Erik S. Anderson, P.E.
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BEFORE THE ARIZONA CORPORATION COMMISSION

COMMISSIONERS
TOM FORESE, CHAIRMAN
BOB BURNS
BOYD DUNN
DOUG LITTLE
ANDY TOBIN

IN THE MATTER OF THE APPLICATION OF ARIZONA PUBLIC SERVICE COMPANY FOR A HEARING TO DETERMINE THE FAIR VALUE OF THE UTILITY PROPERTY OF THE COMPANY FOR RATEMAKING PURPOSES, TO FIX A JUST AND REASONABLE RATE OF RETURN THEREON, TO APPROVE RATE SCHEDULES DESIGNED TO DEVELOP SUCH RETURN.	**DOCKET # E-01345A-16-0036** **DIRECT TESTIMONY OF ERIK S. ANDERSON, P.E. ON BEHALF OF WARREN WOODWARD AND IN OPPOSITION TO THE SETTLEMENT AGREEMENT**
IN THE MATTER OF FUEL AND PURCHASED POWER PROCUREMENT AUDITS FOR ARIZONA PUBLIC SERVICE COMPANY	**DOCKET # E-01345A-16-0123**

Erik S. Anderson, P.E., Witness in the above-referenced proceeding on behalf of Intervenor Warren Woodward, hereby submits his Direct Testimony.

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I. INTRODUCTION

Q: Please state your name, address, and occupation.

A: Erik S. Anderson, P.E., 3725 E. Roeser Road, Suite 20, Phoenix, Arizona 85040. I am a forensic electrical engineer working on root cause failure analysis of matters that cause loss of property, personal injury, and loss of life. I am the President of an engineering firm that offers professional engineering services across the United States and that manufactures current transformers.

Q: What is your professional and educational background?

A: I have a Bachelor of Science degree from North Dakota State University, Fargo, North Dakota, in Electrical and Electronic Engineering. I am a licensed Professional Engineer in the states of Minnesota, Illinois, Arizona, Wisconsin, Indiana, Iowa, New Mexico, Texas, Louisiana, California, Kentucky, Michigan, and Nevada. I am a licensed Class A Master Electrician in the state of Minnesota. I hold a Private Investigators License in Arizona and I am a Certified Fire and Explosion Investigator. I have 30 years of experience as a forensic engineer. I have over 20 years of experience of design and manufacture of current transformers. I have been involved in many thousands of matters concerned with determining the root cause of failures of electrical devices that may have caused a loss of property, personal injury, or loss of life. I have given expert witness testimony in approximately 113 separate matters. [Attached hereto as Exhibit "D" is a copy of my current curriculum vitae.]

Q: What is the purpose of your direct testimony in these proceedings?

A: My direct testimony in these proceedings is regarding the effect the Smart Meter has on the 60 Hz waveform of the electrical power as delivered by the utility. My direct testimony will be that the Smart Meter causes a significant amount of noise on the 60 Hz signal.

Q: Have you testified previously before the Commission?

A: No.

II. SUMMARY OF DIRECT TESTIMONY

Q: Please summarize your direct testimony.

A: I have witnessed and analyzed the effects of the use of a Smart Meter on the incoming electrical power voltage waveform. The Smart Meter, when transmitting data, causes a significant amount of noise on the incoming electrical power. Power is delivered at 60 Hz. The Smart Meter causes much higher frequencies to be imposed on the 60 Hz sinusoidal wave. When the Smart Meter transmits information, there is a significant increase of the noise observed on the 60 Hz sinusoidal waveform. There were significant increases in the noise in the range of 2 to 50 kHz, or 2,000 to 50,000 cycles per second.

III. DIRECT TESTIMONY

Q: Please describe the test setup of the incoming electrical power.

A: The test setup consists of a meter socket enclosure suitable for 120/240 Volt, single-phase, three-wire connection. A Smart Meter, Landis & Gyr, Gridstream RF, Focus AXR-SD, Form 2S, CL200, 240 V, 3 W, 60 Hz, power meter was used. The voltage waveform was captured with a Fluke 215C Scopemeter. One input to the Scope meter was connected to the incoming voltage, 120 Volts-to-Ground, unfiltered. The other input to the Scope meter was connected to the incoming voltage with the 60 Hz Sine wave filtered out. A radio frequency (RF) meter was also used to indicate when an RF signal increase was detected.

Q: Please describe the observations you made during the testing of the Smart Meter.

A: When the test equipment was connected to the incoming power the waveform of the incoming electrical power was observed. The 60 Hz signal was recognized as the dominant frequency with some noise observed on the waveform. The 60 Hz was filtered out to analyze the noise on the signal. Without the Smart Meter attached, the noise level was approximately 45 milliVolts at its peak. When the Smart Meter was added to the circuit and the noise on the 60 Hz Sine wave was noticeably larger. The peak noise voltage, with the Smart Meter attached was approximately 85 milliVolts. The amount of noise, with the Smart Meter attached to the circuit was approximately twice as large than without the Smart Meter.

Q: Can you show us examples of the waveforms?

A: Yes. Exhibit A is a screenshot of the waveform without a smart meter in the circuit. Exhibit A shows the 60 Hz waveform in red. The noise waveform, after filtering out the 60 Hz, is shown in blue. When the Smart Meter is installed in the circuit, and it is transmitting, the waveforms look like that in Exhibit B. Exhibit B shows the noisy, dirty, waveform of the 60 Hz signal in red. The noise waveform is shown in blue.

Q: What are the frequencies observed on the noise (blue) waveform, of Exhibit B?

A: The dominant frequencies found on the waveform of the noise (blue) waveform of Exhibit B are approximately in the range of 2 to 50 kHz. These are the

frequencies that the Smart Meter generates when it is transmitting

Q: Can you provide a sampling of those frequencies?

A: Yes, Exhibit C showcases waveforms found to represent 12.5 kHz, 14.28 kHz, 16.6 kHz, 20 kHz, and 33.3 kHz. The point between the two cursors represents these frequencies.

IV. CONCLUSION

Q: DO YOU HAVE ANY CONCLUDING REMARKS?

A: Yes. The Smart Meter tested exhibited a significant amount of noise generation on the incoming electrical power to the residence.

RESPECTFULLY SUBMITTED this 3rd day of April, 2017.

By: /s/ Erik S. Anderson
Erik S. Anderson, P.E., C.F.E.I.
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Phoenix, AZ 85040

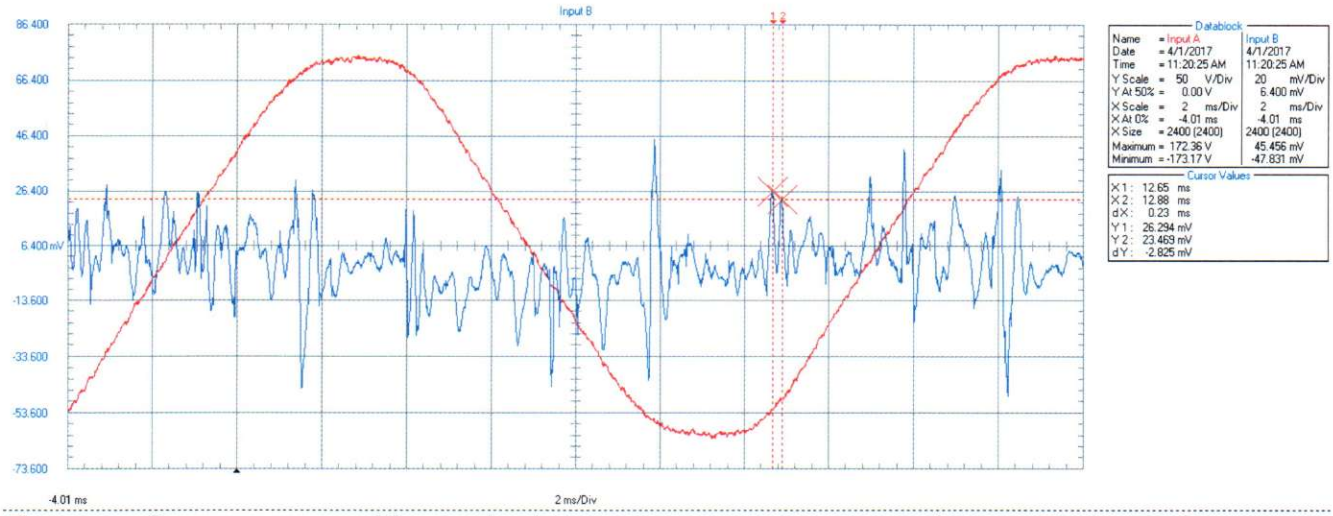
Original and 13 copies of the
foregoing hand-delivered
this 3rd day of April, 2017 to: Arizona Corporation Commission, Attn: Docket Control Center, 1200 W. Washington, Phoenix, AZ 85007

Copies of the foregoing
mailed/e-mailed this 3rd
day of April, 2017 to: Docket Service List

By,

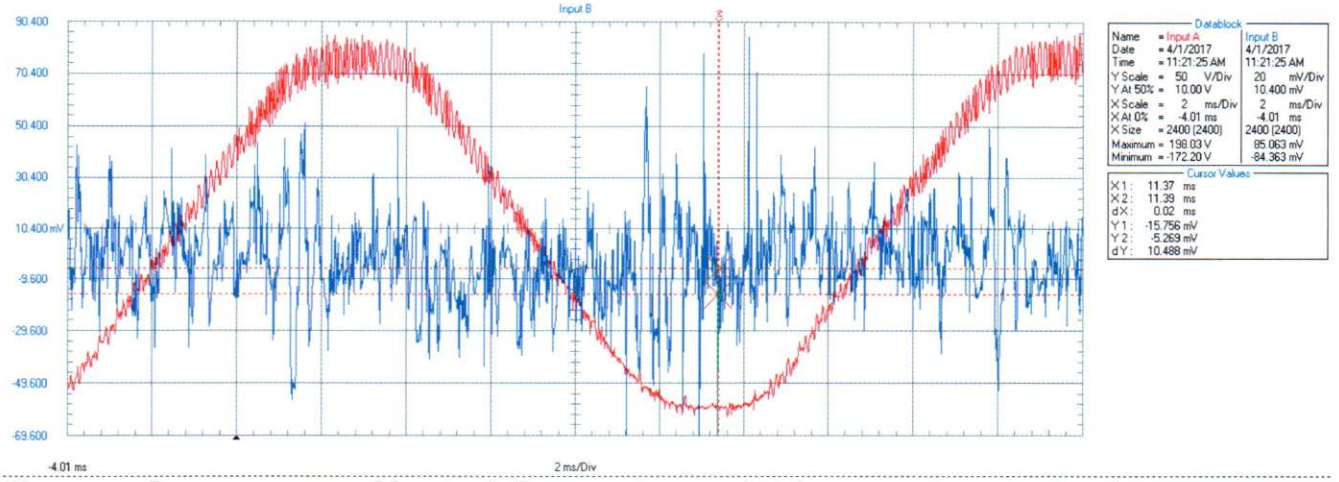
Warren Woodward
200 Sierra Rd.
Sedona, AZ 86336

Exhibit "A"



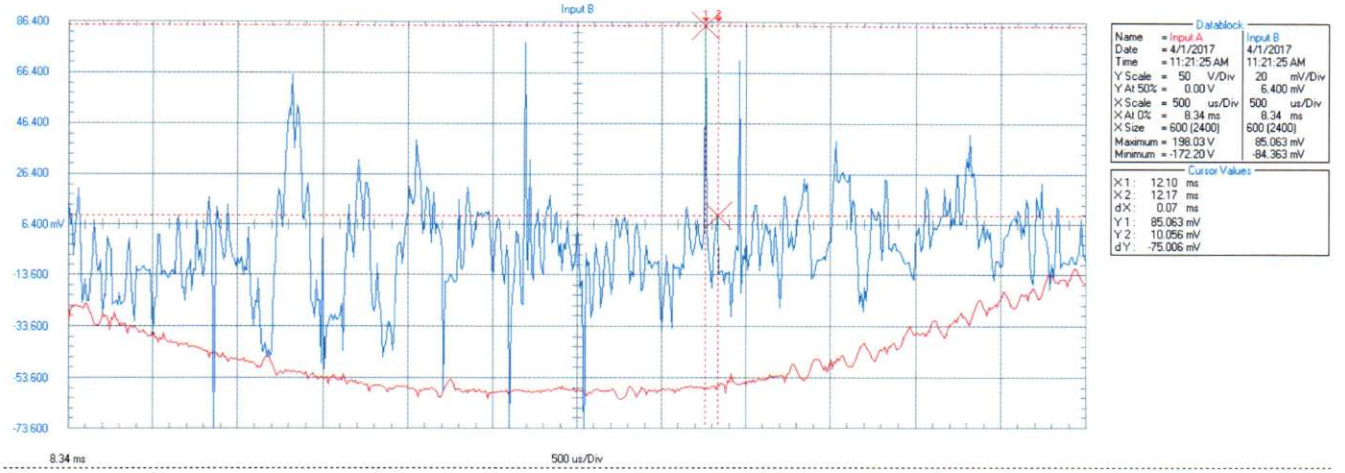
The waveforms were collected without a smart meter using a Fluke 215C Scopemeter. Channel A was connected to a 120 VAC receptacle. Channel B was attached to the same potential except through a Graham Ubiquitous filter (removes the 60 cycle).

Exhibit "B"

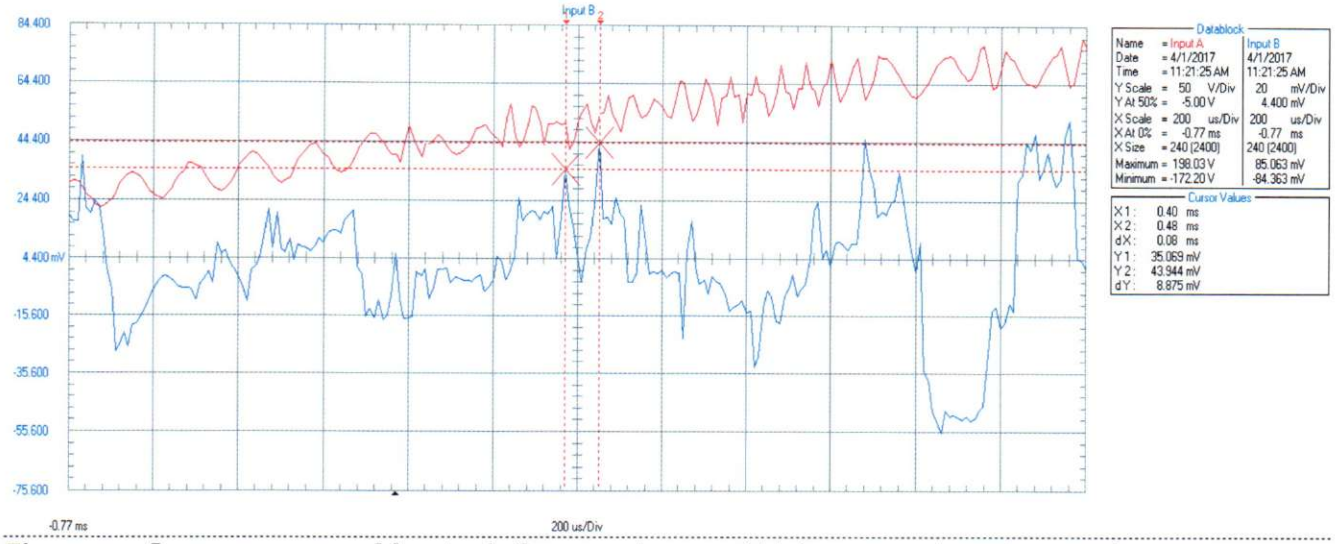


The waveforms were collected from a transmitting smart meter using a Fluke 215C Scopemeter. Channel A was connected to a 120VAC receptacle. Channel B was connected to the same potential except through a Graham Ubiquitous filter (removes the 60 cycle). The point between the two cursors represents a frequency of 50 kilo Hertz.

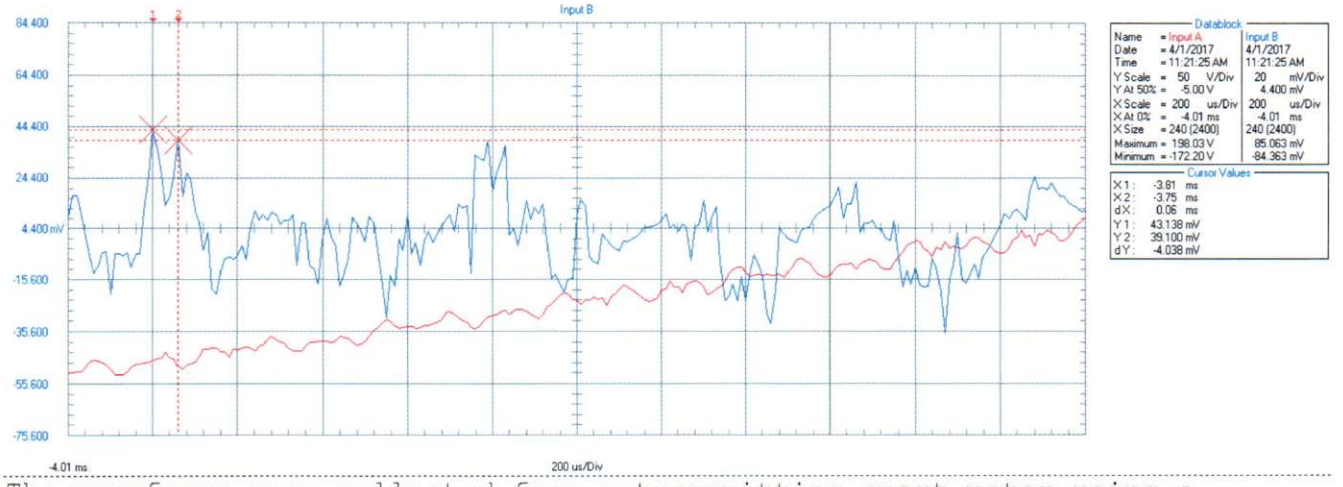
Exhibit "C"



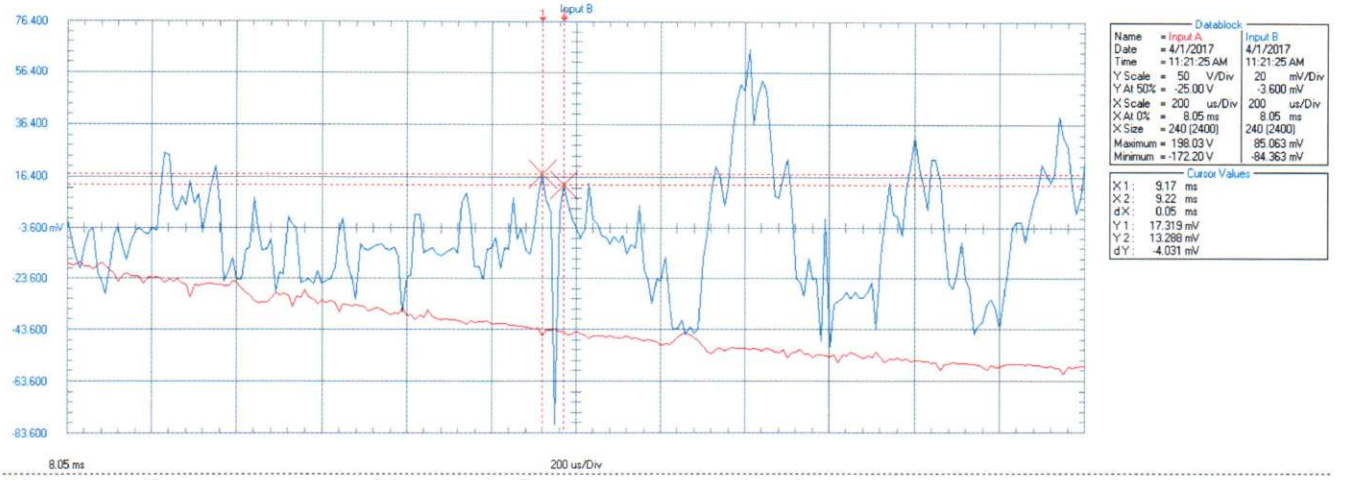
The waveforms were collected from a transmitting smart meter using a Fluke 215C Scopemeter. Channel A was connected to a 120VAC receptacle. Channel B was connected to the same potential except through a Graham Ubiquitous filter (removes the 60 cycle). The point between the two cursors represents a frequency of 14.28 kilo Hertz.



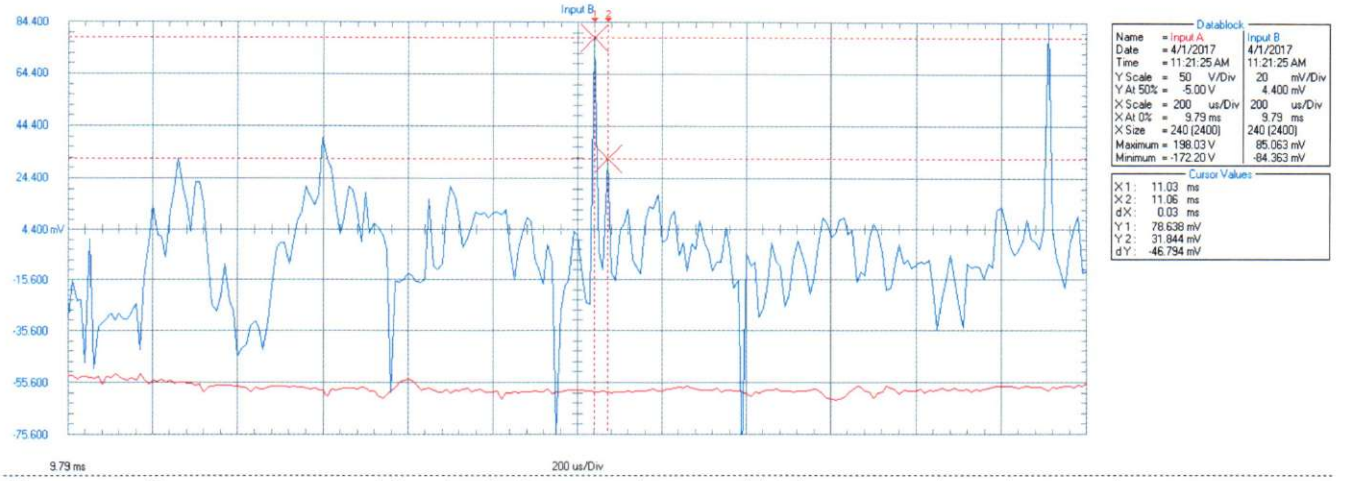
The waveforms were collected from a transmitting smart meter using a Fluke 215C Scopemeter. Channel A was connected to a 120VAC receptacle. Channel B was connected to the same potential except through a Graham Ubiquitous filter (removes the 60 cycle). The point between the two cursors represents a frequency of 12.5 kilo Hertz.



The waveforms were collected from a transmitting smart meter using a Fluke 215C Scopemeter. Channel A was connected to a 120VAC receptacle. Channel B was connected to the same potential except through a Graham Ubiquitous filter (removes the 60 cycle). The point between the two cursors represents a frequency of 16.6 kilo Hertz.



The waveforms were collected from a transmitting smart meter using a Fluke 215C Scopemeter. Channel A was connected to a 120VAC receptacle. Channel B was connected to the same potential except through a Graham Ubiquitous filter (removes the 60 cycle). The point between the two cursors represents a frequency of 20 kilo Hertz.



The waveforms were collected from a transmitting smart meter using a Fluke 215C Scopemeter. Channel A was connected to a 120VAC receptacle. Channel B was connected to the same potential except through a Graham Ubiquitous filter (removes the 60 cycle). The point between the two cursors represents a frequency of 33.3 kilo Hertz.

Exhibit "D"

ANDERSON ENGINEERING OF NEW PRAGUE, INC.
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ERIK S. ANDERSON
Registered Professional Engineer

REGISTRATION:

Licensed Professional Engineer

State of Minnesota	1991	21471
State of Illinois	1999	062052733
State of Arizona	2003	39627
State of Wisconsin	2008	39418-006
State of Indiana	2008	PE.10809314
State of Iowa	2008	18758
State of New Mexico	2008	19001
State of Texas	2009	102714
State of Louisiana	2009	PE.0034787
State of California	2010	105359
State of Kentucky	2012	28492
State of Michigan	2013	6201060247
State of Nevada	2013	022690

Other Licenses:

Licensed Class A Master Electrician – State of Minnesota	1995	AM005344
Private Investigator – Arizona	2011	1615601
Certified Fire and Explosion Investigator (C.F.E.I.)	2012	17853-9760

EDUCATION: B.S. in Electrical and Electronic Engineering
North Dakota State University, Fargo, North Dakota, 1987.

Chemical Engineering Course Work
University of Minnesota, Minneapolis, Minnesota, 1981-1983.

CONTINUING Hazardous Materials: HAZWOPER: 40-hour worker 2008

EDUCATION:

Annual 8-Hr. HAZWOPER Refresher Course: 2009, 2010, 2011, 2012, 2013, 2014, 2015,

Asbestos Awareness: 05/09, 3/14, 09/16

Annual Fire Investigation Seminar Instructor
Maricopa AZ: 04/08, 03/09, 03/12, 03/13

Minnesota Chapter IAAI Fire & Arson Conference
3/88, 3/89, 3/90, 3/01, 3/05, 3/06.

Instructor: Fire/Arson Level 3
Mesa, Arizona, 10/03.

Illinois Chapter IAAI Northern Zone Winter Seminar
Instructor: Electrical Appliance Fires, 2/03.

Completed Code & Code Change Class
Minnesota Electrical Association – National Electrical Code
1/99, 2/01, 1/03, 1/05, 1/07, 1/09, 1/11, 2/13, 5/15

Illinois Chapter IAAI Fire Investigation Conference
Instructor: Forensic Electrical Engineering Principles & Practices, 9/99.

Graduate Course Work, University of Minnesota
Minneapolis, Minnesota, 1995-1997.

Master Electrician Course, Hennepin County Technical College, Eden Prairie, Minnesota 3/95.

Completed Designing Electrical Systems for Hazardous Locations
University of Wisconsin-Madison, 4/92.

Completed Electrical Fires Accidental and Deliberate
Sponsored by Georgia Chapter of IAAI, 12/91.

Completed Fire and Arson Investigation Course,
Nebraska State Fire & Arson Investigators Conference, 10/87

EXPERIENCE:

01/05 - Present

Anderson Engineering of New Prague, Inc., *Phoenix, AZ*
President & Forensic Electrical Engineer. Responsible for all aspects of business operations including engineering services to clients, product testing, fire investigation, and failure analysis.

Our case load also includes construction defect cases involving the evaluation of the workmanship of the electrical subcontractor and personal injury cases involving electric shock and/or electrocutions.

4/87 – 1/05	Anderson Engineering of New Prague, Inc., *New Prague, MN* Electrical Engineer. Responsible to client for engineering services including product testing, fire investigation, and failure analysis. Midwest Current Transformer, Division of Anderson Engineering of New Prague, Inc., *New Prague, MN.* Designer, manufacturer, and quality control engineer of current transformers.
1/84 - 11/84	O.S. Anderson Engineering, Inc., *New Prague, MN.* Research and Design Coordinator. Duties included work on transponder design for communications system through earth.
6/83 - 9/83	Koch Refinery, *Southeast St. Paul, MN.* Conducted ultrasound testing on oil refinery systems.
1981 & 1982 (Summers)	O.S. Anderson Engineering, Inc., *New Prague, MN.* Assistant Engineer. Designed software for and compiled data of E-fields generated by high voltage transmission lines, assisted in investigations of various cases involving questions of product liability.
PROFESSIONAL AFFILIATIONS:	Member Institute of Electrical and Electronic Engineers (IEEE) Member National Society of Professional Engineers (NSPE) Member Minnesota Society of Professional Engineers (MnSPE) Member International Association of Arson Investigators (IAAI) Member National Fire Protection Association (NFPA) Member National Association of Fire Investigators (NAFI) Member American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)

EXPERT TESTIFYING WITNESS:	Arbitrations:	02
	Depositions:	85
	Trials:	26