BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of SAN DIEGO GAS & ELECTRIC COMPANY for Review of its Proactive De-Energization Measures and Approval of Proposed Tariff Revisions (U 902-E)	Application No. 08-12-021 (Filed December 22, 2008)

MUSSEY GRADE ROAD ALLIANCE ADDITIONAL COMMENTS REGARDING SAN DIEGO GAS & ELECTRIC REPLY COMMENTS AND RESPONSES TO ALJ QUESTIONS CONCERNING WIND ISSUES

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MUSSEY GRADE ROAD ALLIANCE ADDITIONAL COMMENTS REGARDING SAN DIEGO GAS & ELECTRIC REPLY COMMENTS AND RESPONSES TO ALJ QUESTIONS CONCERNING WIND ISSUES

I. INTRODUCTION

The Mussey Grade Road Alliance ("Alliance") files these additional comments with the California Public Utilities Commission ("Commission") in accordance with assigned Administrative Law Judge Kenney's email of May 15th authorizing additional comments, and pursuant to ALJ Kenney's email of May 20th, 2009, requesting the Alliance answer three specific questions regarding wind issues and to include those answers in this filing.

II. ADDITIONAL COMMENTS REGARDING SDG&E REPLY COMMENTS TO CPSD

In its response to the CPSD comments, SDG&E argues that its application of a 35-mph continuous wind speed threshold is appropriate because it additionally has four other trigger conditions that must be met before shut-off "and most of them (fuel moisture for example) have nothing to do with utility equipment design criteria."[1] The company also states that "the trigger at which some facilities may begin to be at risk [as having] (55-mph wind gusts)". The justification for a lower EPSO trigger threshold is that "35 mph sustained wind [is the] trigger at which fire fighting aircraft are hindered". This assertion is consistent with the data request response received by the Alliance from SDG&E[2], and submitted with our initial Comments, in which we dismissed the SDG&E argument for a lower shut-off threshold on several grounds:

- Because 99% of wildland fires are *not* caused by power lines, and because wildland fire risks will be *increased* for residents without electricity, a trigger point that is

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[1] A.08-12-021; REPLY COMMENTS OF SAN DIEGO GAS & ELECTRIC COMPANY IN RESPONSE TO ALJ RULING INVITING COMMENTS ON BACK-UP GENERATORS FOR FIREFIGHTING PURPOSES; May 19, 2009.

[2] A.08-12-021; Alliance Comments; Appendix C; SDG&E Response to MGRA Data Request #1, part 2. Feb. 24, 2009. MGRA-21.

based on fire-fighting criteria rather than risk to power line infrastructure might actually *increase* the overall risk to residents.[3]

- RAWS gust speed wind data is more reliable that continuous speed wind data.[4]
- Even if one accepts a wind speed scaling to adjust RAWS measurements taken at 6 meters to be wind speeds expected at the top of poles at 10 meters, there is no justification to apply a similar scaling to the 35-mph continuous wind speed criterion, since this value has by SDG&E's own admission, nothing to do with wind loading of poles.[5]

Hence, we concur with CPSD's arguments and do not believe that the counterarguments by SDG&E are valid.

III. RESPONSE TO ALJ KENNEY'S QUESTIONS

ALJ Kenney asked the Alliance for responses to several questions concerning wind issues and at the same time invited further input from all parties regarding the same. The issues raised by ALJ Kenney generally concern issues discussed in Appendix B of the SDG&E's Reply Comments. Appendix B contains a letter to Mr. Yari of SDG&E from the SDG&E consultant Dr. Jon A. Peterka of CPP, Inc. The letter describes the method used to obtain wind speed profile as a function of height.

In his May 20, 2009 email ALJ Kenney states that "I am asking the above questions because they have a bearing on the RAWS measured wind speed that should be used to trigger a power shut off event and, ultimately, the frequency and duration of power shut off events."[6] The Alliance would like to clarify that our expert is a physicist and is capable of analyzing and applying the methods described in the referenced standards. In addition to the information provided by the Alliance in this filing, we urge the Commission to obtain guidance from a licensed engineer for the adoption of specific criteria, such criteria that would potentially affect the health and safety of ratepayers. Questions and answers are provided in the next section.

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[3] A.08-12-021; Alliance Comments; pp. 10-11.
[4] Ibid; pp. 26-27.
[5] Ibid.
[6] May 20, 2009 Email to Diane Conklin and copied to the service list from ALJ Kenney; Subject: Re: A.08-12-021; SDG&E's Reply Comments in Response to ALJ Ruling Inviting Comments on Back-Up Generators for Firefighting Purposes.

A. RAWS siting

Question #1: *"1. The exposure coefficients used in SDG&E's filing are based [on] the assumption that many SDG&E utility poles are located in rough terrain, causing a steeper increase in horizontal wind velocity as one moves up vertically from the ground. However, the wind measurements used to shut off power will be taken at RAWS. It is my assumption that RAWS are generally located away from rough terrain in order to get an accurate measurement of wind speeds. If my assumption is correct, does that mean that wind speeds measured at RAWS will typically be higher than wind speeds experienced by utility poles located in rough terrain?"*

Answer #1: The answer to this question is specified in the NWCG reference manual.[7]

"*The standard fire weather station should be located in a large, open area away from obstructions and sources of dust and surface moisture. The station should be on level ground where there is a low vegetative cover…*"

"*Locate the station in a place that is representative of the conditions existing in the general area of concern. Consider vegetative cover type, topographic features, elevation, climate, local weather patterns, etc…*"

"*The following situations should be avoided when selecting a station site…*

*5. **Large buildings, trees, and dense vegetation.** Locate station at least a distance equal to the height of the obstruction.*
*6. **Distinct changes in topography** such as gullies, peaks, ridges, steep slopes, and narrow valleys.*"

The specific answer to the ALJ's question is that the RAWS stations are supposed to be found in locations that are similar in topography and vegetation to the areas that they are supposed to represent, and that they should be removed from large obstructions by a distance equaling the height of the obstruction.

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[7] NWCG; National Fire Danger Rating System; Weather Station Standards; PMS 426-3; May 2005 revision; pp. 11-12.

To determine whether the San Diego County RAWS stations planned for use in SDG&E's EPSO match these requirements, we have prepared a visual presentation, attached as Appendix A to this filing, titled A.08-12-021_MGRA_AppA_SDRAWS.pdf. This consists of 1) Google Earth views of a number of San Diego County RAWS sites as specified by their coordinates and 2) photos of the RAWS stations (when available) available at the Western Regional Climate Center website. The general answer to the ALJ's question based on these depictions is that the back country of San Diego is extremely diverse in conditions and topography, as are its RAWS sites. These are not exclusively in open areas, though they do seem to comply with the requirement that they be removed from any obstruction by at least the height of the obstruction.

B. Exposure coefficients and height-velocity scaling

Question #2: *"2. Assuming the Commission decides it is appropriate to shut off power when wind gusts reach 55 mph at 10 meters, and all other criteria are met, what is the appropriate proxy speed measured by RAWS located at 6 meters? Put differently, what is the appropriate exposure coefficient for the power law equation? Please explain your reasoning."*

Answer #2: Using the reasoning below, application of the ASCE standard gives a proxy speed of 51.4 mph using a power law exponent of 0.143 for rough terrain and 52.3 mph using a power law exponent of 0.105 for open terrain.

Question #3: *"3. It is my understanding that an exposure coefficient of around 0.147 is often used. Is that appropriate here? Why or why not?"*

Answer #3: The suggested number is close to a value found in the ASCE standard. Appropriateness is discussed below.

To answer these questions, we have adopted the nomenclature and method described in the SEI/ASCE 7-02 Standard,[8], Section 6.0, which describes wind loading. This would appear to be consistent with the reference made in Dr. Peterka's letter: "These boundary layer effects are well-

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[8] American Society of Civil Engineers; Minimum Design Loads for Buildings and Other Structures; SEI/ASCE 7-02; Reston VA.

established and are reflected in commonly used loading guides for buildings and other structures such as those published by the American Society of Civil Engineers."[9]

1. Definition of exposure coefficient

In the email by the judge and in Dr. Peterka's letter, the term "exposure coefficient" is used to apply to the exponent *E* in the velocity power law relation:

$$V_r = V_x\,(x/r)^E \qquad [1]$$

which Dr. Peterka describes as "the exposure coefficient that accounts for surface roughness".

The ASCE 7-02 standard uses the term "exposure coefficient" to apply to a multiplicative term K_z which is called the "velocity pressure exposure coefficient evaluated at height *z*"[10]. This is used in the velocity pressure equation in section 6.5.10.[11]

$$q_z = 0.00256\,K_z K_{zt} K_d V^2 I\ (lb/ft^2) \qquad [2]$$

The value of K_z is calculated using the equation provided in Table 6-3 of the ASCE standard[12]:

$$K_z = 2.01\,(z/z_g)^{2/\alpha} \qquad [3]$$

The parameters z_g and α are given in Table 6-2 of the standard,[13] and depend on the surface roughness of the terrain. The exponent α is defined as the "3-sec gust speed power law exponent".[14]

Hence, there is a difference in usage of the term "exposure coefficient" between the ASCE standard and that used by Dr. Peterka. There might potentially be other conventional uses of this term within the engineering community that our expert is unaware of.

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[9] SDG&E Reply, Appendix B.
[10] ASCE 7-02, p. 25.
[11] Ibid, p. 31.
[12] Ibid.; p. 75.
[13] Ibid.; p. 74.
[14] Ibid.; p. 26.

2. Variation of the wind speed with height

According to equations [2] and [3] above, the wind pressure q_z would be expected to vary with height as

$$q_z \sim (z/z_g)^{2/\alpha} \qquad [4]$$

So the ratio of pressures at heights *x* and *r* would be

$$q_r = q_x(x/r)^{2/\alpha} \qquad [5]$$

From equation [2], one sees that wind pressure varies as the wind velocity squared. So the wind speed would vary with height as the square root of the pressure relation, or:

$$V_r = V_x\ (x/r)^{1/\alpha} \qquad [6]$$

This is the same as Equation 1 from SDG&E Appendix B, with $E = 1/\alpha$.

3. Values of the power law exponent

The value of the exponent varies with surface roughness. Surface Roughness classes within the ASCE standard are defined in section 6.5.6.2,[15] and go from Class B representing the roughest surface to Class D which represents the smoothest. Class B and Class C are defined respectively as:

"*Surface Roughness B: Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.*

Surface Roughness C: Open terrain with scattered obstructions having heights generally less than 30 ft (9.1 m). This category includes flat open country, grasslands, and all water surfaces in hurricane-prone regions."

These Surface Roughness classes each have equivalent and corresponding Surface Exposure classes (Surface Exposure Class B and Surface Exposure Class C).

From these descriptions, we would intuit that rough terrain of San Diego's back-country would most likely be classed as Surface Roughness B, since it consists of wooded areas with many

[15] Ibid., pp. 28-29.

obstructions of larger trees, boulders and outcrops, with some more level and open areas being Surface Roughness Class C.

For Surface Exposure Class B, $\alpha = 7.0$, while for Surface Exposure Class C, $\alpha = 9.5$. The corresponding power law exponent would then be 1/7.0 for Surface Exposure Class B, which is equal to .143. For Exposure Class C, the exponent would be 1/9.5 or .105.

We note that the number suggested by ALJ Kenney – 0.147 – is very close to the exponent value of 1/7 for Surface Exposure Class B. We are unable to comment whether this is the number in common usage for engineering design, since our expert is not a member of the engineering community.

We also note that the range of acceptable values given by Dr. Peterka for the exponent value is from .25 to .30, and that if we were to calculate the pressure gradient (rather than the velocity gradient) given in Equation 4, we would use the exponent $2/\alpha$, which would be equal to .286, which is within that range. We do not know if this is coincidental. We also do not know the method that was used by Dr. Peterka to obtain his acceptable range.

We are therefore unable to reproduce Dr. Peterka's result using a rote application of the engineering standard described in ASCE 7-02. There might potentially be other methods for calculating the wind speed variation with height that are accepted within the engineering community and of which our expert is unaware.

4. Extrapolating from RAWS height (6 m) to pole height (10 m)

Assuming that the rote application of ASCE 7-02 performed by our expert is correct and applies to this case, if we were to extrapolate from a wind speed measured at a RAWS weather station at 6 m to the top of a utility pole at 10 m, the scaling in wind speed would be equal to:

$$(10\text{ m} / 6\text{ m})^{1/7} = 1.069$$

This is significantly less than the 15% correction applied by SDG&E.[16] A 55-mph wind at the top of a 10 m utility pole would correspond to a 51.4-mph wind at 6 m.

Using Surface Exposure Class C, with $\alpha = 0.105$, we would obtain a scaling factor of:

$(10 \text{ m} / 6 \text{ m})^{1/9.5} = 1.051$

A 55-mph wind at the top of a 10 m utility pole would correspond to a 52.3-mph wind at 6 m.

We would like to note at this point that in the Alliance Opening Comments, we accepted that it was appropriate to adjust wind speed based on height, and stated that "This is an appropriate step to take if the goal is to keep the gust speed at pole height below the GO-95 design criteria. The 48-mph gust speed adjustment would be correct under this assumption."[17] Having examined the issue more closely we no longer see any evidence provided by SDG&E that convinces us that the 48-mph threshold would be appropriate or correct.

Additionally, Dr. Peterka supplied an alternative set of exponents to correct gust speeds (versus continuous), giving this range as .20 - .25[18]. No basis can be found for this adjustment in the ASCE standards, though from a physics standpoint it is intuitively reasonable that gust effects would be more strongly attenuated in rough terrain. The net result of this correction would be to further reduce the difference between the 6 m and 10 m wind speeds. If this is correct, application of a gust correction would be completely appropriate to this case, since the EPSO trigger being suggested is for 55-mph *gust* speed at 10 m. However, SDG&E did not adopt this range of values from its consultant, which would lead to corrections of 10% - 12%, versus the 15% correction it has put forward even though it was told that smaller exponent values needed to be used for gusting winds.

IV. GEOGRAPHY AND TOPOGRAPHY ARE THE ELEPHANTS IN THE LIVING ROOM

ALJ Kenney's questions, as the Alliance understands them, concern the correct way to extrapolate from measurements at a RAWS station and apply those measurements throughout a

[16] SDG&E Reply, p. 11.

[17] A.08-12-021; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON SDG&E'S SHUTOFF PLAN AND PROPOSED RULE 14 CHANGE; p. 27.

[18] Ibid., Appendix B.

utility network. Primarily, this has centered on the difference in height between the anemometer on a RAWS station and the top of a utility pole. While it is important to correctly adjust for this difference, this difference may be dwarfed by the variations in wind speed caused by differences in physical location between the RAWS station and the utility infrastructure, which can be many miles. Both geography and topography contribute to these potential differences, and not in ways that are easy to correct for. It is for this reason we have urged that shut-off be reviewed in more detail in Phase 2 of R.08-11-005.

A. Geographical variations of wind speed

Santa Ana windstorms are dynamic events that do not strike everywhere uniformly and at once. Rather, they ebb and flow from one place to another as air flow high pressure over the Great Basin meets and interacts with the typical on-shore breezes in the coastal and near-inland areas of Southern California. This introduces geographical variations in wind speed. Two variables that will be generally be correlated with wind speed are elevation (with higher regions generally having greater wind speeds) and distance from the coast (with on-shore effects becoming weaker as one goes inland). Hence, to the extent that weather stations used to measure wind speed are at different elevations or distances from the coast than the systems they are measuring, differences between the wind speeds at the weather station and the utility network components may be observed. In Appendix A of our opening comments, we presented a computer simulation of the wind conditions just prior to the start of the Witch fire in 2007[19]. We present this again below:

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[19] A.08-12-021; MGRA Opening Comments; Appendix A; Mitchell, Joseph W; M-bar Technologies and Consulting, LLC for the Mussey Grade Road Alliance; "WHEN TO TURN OFF THE POWER? COST/BENEFIT OUTLINE FOR PROACTIVE DEENERGIZATION"; March 27, 2009; p. 12.

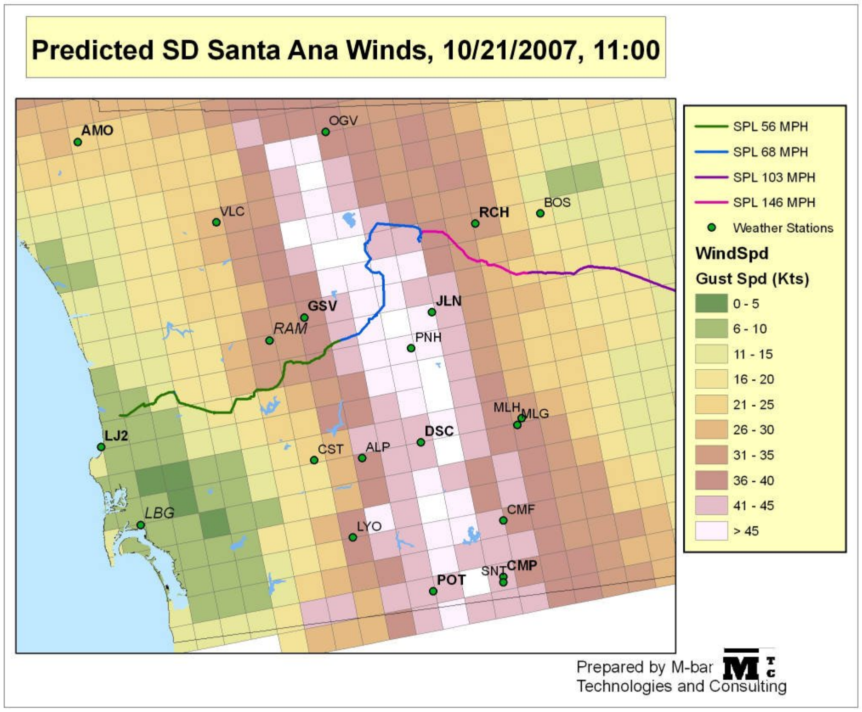

Figure 1 - October 21, 2007 San Diego Winds
The NDFD predicted wind gust speeds for 11 a.m. on October 21, 2007, roughly two hours prior to the start of the Witch Creek Fire. Superimposed is a proposed power line route. Weather station locations are also shown, with those used in the MGRA analysis indicated in bold face, and those used only on the SDG&E analysis in italics.

Significant variations in predicted wind speeds over small geographic areas can be seen to occur even for idealized computer models.

Another example of strong geographic wind speed dependency occurred during the 2003 Cedar fire. At the time that this fire was ignited, Santa Ana conditions were being recorded at the Julian weather station, less than ten miles away. However, Santa Ana winds did not reach the fire location for approximately another six hours[20].

B. Topography and wind

Topographic features will also affect the wind speed, and as can be seen in the photos and aerial views in Appendix A, these can vary significantly even in the vicinity of a RAWS weather station. SDG&E recognizes that these topographic changes can significantly affect wind speeds. In

[20] Mitchell, Joseph W.; Wind-enabled ember dousing; Fire Safety Journal; Volume 41, Issue 6, September 2006, Pages 444-458.

a reply to the Alliance during A.06-08-010 Sunrise, it explained what sort of wind effects the topography was expected to have, and answered:

"'*The behavior of airflow through mountain ranges was reviewed via descriptions in the technical literature. Relevant characteristics of mountain phenomena include the following.*
Winds can be strong and gusty near the mouths of canyons oriented parallel to the direction of airflow.
Funneling of airflow through mountain passes and along deeper valleys can cause unusually high wind speeds.
Topographic features indicative of high wind energy include: long, sloping valleys parallel to prevailing winds, high elevation plateaus in areas of strong geostrophic winds, valleys with persistent down slope winds associated with strong pressure gradients, and exposed ridge crests and mountain summits in areas of strong geostrophic winds…'"[21]

A full treatment of wind effects that would be appropriate for a given landscape under Santa Ana wind conditions has not yet been carried out, and is one of the research projects called for in the Alliance's Cost/Benefit analysis outline for the Application.[22]

The ASCE Standard 7-02 specifies how to apply a topographic correction factor to building design. While this would be difficult to apply to a complex topography and extensive network, it suffices to show the magnitude of potential variations due to simple topographic features. The formula given in the ACSE standard for applying this correction to pressure is given by the Topographic Factor K_{zt}, which can be found as a multiplier in Equation 2. The standard method for calculating this Factor is:[23]

$$K_{zt} = (1 + K_1 K_2 K_3)^2 \qquad [7]$$

[21] A.06-08-010; Sunrise Powerlink Project; SDG&E's 3/3/08 Responses to MGRA Data Request No. 6; MGRA-50. Quoted in MGRA Phase 2 Testimony, Appendix G, p. 9.
[22] A.08-12-021; Alliance Comments, Appendix A, pp. 13-14.
[23] ACSE 7-02, p. 30.

where K_1, K_2, and K_3 are variables depending on topography, and which are specified in Figure 6-4 of the Standard[24]. The maximum increase in pressure specified in the table of Figure 6-4 would be at the top of a 45 degree two-dimensional ridge, for which $K_1 = 0.72$, $K_2 = 1.00$, and $K_3 = 1.00$. This would lead to $K_{zt} = 2.96$. Once again, this is a pressure difference, and the corresponding velocity that accounts for this is given by the square root, or 1.72. Hence, according to the ASCE method, a 55-mph wind blowing up a 45 degree, two-dimensional ridge would have a speed of 95-mph at the top of the ridge.

Utility infrastructure in locations having increased topographic exposure to high winds need to be built to a higher standard, as per GO-95, Rule 31.1: "For all particulars not specified in these rules, design, construction, and maintenance should be done in accordance with accepted good practice for the given local conditions known at the time by those responsible for the design, construction, or maintenance of [the] communication or supply lines and equipment."[25]

For this reason, we do not believe that it would be appropriate to shut off power to areas based on the windiest and most exposed portions of the network. Instead, these exposed areas should be hardened so that a uniformly appropriate shut-off criterion, if one is desired, can be applied to the entire network.

V. CONCLUSION

The Alliance has responded to SDG&E's reply to CPSD, and maintains that SDG&E's arguments are not correct. As requested, the Alliance has answered the ALJ's questions. The Alliance expert applied the calculation methods specified in the ASCE 7-02 standards, but was not able to reproduce SDG&E's claimed wind velocity/height relationship between RAWS weather stations and the tops of utility poles.

Of importance is the fact that the backcountry of San Diego County is widely varied in topography, vegetation, and geography, and that these factors will inevitably introduce differences between wind measurements at RAWS weather stations and conditions that will be experienced at the tops of utility poles throughout the network. Hence, any threshold for shut-off using RAWS will

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[24] Ibid.; p. 47.
[25] GO-95, p. III-5.

necessarily be approximate. Further refinements are possible, but will require additional analysis, possibly within the scope of R.08-11-005 Phase 2.

Respectfully submitted this 26th day of May, 2009,

By: __/S/____ ***Diane Conklin***____________________

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CERTIFICATE OF SERVICE

I hereby certify that pursuant to the California Public Utilities Commission's Rules of Practice and Procedure, I have served a true copy of the **MUSSEY GRADE ROAD ALLIANCE ADDITIONAL COMMENTS REGARDING SAN DIEGO GAS & ELECTRIC REPLY COMMENTS AND RESPONSES TO ALJ QUESTIONS CONCERNING WIND ISSUES** to all parties on the service list for Application A.08-12-021 via electronic mail.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed this 26th day of May, 2009 at Ramona, California.

/s/ Diane Conklin

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VERIFICATION

I am the subject matter expert for the **MUSSEY GRADE ROAD ALLIANCE**, intervenor herein. I am the founder of M-bar Technologies and Consulting, LLC, a wildland fire research and consulting company. The technical data and statements in this document are all true of my own knowledge, except as to matters which are therein stated on information or belief, and as to those matters I believe them to be true.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed this 26th day of May, 2009 at Ramona, California.

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