Environmental Resources Management

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April 4, 2018

Mr. Michael Malone
CPS Energy
145 Navarro Street
San Antonio, Texas 78205

Project No. 0337367

Subject: Written Demonstration – Responses to Potential Statistically Significant Increases
Calaveras Power Station
San Antonio, Texas

Dear Mr. Malone:

Executive Summary

Title 40, Code of Federal Regulations, Part 257 (40 CFR §257) (a.k.a. the Coal Combustion Residual (CCR) Rule) was published in the Federal Register in April 2015 and became effective in October 2015. The CCR Rule allows for continued beneficial use of all CCR. CPS Energy operates active surface impoundments and a landfill primarily for temporary storage and historically for disposal of fly ash and bottom ash.

One of the many requirements of the CCR Rule was for CPS Energy to determine if there are impacts to groundwater from any of the surface impoundments and landfill at the Calaveras Power Station that contain CCR, and post the determination to its website by January 31, 2018. As required by the CCR Rule, eight rounds of groundwater sampling were completed by October 17, 2017. The evaluation of the groundwater sample results indicated a potential statistically significant increase (SSI) for a limited number of constituents from the Evaporation Pond (EP), Fly Ash Landfill (FAL), and Bottom Ash Ponds (BAPs). Groundwater sample results from the Sludge Recycling Holding (SRH) Pond did not indicate a potential SSI.

Based on the evidence provided in this Written Demonstration, no SSIs over background levels have been determined for any of the CPS Energy CCR units (EP, FAL, BAPs, and SRH Pond) and therefore, CPS Energy will continue with a detection monitoring program.

Introduction

CPS Energy owns and operates the Calaveras Power Station that consists of two power plants (J.T Deely and J.K. Spruce) that are subject to regulation under the CCR Rule. Currently, CPS Energy operates four CCR units at the Power Station: Evaporation Pond (EP), Fly Ash Landfill (FAL), Bottom Ash Ponds (BAPs), and the Sludge Recycle Holding (SRH) Pond. For the purpose of this Written Demonstration, the EP and FAL are collectively referred to as "Northern CCR Units". An *Annual Groundwater Monitoring and Corrective Action Report* was submitted for each of these CCR units. The *Annual Groundwater Monitoring and Corrective Action Reports* indicated that a potential statistically significant increase (SSI) over background levels was determined for one or more Appendix III constituents from monitoring wells associated with the EP, FAL, and BAPs. A potential SSI over background levels was not determined from monitoring wells associated with the SRH Pond.

According to the CCR Rule [§257.94(e)], if the owner or operator of a CCR unit determines there is a SSI over background levels for one or more Appendix III constituents, the owner or operator may demonstrate that a source other than the CCR unit caused the SSI over background levels or that the SSI resulted from error in sampling, analysis, statistical evaluation or natural variation in groundwater quality. The CCR Rule also indicates that the owner or operator must complete the written demonstration within 90 days of detecting a SSI over the background levels. If a successful demonstration is completed within the 90-day period, the owner or operator may continue with a detection monitoring program. If a successful demonstration is not completed within the 90-day period, the owner or operator must initiate an assessment monitoring program.

Groundwater Quality – General Comments

Several groundwater monitoring wells were installed in the northern portion of the property prior to the construction of the Northern CCR Units (EP was initially constructed as a landfill in 1990 and later converted to the surface impoundment in 1996 and the FAL was constructed in 1992). For the purpose of this Written Demonstration, the groundwater monitoring wells installed before the CCR units were constructed are termed "pre-existing monitoring wells". Groundwater monitoring results from the pre-existing monitoring wells were evaluated to compare background water quality and spatial and temporal variability as it relates to potential SSIs. In general, between 1988 and 1992, there was considerable variability in the concentrations in the wells. For example, TDS concentrations ranged from less than 500 mg/L to 9,000 mg/L and pH values ranged between 3.0 and 7.0 standard units (SU) with no apparent pattern in location, screened interval, or sample timing. Spatial variability was also observed at monitoring wells located upgradient from the Northern CCR Units, both before and after these CCR units were constructed. Note that several of the pre-existing monitoring wells are being used in the current groundwater monitoring system/monitoring well network.

Evaporation Pond (EP)

The downgradient monitoring well results from the October 2017 sampling event were used for comparison to historical data. Upper Prediction Limits (UPLs) and Lower Prediction Limits (LPLs) were calculated in the *Annual Groundwater Monitoring and Corrective Action Report* for the purpose of determining a potential SSI over background levels. Downgradient monitoring well results determined to be a potential SSI (i.e., greater than the UPLs or less than the LPLs) are shown in Table 1. A potential SSI was not determined in any other monitoring well associated with the EP.

TABLE 1. EP Downgradient Results Exceedances

Analyte	Well	LPL	UPL	Sample Date	Value	Unit
Fluoride	JKS-36	--	0.465	2017-10-11	1.32	mg/L
pH	JKS-36	5.68	6.75	2017-10-11	3.24	SU

All initial exceedances of the UPL and LPL were confirmed with re-testing of JKS-36 in January 2018 per the 1-of-2 re-testing scheme.

As shown in Figure 1, fluoride concentrations in JKS-36 from 1988 to 1992 fluctuated between approximately 0.6 and 1.5 mg/L, with no apparent pattern or significant increasing or decreasing trend. The concentrations of fluoride detected in JKS-36 during the initial CCR monitoring period were within this range and appear to be naturally occurring. There is no apparent correlation to screened depth, lithology, or proximity to the unit, and the concentrations reflect natural variability of this constituent.

As shown in Figure 1, data collected in JKS-36 from 1988 to 1992 indicate what should be considered stable background conditions prior to the unit being in long term use, with pH values fluctuating between approximately 3.2 and 4.6 SU. The pH values measured in JKS-36 during the initial CCR monitoring period were within this range and appear to be naturally occurring. In addition, as shown on Figure 2, three other monitoring wells in the northern portion of the property (JKS-31, JKS-40, and JKS-43) have similarly low pH values. There is no apparent correlation to screened depth, lithology, or proximity to the unit, and the values reflect natural variability of this constituent. Furthermore, pH values measured in water within the EP in January 2018 ranged between 8.86 and 9.24 SU, so the expectation would be that a release from the EP would also be alkaline.

Fly Ash Landfill (FAL)

The downgradient monitoring well results from the October 2017 sampling event were used for comparison to historical data. UPLs and LPLs were calculated in the *Annual Groundwater Monitoring and Corrective Action Report* for the purpose of determining a potential SSI over background levels. Downgradient monitoring well results determined to be a potential SSI (i.e., greater than the UPLs or less than the LPLs) are shown in Table 2. A potential SSI was not determined in any other monitoring well associated with the FAL.

TABLE 2. FAL Downgradient Results Exceedances

Analyte	Well	LPL	UPL	Sample Date	Value	Unit
Calcium	JKS-33	--	450	2017-10-10	531	mg/L
Chloride	JKS-33	--	314	2017-10-10	666	mg/L
Chloride	JKS-60	--	314	2017-10-10	352	mg/L
pH	JKS-31	4.02	6.73	2017-10-10	3.98	SU
pH	JKS-46	4.02	6.73	2017-10-10	3.20	SU

All initial exceedances of the UPL and LPL were confirmed with re-testing of JKS-31, JKS-33, JKS-46, and JKS-60 in January 2018 per the 1-of-2 re-testing scheme.

The apparent elevated concentrations of calcium and chloride measured in JKS-33 and JKS-60 are consistent with historical results of monitoring wells in the vicinity of the FAL before the unit was constructed and appear to be naturally occurring. As shown in Figure 3, calcium concentrations in JKS-33 have fluctuated between approximately 300 and 1,400 mg/L since monitoring began in 1988, with no significant change in concentrations since construction of the FAL. As also shown in Figure 3, chloride concentrations in JKS-33 have decreased from approximately 1,600 to less than 800 mg/L since monitoring began in 1988.

As shown in Figure 2, data collected in JKS-31 from 1988 to 1992 indicate stable background conditions, with pH values fluctuating between approximately 2.8 and 5.0 SU. The pH values measured in JKS-31 and JKS-46 during the initial CCR monitoring period were within this range and appear to be naturally occurring. As mentioned above, and as also shown in Figure 2, three other monitoring wells in the northern portion of the property (JKS-36, JKS-40, and JKS-43) have similarly low pH values. There is no apparent correlation to screened depth, lithology, or proximity to the unit, and the values reflect natural variability of this constituent.

Note: The FAL is primarily used for storage of fly ash prior to offsite beneficial use.

Bottom Ash Ponds (BAPs)

The downgradient monitoring well results from the October 2017 sampling event were used for comparison to historical data. UPLs and LPLs were calculated in the *Annual Groundwater Monitoring and Corrective Action Report* for the purpose of determining a potential SSI over background levels. Downgradient monitoring well results determined to be a potential SSI (i.e., greater than the UPLs or less than the LPLs) are shown in Table 3. A potential SSI was not determined in any other monitoring well associated with the BAPs.

TABLE 3. BAPs Downgradient Results Exceedances

Analyte	Well	LPL	UPL	Sample Date	Value	Unit
Fluoride	JKS-48	--	0.857	2017-10-10	1.22	mg/L
Fluoride	JKS-55	--	0.857	2017-10-10	0.864	mg/L
Boron	JKS-50R	--	3.52	2017-10-10	4.54	mg/L

All initial exceedances of the UPL were confirmed with re-testing of JKS-48, JKS-50R, and JKS-55 in January 2018 per the 1-of-2 re-testing scheme.

As shown on Figure 4, historical results from monitoring wells located upgradient of the Northern CCR Units, before and after the CCR units were constructed, indicate fluoride concentrations fluctuating between approximately 0.2 and 4.2 mg/L. The apparent elevated concentrations of fluoride detected in JKS-48 and JKS-55 during the initial CCR monitoring period are within the range of concentrations historically detected in these other monitoring wells, and appear to be naturally occurring.

Boron concentrations detected in the monitoring wells located near the BAPs range from approximately 0.6 and 4.7 mg/L. While the highest boron concentration detected exceeds the UPL for the BAPs, background monitoring wells for the BAPs and other monitoring wells located in the northern portion of the property have boron concentrations within the same order of magnitude. These boron concentrations in the monitoring wells located in the northern portion of the property reflect the natural variability in groundwater quality before the CCR units were constructed.

For comparison, a study of groundwater contamination from coal power plants across the southeast United States documented a 1 to 2 order of magnitude increase in boron concentrations between background and affected monitoring wells (Harkness et al., 2016). The detections in the wells in the study had boron concentrations of 1 to 6 mg/L, compared to background levels ranging from non-detect to 0.04 mg/L. Another study of affected groundwater from a CCR site in Indiana (Buszka et al., 2007) documented a 2 to 3 order of magnitude increase in boron concentrations between background and affected monitoring wells.

In addition, the statistical analysis shows that no other Appendix III constituents are elevated above background concentrations. If the elevated boron concentration was associated with a release, other elevated Appendix III constituent concentrations would also be expected (Milligan and Ruane, 1980).

Finally, the concentration of boron within the BAPs was considered with respect to concentrations in the surrounding monitoring wells. During two sampling events in February 2018, grab samples of effluent water from the BAPs had reported boron concentrations of 1.03 mg/L and 1.16 mg/L. Because boron is concentrated in coal ash compared to the original coal (Openshaw, 1992), and because boron is one of the more easily leached constituents in coal ash (Izquierdo and Querol, 2012), a low concentration of boron in the effluent indicates that the leachable boron concentration in the bottom ash is relatively low. In February 2018, a grab sample of the bottom ash that is being sent to the BAPs had a boron concentration of 122 mg/kg, and the toxicity characteristic leaching procedure (TCLP) analysis on this same sample had a boron concentration of 1.1 mg/L. The concentration of boron in the effluent and the leachable concentration of boron in the bottom ash are less than the concentration in JKS-50R.

Summary

EP – The concentrations of constituents associated with potential SSIs (fluoride and pH) appear to be naturally occurring and reflect natural variation in groundwater quality in the vicinity of the CCR unit.

FAL – The concentrations of constituents associated with potential SSIs (calcium, chloride, and pH) appear to be naturally occurring and reflect natural variation in groundwater quality in the vicinity of the CCR unit.

BAPs – The concentrations of constituents associated with potential SSIs (fluoride and boron) appear to be naturally occurring and reflect natural variation in groundwater quality in the vicinity of the CCR unit. In addition, if the boron concentration was associated with a release, other elevated Appendix III constituents would be expected and the expectation would be that the detected boron concentration would be lower based on the effluent water and bottom ash analyses.

Conclusions

Based on the evidence provided in this Written Demonstration, no SSIs over background levels have been determined for any of the CPS Energy CCR units (EP, FAL, BAPs, and SRH Pond) and therefore, CPS Energy will continue with a detection monitoring program.

References

Buszka, P. M., J. Fitzpatrick, L. R. Watson, and R. T. Kay. 2007. Evaluation of Ground-Water and Boron Sources by Use of Boron Stable-Isotope Ratios, Tritium, and Selected Water-Chemistry Constituents near Beverly Shores, Northwestern Indiana, 2004. U.S. Geological Survey Scientific Investigations Report Series 2007-5166.

Harkness, J. S., B. Sulkin, and A. Vengosh. 2016. Evidence for Coal Ash Ponds Leaking in the Southeastern United States. Environmental Science and Technology, v. 50 no. 12, p 6583-6592.

Izquierdo, M. and X. Querol. 2012. Leaching behaviour of elements from coal combustion fly ash: An overview. International Journal of Coal Geology. v. 94., p. 54-66.

Milligan, J. D. and R. J. Ruane. 1980. Effects of Coal-ash Leachate on Ground Water Quality. USEPA Interagency Energy/Environment R&D Program Report, EPA-600/7-80-066.

Openshaw, S. C. 1992. Utilization of Coal Fly Ash. MS Thesis. University of Florida.

Certification

Certification from a qualified professional engineer verifying the accuracy of the information provided in this Written Demonstration is provided in Attachment 1.

We appreciate the opportunity to work with you on this project. Please contact me if you should have any questions.

Sincerely,

Environmental Resources Management

Melissa Boysun, P.G.

Texas Professional Geoscientist No. 11387

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Figures

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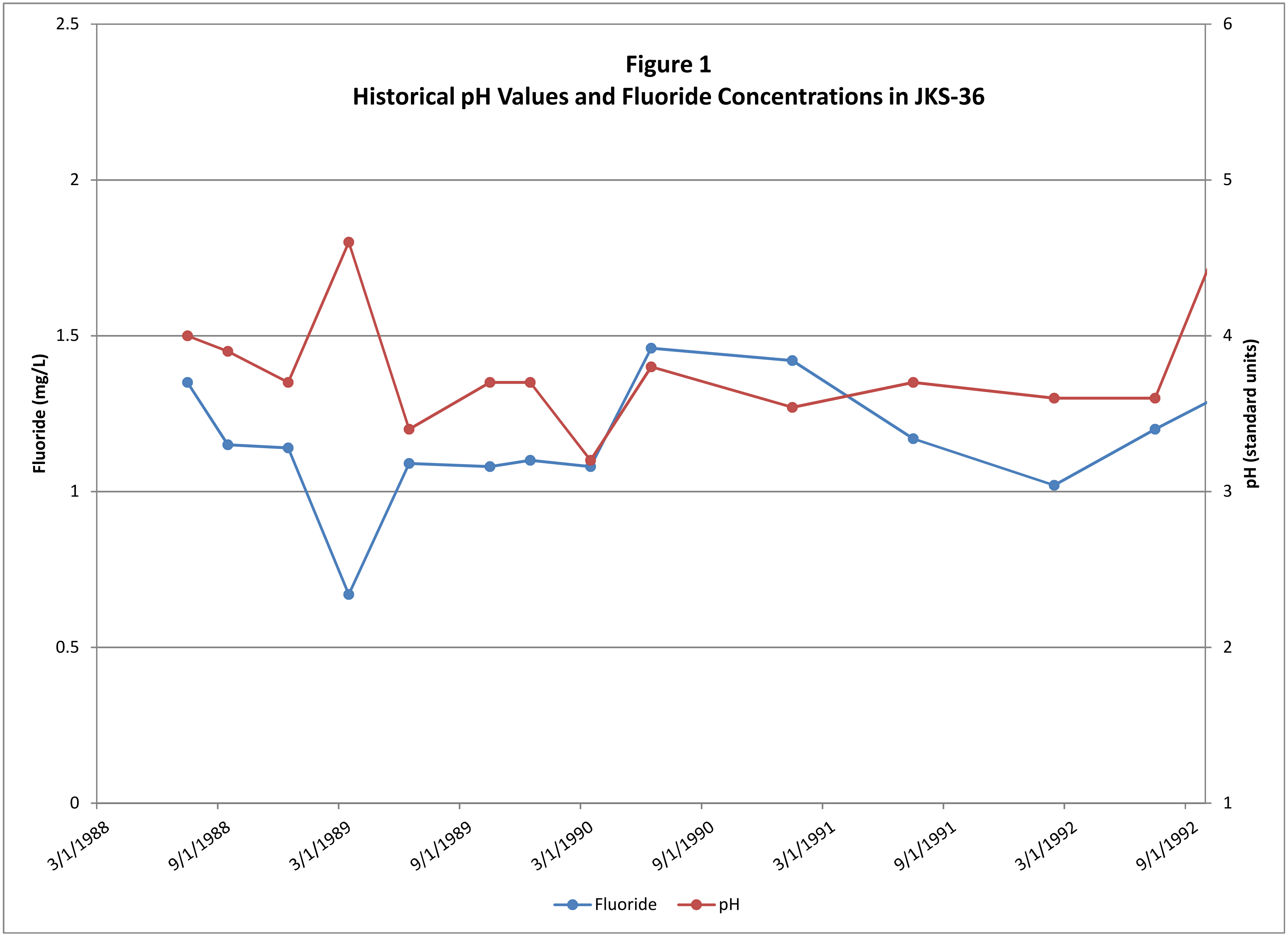

Figure 1
Historical pH Values and Fluoride Concentrations in JKS-36
Fluoride (mg/L)
pH (standard units)
2.5
2
1.5
1
0.5
0
6
5
4
3
2
1
3/1/1988
9/1/1988
3/1/1989
9/1/1989
3/1/1990
9/1/1990
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9/1/1992
Fluoride
pH

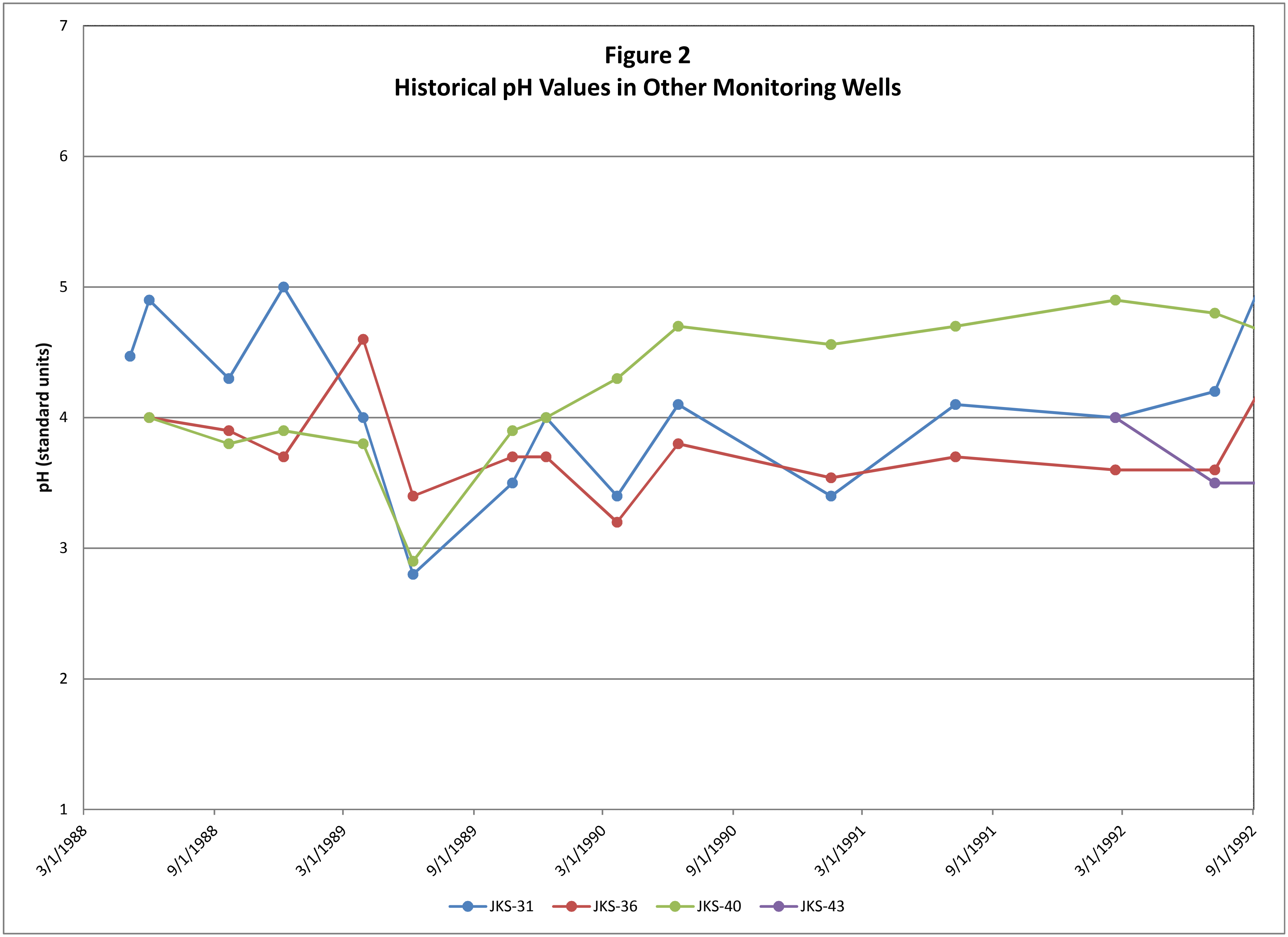
Figure 2
Historical pH Values in Other Monitoring Wells
pH (standard units)
7
6
5
4
3
2
1
3/1/1988
9/1/1988
3/1/1989
9/1/1989
3/1/1990
9/1/1990
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JKS-36
JKS-40
JKS-43

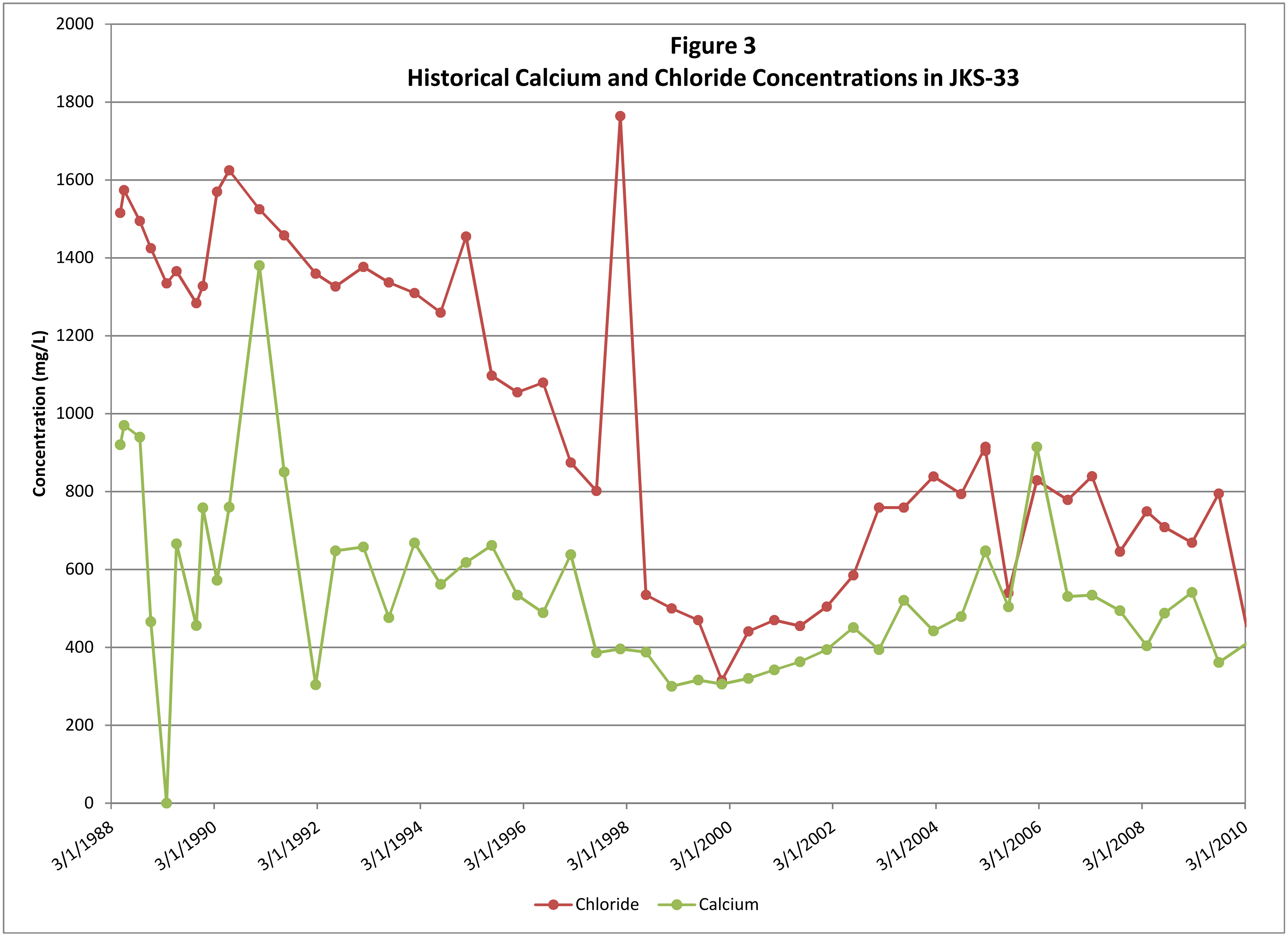

Figure 3
Historical Calcium and Chloride Concentrations in JKS-33
Concentration (mg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
3/1/1988
3/1/1990
3/1/1992
3/1/1994
3/1/1996
3/1/1998
3/1/2000
3/1/2002
3/1/2004
3/1/2006
3/1/2008
3/1/2010
Chloride
Calcium

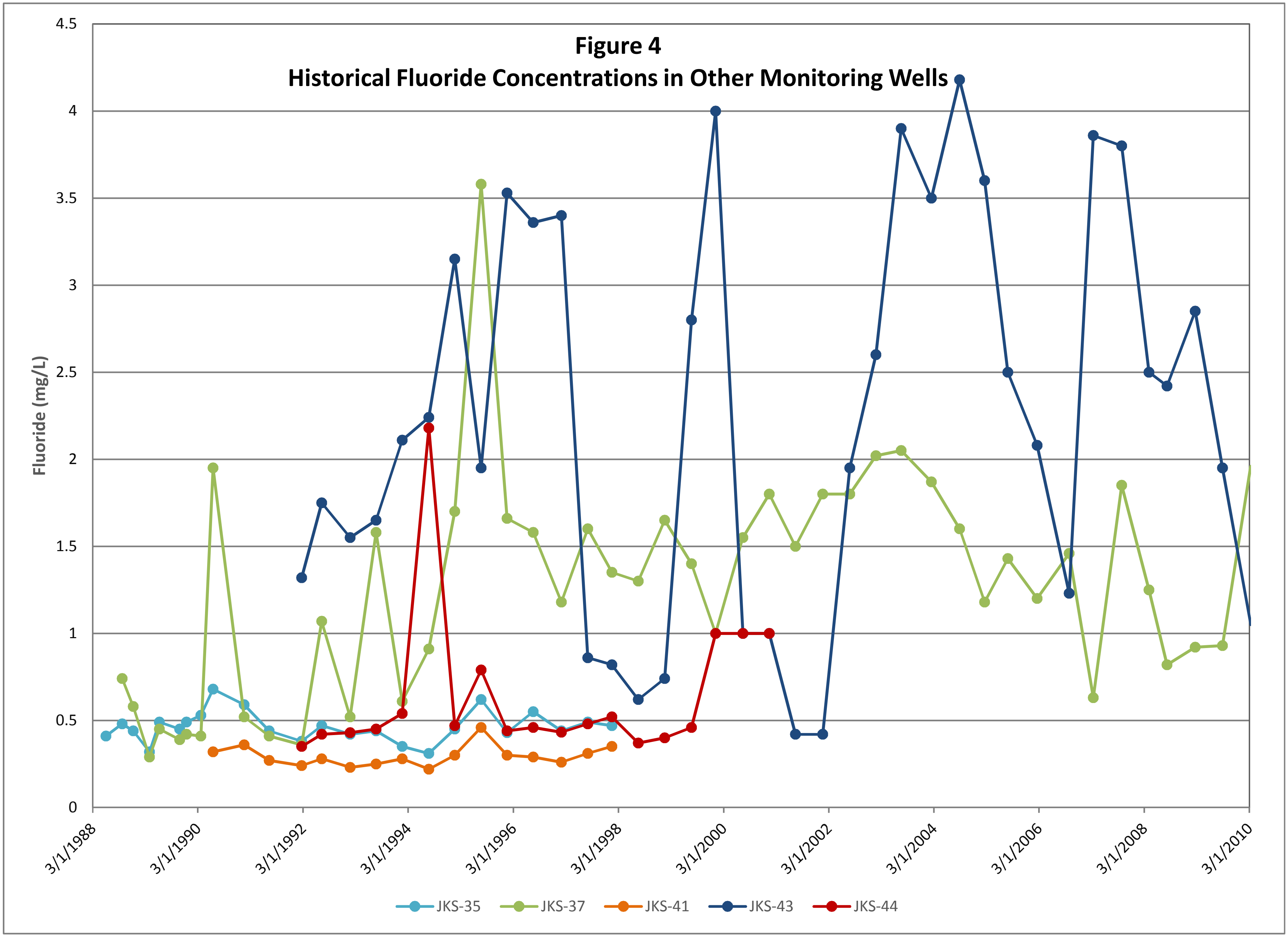
Figure 4
Historical Fluoride Concentrations in Other Monitoring Wells
Fluoride (mg/L)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
3/1/1988
3/1/1990
3/1/1992
3/1/1994
3/1/1996
3/1/1998
3/1/2000
3/1/2002
3/1/2004
3/1/2006
3/1/2008
3/1/2010
JKS-35
JKS-37
JKS-41
JKS-43
JKS-44

Certification

Attachment 1

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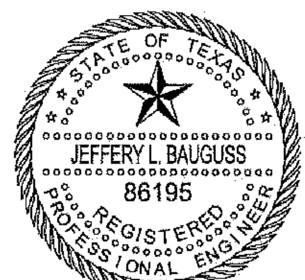
WRITTEN DEMONSTRATION CERTIFICATION

Calaveras Power Station
San Antonio, Texas
CPS Energy

CERTIFICATION

I hereby verify the accuracy of the information provided in this Written Demonstration in accordance with the requirements of 40 CFR §257.94(e)(2).



4/4/18

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