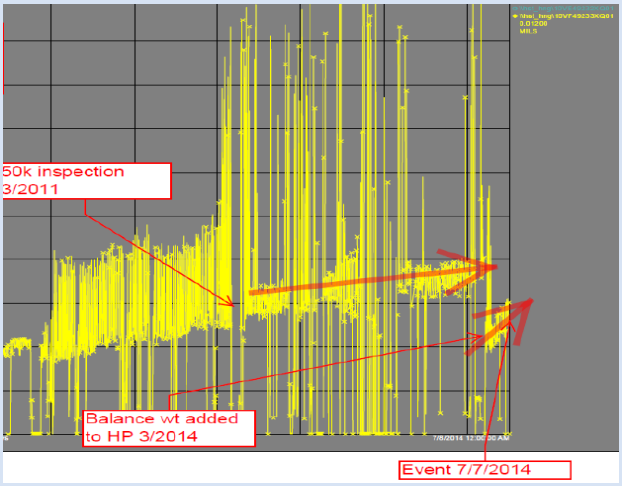
CLAIM EXAMPLE – VIBRATION HISTORY

2000 MW Combined Cycle Plant



CLAIM EXAMPLE – AFTER ACTIONS

2000 MW Combined Cycle Plant

- Review of vibration data showed a significant phase angle shift after the 2011 major inspection, indicative of coupling loosening
- Turbine hood sprays were moved further from turbine to reduce droplet erosion
- The sister unit on adjacent power block was found with loose coupling bolts on HP-IP/LP coupling
  - OEM increased the coupling bolt preload spec by as much as 40%

CLAIM EXAMPLE – REPAIRED IP / LP ROTOR

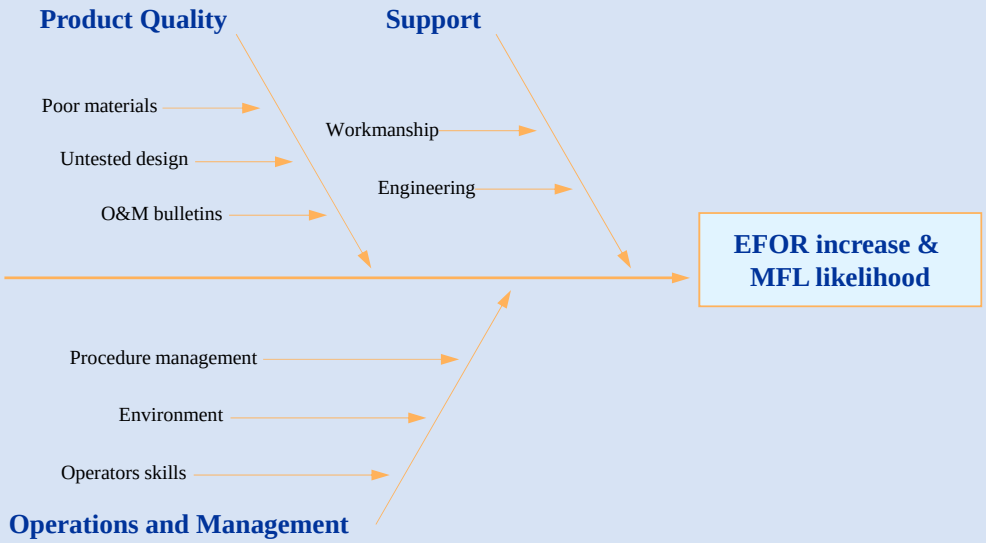
2000 MW Combined Cycle Plant

CLAIM EXAMPLE – LESSONS LEARNED

2000 MW Combined Cycle Plant

1. As a consequence of a coupling bolt loosening, L-0 blades will experience high vibratory loading, leading to fatigue failure. Do not ignore significant vibration amplitude or phase angle shifts.
2. Monitor and reduce LSB pitting corrosion. Verify hood spray operating set points and position. Many stations are now relocating hood sprays further downstream toward the condenser.
3. Verify oil pool runoff (drainage) away from unit lower level, other power blocks and control room buildings.
4. Inspect 42” last stage blades after back-pressure excursions.
5. Include steam non-return valve dismantled inspections with STG major overhauls.

STEAM TURBINE FAILURE CAUSAL FACTORS



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John Kinneary

Executive General Adjuster – Claims

AEGIS Insurance Services, Inc.

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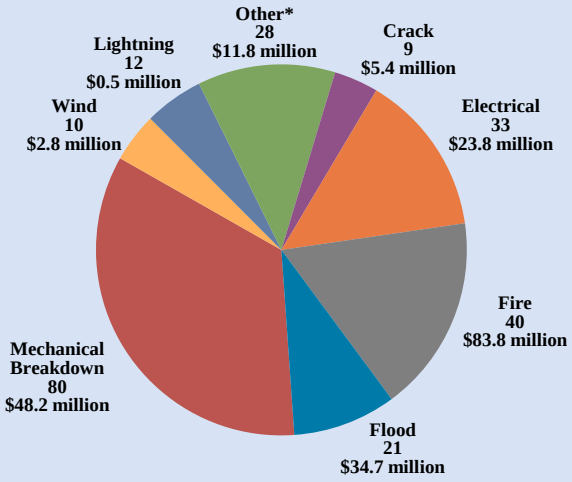
PROPERTY CLAIMS DEPARTMENT

- AEGIS Property Claims personnel
  - Vice President Property Claims – Andrew Granzow
  - Executive General Adjuster – John Kinneary
  - National General Adjuster – Josh Roznowski
- Handle all-risk first party property claims under operational and builders risk policies
- Pending claims: 233
- Current total incurred: $211 million

OUTSTANDING CLAIMS AS OF JUNE, 2018

By Cause of Loss, Number of Claims / Outstanding Reserves



* Includes Hail, Collapse, Collison, Earthquake, Explosion, Theft, Water, Volcanic Action

NATURAL CATASTROPHES – 2017

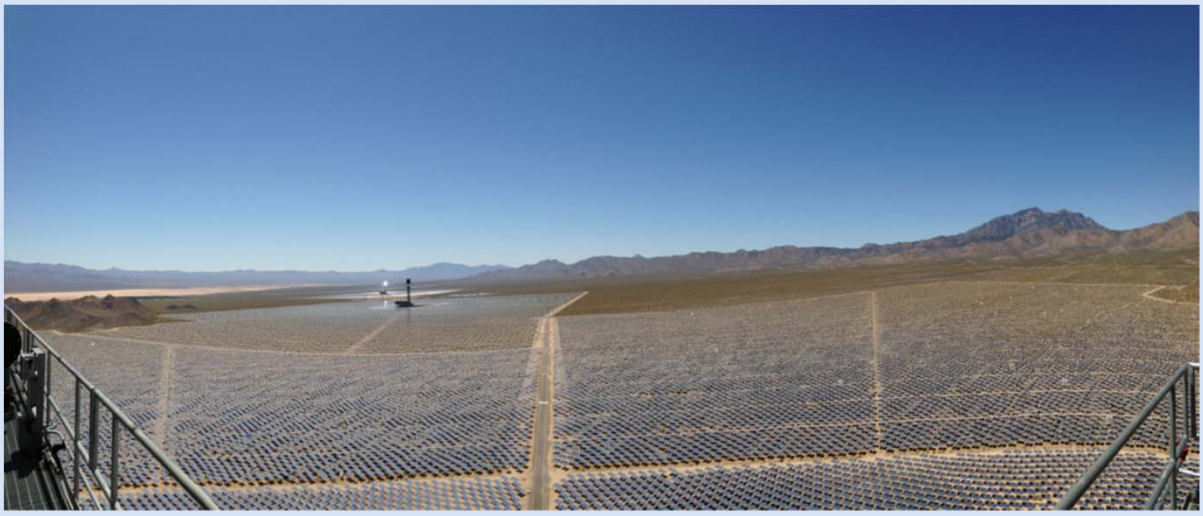
Total Incurred	Description	Event Date
$5.6 million	Mudslides	January 2017
$30.9 million	NWS Harvey	August 2017
$0	NWS Irma	September 2017
$0	NWS Maria	September 2017
$2.5 million	California wildfires	December 2017

CLAIM EXAMPLE

370 MW Concentrated Solar Thermal Facility

CLAIM EXAMPLE

370 MW Concentrated Solar Thermal Facility



CLAIM EXAMPLE

370 MW Concentrated Solar Thermal Facility

- Steam Turbine Generator (STG) – mechanical breakdown
  - 133 MW Siemens SST-900 turbine / SGEN 6-100A-2P generator (2012)
  - Through bolt failure in generator – replacement core available, rotor rewind
  - Claim settled: property damage $14.4 million + business interruption $6.5 million = $20.9 million net
  - Deductibles = $100,000 property damage, 45 days time element
  - No viable subrogation due to contractual provisions and expired warranty

CLAIM EXAMPLE

370 MW Concentrated Solar Thermal Facility

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CLAIM EXAMPLE

370 MW Concentrated Solar Thermal Facility

CLAIM EXAMPLE

370 MW Concentrated Solar Thermal Facility

- Steam Turbine Generator (STG) – repair logistics
  - Insufficient egress from turbine building to remove large equipment
  - Entire roof had to be raised and walls stabilized
  - All cabling, fire suppression, lighting and piping above the unit had to be disassembled
  - Air shipment of 172,000-lb. replacement core from Germany = $1.5 million: saved six weeks

CLAIM EXAMPLE

370 MW Concentrated Solar Thermal Facility

- Fire in generating tower
  - Boiler = 2,646 psig, 1,013 F
  - 450’ high
  - Heliostat control system malfunction – mirrors focused on tower
  - Damage to cabling, instrumentation
  - Claim open – property damage paid to date: $7 million, business interruption within waiting period
  - Deductibles = $100,000 property damage, 45 days time element
  - Subrogation – tbd

CLAIM EXAMPLE

370 MW Concentrated Solar Thermal Facility

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CLAIM EXAMPLE

24 MW Wind Turbine Facility

CLAIM EXAMPLE

24 MW Wind Turbine Facility

CLAIM EXAMPLE

24 MW Wind Turbine Facility

CLAIM EXAMPLE

24 MW Wind Turbine Facility

- Wind Turbine Generator (WTG) – mechanical breakdown
  - 8 x 3 MW Siemens D3 units (2012)
  - Nacelle fell to ground
  - Improper lubrication / anti-seize compound of yaw ring bolts during installation
  - Similar issue on other units corrected prior to any loss
  - Repair period = 17 months
  - Claim open – paid to date: $8 million
  - Deductibles = $100,000 property damage, 30 days time element
  - Subrogation and warranty claims remain under review

CLAIM EXAMPLE

24 MW Wind Turbine Facility

- Wind Turbine Generator (WTG) – repair logistics
  - Civil works estimated at $3.5 million in remote location
    - Road preparation / grading / restoration – high spots lowered to accommodate transport of repair equipment and replacement blades – then had to be restored to original grade
    - Removal and reinstallation of traffic lights and signage as well as roadway center medians
  - Crane costs estimated at $1.5 million – had to be sourced off-island
  - Tower replacement due to incompatibility with replacement nacelle
  - Overall repair costs approximately 2.5 times higher than original installation cost
  - Economy of scale – original costs allocated over eight units, repair costs over one unit

LESSONS LEARNED FROM AEGIS MEMBER CASE STUDIES

Laura Conklin

Senior Utility Consultant – Loss Control

AEGIS Insurance Services, Inc.

AEGIS 2018 PHC

LOSS CONTROL DIVISION

Mission

Assist AEGIS member companies in maintaining effective and safe operating systems while reducing their overall long-term cost of risk, by developing and providing products, services and training specifically for this purpose.

LOSS CONTROL DIVISION

Loss Prevention – Utility Operations

- Risk assessments conducted on an average cycle of three years
- Topics based on AEGIS losses, industry practices and regulations
- Collaborative process with risk manager and member's subject matter experts
- Two- to three-day review and discussion of standards, procedures and policies
- Includes half-day field visit
- New consolidated report format

LESSONS LEARNED FROM AEGIS MEMBER CASE STUDIES

Mark Rutkowski

Senior Litigation Counsel – Claims

AEGIS Insurance Services, Inc.

CLAIMS DIVISION

Mission

The AEGIS Claims Division is committed to consistently providing superior claims management services to every AEGIS member. While working in partnership with members, brokers, counsel and other AEGIS divisions, the Claims Division strives to manage every claim in a fair and efficient manner and to reach mutually satisfactory resolutions while containing costs and mitigating exposure, to the extent possible.

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CLAIMS DIVISION

Services

- Gas Litigation Service
- Electric Litigation Service
- Employment Practices Litigation Service
- Litigation Cost Control Service
- The AEGIS Structured Settlement Company

CLAIMS

Gas Explosion

GAS EXPLOSION CLAIM

Facts

- Tenants at a residential apartment building smelled gas around 8:00 pm one evening, but did not call the natural gas company or 911
- The fire department was called several hours later by someone passing the building
- The fire department responded around 11:30 pm, notified the gas company of an outside intermittent odor of unknown origin, checked the basement and left
- The member sent a two-man crew and a work truck which arrived at 12:30 am; discovered a strong odor of natural gas inside the building
- The workmen entered the building and knocked on the doors to the two first-floor apartments – there was no answer

GAS EXPLOSION CLAIM

Facts

- The workers gained entrance to the basement and noticed that the meter for apartment 1F was spinning
- They locked out the 1st floor meters and again knocked on the doors of the first floor apartments
- They did not know how long the gas had been leaking
- They instructed one resident to open windows to ventilate, then returned to their truck
- 20 minutes later, the building exploded

GAS EXPLOSION CLAIM

Damages

- Someone was asleep in apartment 1F
- 56 year-old man sustained third degree burns to 46% of his body
- Four fingers amputated, 13 surgeries and $550,000 in medical bills

GAS EXPLOSION CLAIM

Liability

- Lawsuit was filed against the gas company
- Overriding issue: **Was the member negligent in failing to gain access, or in attempting to have persons with authority gain access, to Apt. 1F once it knew of the open gas line in that apartment?**

GAS EXPLOSION CLAIM

Resolution

- The case was settled at mediation prior to trial

GAS EXPLOSION CLAIM – LESSONS LEARNED

- Protection of life and property is the highest priority
- Take additional actions, including requesting assistance from 911, to gain access and evacuate occupants
- Improve public safety messages to stress the urgency of reporting gas leaks or odors – despite the odor of natural gas, residents did not report it
- More employee training – the decision to wait inside service van for 20 minutes prior to taking further action was contrary to all company procedures

GAS EXPLOSION CLAIM – LESSONS LEARNED

- **How do we know employees will take the correct action in an emergency?**
  - Employee selection, training and qualification
  - Emergency exercises and drills
  - Review industry lessons learned
  - Establish and support a culture of operational excellence that values public safety and compliance with established procedures

GAS EXPLOSION CLAIM

Loss Control Products and Services

- AEGIS videos
  - Anatomy of a Gas Leak
  - The Smell of Danger (revised)
  - Public Safety Communications and Response
- Natural Gas Operator Training (for fee)
  - First response
  - Natural gas leak pin pointing
- Focused Services
  - Emergency exercises
  - Public safety awareness program review
- Public safety and awareness QuickStart guide

CALL CENTER ELECTRIC INCIDENT CLAIM

Facts

Man Recovering After Trying to Remove Downed Wires

CALL CENTER ELECTRIC CLAIM

Facts

- While trying to move downed power lines that had fallen across his driveway, plaintiff sustained serious injury
- Pole with live conductor came down in plaintiff's driveway
- Pole was rotted through
- The subject pole and 2.4 kV line were owned by the plaintiff, not the insured
- After noticing the downed pole on the morning of the incident, plaintiff's wife called her husband and alerted him to the downed wire across their driveway

CALL CENTER ELECTRIC CLAIM

Facts

- That morning, plaintiff contacted the insured's customer service line and spoke with a representative
- Shortly after making the phone call to the utility, he grabbed the primary conductors in an attempt to move them
- Plaintiff had both hands amputated and sustained a head injury when he was thrown back due to the electric contact

CALL CENTER ELECTRIC CLAIM

Transcript

P:	Well it looks like a...a... pole uh – uh a telephone pole or a pole that um, I don't know, there is a like a small little transformer on top, that's fallen almost across our driveway.
CSR:	Alright.
P:	And, um you know, our electricity is working but um, you know our cable is out and I don't know whose pole it is (chuckles).
CSR:	Well we can have a technician to come out and look at it.
P:	Ok, it's down, and it's across – it's our top – we are on the top hill and um, you know, uh – it's, I don't know, a pole. Are poles usually power company poles? Whose pole is it? Do you know, could you tell me?
CSR:	Well, a few utilities share the same poles.

CALL CENTER ELECTRIC CLAIM

Transcript

P: OK, **well I don't know any other utilities, so I'm calling you. It looks like it's dangerous there** and wires, you know, hanging from it and we don't know what to do.

CSR: OK and, and the wires that are down, are those going from pole to pole or pole to house?

****

CSR: OK and is there anything happening with the transformer on the top of the pole?

P: No, you know my wife just pointed it out to me so I haven't been over to look at it. I figure I call you as soon as possible. It doesn't look like anything is going on but it's definitely fallen.

CSR: OK, are you able to get in and out of your driveway?

P: Um, my wife got out and **I have to leave for work any minute so I guess I am going out.**

CSR: OK, I am going to go ahead and process this order for you, and will have a technician out as soon as possible.

CALL CENTER ELECTRIC CLAIM

Liability Investigation

- The insured reviewed the customer care call-taker script and response time guideline
  - No guidance for call-takers to warn callers to stay away from electrical facilities
  - Response time guideline provided no guidance for downed pole or sagging wire scenarios
  - The call-taker failed to warn the customer about the possibility that the lines were live

CALL CENTER ELECTRIC CLAIM – LESSONS LEARNED

- Customer service representatives should be trained to provide precautionary advice to callers
- Sample precautionary statement
  - **Stay away from the downed wires and do not attempt to touch or move them. If possible, keep children and pets far away from the area. The wires can be dangerous even if they are not arcing and sparking**
- Customer service representative training
- Call monitoring and quality assurance
- Customer-owned poles and conductors
  - How can the utility ensure these installations are safe?

CALL CENTER ELECTRIC CLAIM

Loss Control Products and Services

Call center risk assessment

- Half-day call center review of emergency call handling

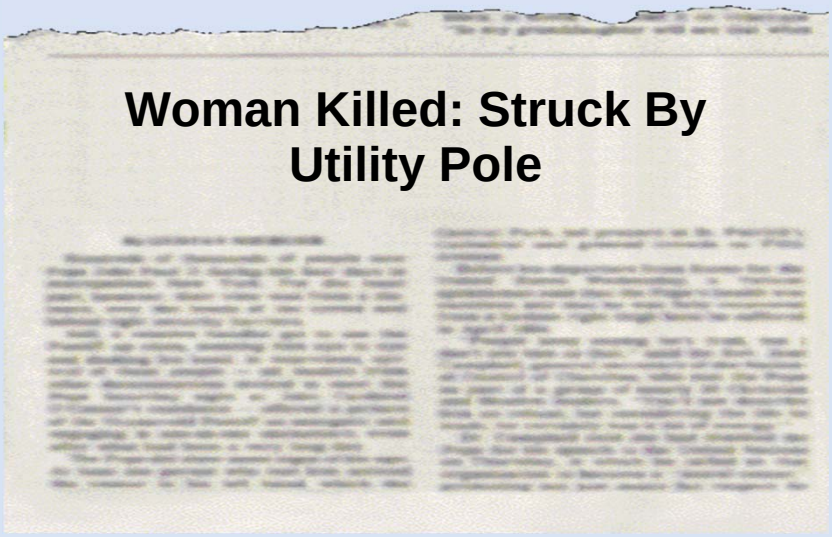
Focused service

- Call center training based on risk assessment findings

AEGIS videos

- A Call for Help
- Within a Child's Reach

AGING ELECTRIC INFRASTRUCTURE CLAIM



Woman Killed: Struck By Utility Pole

AGING ELECTRIC INFRASTRUCTURE CLAIM

Facts

- Decedent was walking her dog when she was struck in the head and killed by a falling utility pole
- Accident occurred during an early season snowstorm with 30 mph winds
- Large tree outside of the insured's right-of-way on adjacent property fell onto the insured's wires mid-span
- Force of tree falling on line caused pole to break at the base

AGING ELECTRIC INFRASTRUCTURE CLAIM

Facts

AGING ELECTRIC INFRASTRUCTURE CLAIM

Investigation

- Pole was secured and removed
- Inspection revealed a significant portion of the pole was rotted near and below the ground line
- Insured's pole expert opined that the pole should have been taken out of service or otherwise reinforced prior to the accident
- Tree that landed on lines also rotten at the base

AGING ELECTRIC INFRASTRUCTURE CLAIM

The Lawsuit

- Wrongful death lawsuit filed against the insured
- Plaintiff claimed
  - The insured failed to properly inspect the right-of-way
  - The insured failed to properly inspect the pole: had an inspection take place, the pole would have been replaced

AGING ELECTRIC INFRASTRUCTURE CLAIM

Liability

- Based on the expert's report, the member conceded that the pole was rotten
- They also conceded that the 40 year-old pole had never been inspected
- The member had a pole inspection program in place since the 1990s, but it was not followed
- There was no clearly defined practice in place by which the inspection protocol was applied to any poles in the region
- Vegetation management – tree was 45 feet from the lines – it likely would not have caught the attention of the tree contractor

AGING ELECTRIC INFRASTRUCTURE CLAIM – LESSONS LEARNED

- Utilities must have effective asset management practices over the **life** of the equipment
- NESC requires poles to be replaced or rehabilitated if the structure deteriorates to two thirds of original design strength
- Utility had no record of ever conducting a ground line inspection, testing or treatment of this pole
- Would a brand new pole fail under similar force?
- Increased expectations of utilities to identify off right-of-way "danger trees" and do enhanced clearing to harden against storm damage

AGING ELECTRIC INFRASTRUCTURE CLAIM

Loss Control Products and Services

- Webinars
  - Wood pole testing
  - Inspection and maintenance practices for steel T&D structures
  - Pole attachments – issues, concerns, and solutions
- Videos
  - How Safe is Your Electric System?


AEGIS