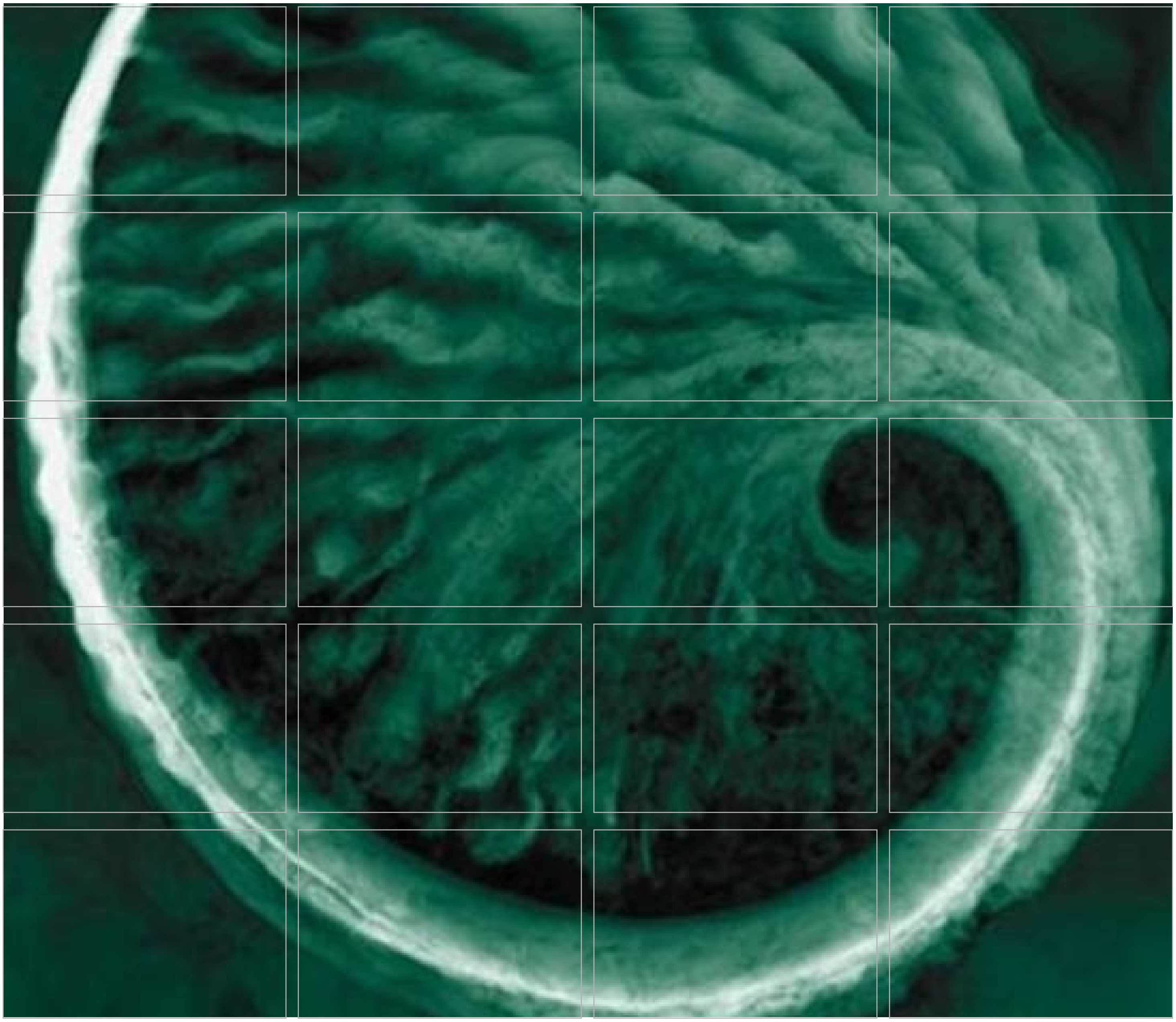

Groundwater Sampling and Analysis Program

CPS Energy
Calaveras Power Station
San Antonio, Texas

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Groundwater Sampling and Analysis Program

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APPENDICES

1.0 INTRODUCTION

CPS Energy owns and operates the Calaveras Power Station which consists of two power plants (J.T Deely and J.K. Spruce) that are subject to regulation under Title 40, Code of Federal Regulations, Part 257 (40 CFR §257) (a.k.a. the CCR Rule). The Power Station is located in unincorporated Bexar County, Texas, approximately 13 miles southeast of San Antonio. Currently, CPS Energy operates five CCR units at the Power Station which are subject to the CCR Rule:

- Sludge Recycle Holding (SRH) Pond,
- North Bottom Ash Pond (BAP),
- South BAP,
- Evaporation Pond (EP), and
- Fly Ash Landfill (FAL).

This Sampling and Analysis Program (SAP) describes the methods and procedures to be used for conducting groundwater monitoring at the Calaveras Power Station CCR Units. This SAP is subject to periodic revision as circumstances and/or new regulations dictate. Revisions to the SAP must be approved by a qualified professional engineer before placed in effect. The most up-to-date version of the SAP shall be kept in the Operating Records for use by CPS Energy and subcontractor personnel.

For the purposes of this SAP, the SRH Pond and BAPs are termed the Southern CCR Units and the EP and FAL are termed the Northern CCR Units. Even though the SRH Pond and the BAPs are in close proximity, two separate monitor well networks will be used to monitor the groundwater in the vicinity of these two Southern CCR Units. Due to the horizontal distance between the EP and FAL, two separate monitor well networks will be used to monitor groundwater in the vicinity of these two Northern CCR Units.

1.1 OBJECTIVES AND PURPOSE

The objective of the groundwater monitoring program is to provide analytical data for groundwater collected from monitor wells as required by the CCR Rule (40 CFR §257.90-257.98). The SAP describes the procedures and techniques associated with the following:

- Pre-field activities,
- Record keeping and chain-of-custody,
- Well assessment prior to purging,
- Groundwater sampling procedures,
- Decontamination and waste management,
- Sample packing and shipping,

- Analytical procedures, and
- Quality assurance.

The purpose of the sampling protocol described herein is to provide the basis for sampling consistency and scientific credibility in obtaining the desired analyses. Groundwater sampling will be conducted in general accordance with applicable procedures established in the *RCRA Groundwater Monitoring: Technical Enforcement Guidance Document* (*TEGD*) (EPA 530-R-93-001, November 1992 and subsequent updates).

1.2 GROUNDWATER MONITOR WELL NETWORKS

Monitor well networks have been installed for all the CCR Units as required by 40 CFR §257.91. Even though the SRH Pond and the BAPs are in close proximity, two separate monitor well networks will be used to monitor the groundwater in the vicinity of these two Southern CCR Units. Due to the horizontal distance between the EP and FAL, two separate monitor well networks will be used to monitor groundwater in the vicinity of these two units. Each monitor well network includes a sufficient number of wells installed in the uppermost aquifer to represent the quality of background groundwater quality (upgradient of the CCR Units), and a sufficient number of wells downgradient of the CCR Units capable of yielding samples representative of constituents passing the waste boundaries.

The locations of monitor well networks are provided in **Figure 1**. Well function information is provided in **Table 1**.

In addition to groundwater monitor wells that comprise the monitor well networks, there are several wells at the Power Station that will be utilized as water level wells to assess groundwater elevations only.

1.3 SAMPLING FREQUENCY AND MONITORING PROGRAMS

<u>Initial Monitoring Period (Prior to October 17, 2017)</u>
Per the CCR Rule, for existing CCR landfills and surface impoundments, CPS Energy must provide analytical data from a minimum of eight independent samples from each background (upgradient) and downgradient well no later than October 17, 2017. Samples must be analyzed for the constituents listed in Appendix III *(Detection Monitoring Constituents*) and Appendix IV (*Assessment Monitoring Constituents*) of the CCR Rule. Detection Monitoring Constituents and Assessment Monitoring Constituents are identified in **Table 2** and **Table 3**, respectively.

<u>Detection Monitoring</u>
A Detection Monitoring Program must be implemented consistent with 40 CFR §257.94. After the initial monitoring period, at a minimum, the Detection Monitoring Program sampling events will be conducted on a semi-annual basis, for the constituents listed in **Table 2** (Detection Monitoring Constituents). This

sampling is done during the active life of the CCR Units and the post-closure period, if applicable.

Assessment Monitoring

After the initial monitoring period, Assessment Monitoring is required whenever a statistically significant increase over background constituent concentrations has been determined for one or more of the constituents listed in **Table 2** (Detection Monitoring Constituents). Sampling must be conducted within 90 days of triggering an Assessment Monitoring Program for the constituents listed in **Table 3 (**Assessment Monitoring Constituents). Within 90 days of receiving the results, and on a semiannual basis thereafter, all wells must be sampled for the constituents listed in **Table 2** and **Table 3**. Groundwater protection standards must also be established of all constituents detected.

Corrective Actions

If any constituent listed in **Table 3** is detected at a statistically significant concentration exceeding the groundwater protection standard defined in 40 CFR §257.95 (or immediately upon detection of a release from a CCR unit), an assessment of corrective action measures consistent with 40 CFR 257.96 must be undertaken.

1.4 STATISTICAL METHOD SELECTION

In accordance with 40 CFR §257.93(f), an appropriate statistical method must be selected to evaluate analytical results. Potential methods that could be selected to evaluate analytical results are as follows:

1. A parametric analysis of variance followed by multiple comparison procedures to identify statistically-significant evidence of contamination (this method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent).
2. An analysis of variance based on ranks followed by multiple comparison procedures to identify statistically-significant evidence of contamination (this method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent).
3. A tolerance or prediction interval (PI) procedure in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance or upper prediction limit (UPL).
4. A control chart approach that gives control limits for each constituent.
5. Another statistical method that meets the performance standards of 40 CFR §257.93, paragraph (g).

For the evaluation of these CCR units, a PI approach will be used. This approach is consistent with all of the requirements in the CCR Rule and the USEPA Unified Guidance (2009). The PI approach is the most strongly recommended because it allows the analyst to establish an acceptable site-wide false positive rate and provides a retesting strategy to minimize false positive results.

A decision framework was developed to optimize the PI approach and to guide stakeholders through the analytical process and to ensure that all the performance criteria are met. The decision framework is provided as **Figure 2**. The primary components of the decision framework include 1) establishing the background (upgradient) dataset and calculating an UPL for the downgradient dataset.

1) Concentrations measured in background wells are used as a basis for comparison to support decisions related to whether the CCR unit is impacting groundwater. This background dataset will be established after reviewing the statistical assumptions for UPLs including:
    - Statistically independent measurements,
    - Spatial stationarity,
    - Verification of detection rate and data distribution for each data set,
    - Accounting for possible outliers, and
    - Temporal stationarity.
2) Background data are used to construct a concentration limit which is then compared to one or more observations from a compliance point (downgradient) population. The acceptable range of concentrations includes all values greater than the prediction limit. To meet performance criteria, UPLs will be constructed with 95% confidence, a 1-of-2 retesting scheme, and an annual site-wide false positive rate of 0.1.

In the final stage of the approach, the background UPL is compared to each downgradient well concentration. Each sampling event will provide downgradient well concentrations that will be compared to the calculated UPLs. If the most recent downgradient well concentration is below the UPL, the test is complete and no further samples need to be collected. If the most recent concentration exceeds the calculated UPL, then the following options may be executed to determine whether a statistically significant increase has occurred:

- Examination of outside factors influencing the concentrations, and
- Resampling and retesting.

Certification from a qualified professional engineer stating that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR units is provided in **Appendix A**.

2.0 *PRE-FIELD ACTIVITIES*

At the beginning of each groundwater monitoring event, the necessary field equipment will be obtained. An example equipment list is provided in **Appendix B**.

Sampling personnel (CPS Energy personnel and/or subcontractors) must comply with all safety and health guidelines for the Power Station.

The levels of personal protective equipment (PPE) to be used for work tasks will be selected based on known or anticipated physical hazards, as well as the types, concentrations and exposure routes of contaminants that may be encountered on site. Currently, it is anticipated that work will be initially conducted in Level D PPE. PPE levels will be upgraded or downgraded based on a change in site conditions. Hazards will be reassessed when a significant change in site conditions occurs.

3.0 RECORD KEEPING AND CHAIN-OF-CUSTODY

This section of the SAP provides information on field recording, field instrument calibration, and chain-of-custody procedures.

3.1 FIELD RECORDING

Documentation of activities associated with groundwater monitoring events will be recorded each day in a bound field logbook with hard cover, water resistant paper, and sequentially numbered pages. Documentation will be completed in waterproof, black or blue ink and written errors will be crossed out with a single line, initialed, and dated. The logbooks will remain on-site during use and then will be stored off-site. Entries in the logbook will be chronological and will include, where applicable and appropriate, such information as the following:

- Date and times,
- Locations of particular events,
- Instrument calibrations,
- Weather (temperature and wind direction) and significant changes in climatic conditions that may affect monitoring activities or results, and
- Other information/observations pertinent to the well inspection, well gauging, and sampling event.

Each page of the field logbook will be signed by the person(s) making entries in the logbook.

Three separate field report forms have been developed as an extension to the field logbook. These include the following:

- Monitor Well Inspection Record (**Form 1**),
- Monitor Well Gauging Record (**Form 2**), and
- Monitor Well Sampling Record (**Form 3**).

These forms (or equivalent) may be used for recording water level data, well purging volumes, and sampling data. The field report forms or logbook may include, but not be limited to the following:

- Names of members of the gauging or sampling team,
- Date and time,
- Specific activity being performed,
- Well identification,
- Sample identification number,
- Sample volume,
- Sampling method,

- Preservative type,
- Analyses to be performed, and
- Measured field water quality parameters and readings (when applicable).

3.2 FIELD INSTRUMENT CALIBRATION

The following meters/probes will be used to analyze groundwater samples in the field:

- Temperature and pH,
- Specific conductance (SC),
- Oxidation-reduction potential (ORP),
- Dissolved oxygen (DO), and
- Turbidity.

The quality of data generated by these measurements will be verified through qualitative means, such as regular calibrations, compliance with operating instructions, and decontamination between uses. A calibration procedure establishes the relationship between a known calibration standard and the accuracy of a measurement made by an instrument according to that standard. Calibration indicates absolute physical or electronic calibration and is not to be confused with chemical standardization.

The calibration for field monitoring equipment will be checked in accordance with manufacturer's specifications, but at least daily. Instrument calibration may be checked prior to entering the site or in the field prior to use. The time, date, and location of instrument calibration and verification will be recorded in the field logbook. If an instrument is out of calibration, then the calibration will be performed as needed.

3.3 CHAIN-OF-CUSTODY

Possession of samples will be traceable from the time of sample collection through check-in at the laboratory. Documentation begins immediately following sample collection and proper labeling and is accomplished using a standard chain-of-custody form. This document traces possession of each sample from the time of collection through time of analysis. For the purpose of these procedures, a sample is considered in custody if it is:

- In sampler's physical possession;
- In view, after being in physical possession;
- Locked to prevent tampering, after having been in physical possession; or
- In a secured area, restricted to authorized personnel.

The chain-of-custody form contains the following information:

- Project number, site name, and company address;
- Number of samples;
- Preservatives used for sample collection;
- Sample description (*e.g.*, water, etc.);
- Sample ID number;
- Date and time of sample collection;
- Number of containers for the sample;
- Name of sampler responsible for sample transmittal;
- Signatures of all persons involved in the chain-of-custody;
- Type of analysis requested;
- Requested turnaround time and level of quality control documentation; and
- Pertinent comments about sample or sample conditions.

This information is entered onto the chain-of-custody form. Upon receipt of samples, the analytical laboratory will initiate its own chain-of-custody procedures.

The sampler shall be responsible for properly packaging and dispatching samples to the analytical laboratory (see Section 6.0). When transferring samples, the sampler shall sign and record the date and time on the first *Relinquished By* line on the chain-of-custody form. The person to whom custody is being transferred shall sign on the first *Accepted By* line of the chain-of-custody form, indicating that custody is being accepted by that person for all the samples listed on the sheet. When samples are shipped via courier, the chain-of-custody form is attached to the inside of the shipping container and the shipping container is sealed using tape. For subsequent transfers of custody, the succeeding *Relinquish* and *Receipt* lines are used. To reduce custody records, the number of custodians in the chain-of-custody is minimized.

The following record keeping items will supplement the chain-of-custody form:

- Field Logbook,
- Monitor Well Sampling Record, and
- Sample Receipt Checklist (typically provided by the laboratory).

4.0 *WELL ASSESSMENT PRIOR TO PURGING*

This section of the SAP provides information about inspecting monitor wells, gauging fluid levels, and weather conditions. To reduce potential cross-contamination during fluid level measurements, one of the following two options are recommended:

1. Activities begin at the upgradient wells and then proceed to downgradient wells, with water that is *potentially affected*; or
2. Each well sampling team carries dedicated well gauging equipment (one set for *potentially affected* wells and one set for non-affected wells). The determination as to which equipment is used at a particular well should be based on historical data.

As required, PPE will be worn at all times during the performance of the described procedures.

4.1 *MONITOR WELL INSPECTION*

The sampling team shall perform a visual inspection of each monitor well and record the results in the field logbook or on a Monitor Well Inspection Record (**Form 1**). The inspection of each well will include the following:

- Inspecting the casing and cap for cracks, signs of deterioration, or tampering;
- Verifying the identification information on the well is correct and clearly visible;
- Determining whether the cap and monitor well are secure (via locks, bolted vault covers, in addition to general facility security);
- Inspecting the well pad for cracks, signs of deterioration, erosion, settling, and/or animal and insect burrowing; and
- Where appropriate, inspecting any dedicated equipment for signs of cleanliness, structural integrity, and deterioration.

4.2 *WATER LEVEL AND TOTAL DEPTH INFORMATION*

The depth to groundwater (DTW) and total depth (TD) in each well will be measured at the beginning of each sampling event before undertaking any purging or sampling activities and will be recorded in the field log book or on a Monitor Well Gauging Record (**Form 2**). The distance from the designated measuring point at the top-of-casing (TOC) to the water surface will be measured to the nearest 0.01-foot with an electric water level indicator. The designated measuring point is typically a notched "V" cut or black square on the PVC casing. In the event that a measuring point has not been designated, measurements including DTW and TD will be taken from the TOC on the true north side of the well.

Total well depth will be measured by allowing the probe to drop to the bottom of the well and determining the depth where the tape becomes slack. The reading will be recorded to the nearest 0.01-foot. These measurements will be compared with previous measurements and the original well depth to determine if sediment has accumulated within the screened interval, (*i.e.*, "silted in"). Wells which have sediment in the screened interval will be redeveloped.

See Section 9.0 for equipment decontamination procedures, investigation-derived waste (IDW) management, and IDW sampling.

4.3 WEATHER CONDITIONS

Weather conditions at the time of gauging/sampling activities (*e.g.*, precipitation, temperature, wind speed and direction) will be recorded in the field logbook or the Monitor Well Sampling Record (**Form 3**).

5.0 GROUNDWATER SAMPLING PROCEDURES

This section of the SAP provides information about purging and sampling groundwater collected from monitor wells. During the last 10 years, the method of micropurging (*i.e.*, low-flow/minimal drawdown sampling) has gained favored status and acceptability in the regulated community. As a result, micropurging will be the preferred method of sampling for all the monitor wells at the Power Station.

For purging and sampling of groundwater it is recommended that activities begin at the upgradient wells and then proceed to downgradient wells, with water that are *potentially affected*. As required, PPE will be worn at all times during the performance of the described procedures.

5.1 MICROPURGING OF WELLS

To establish a common point of reference, low-flow refers to the flow rate at which water enters the pump intake and is the rate that is imparted to the formation pore water in the immediate vicinity of the well screen. The pump intake should be set:

1. Just above the mid-point of the screened interval if the transmissive zone is thicker than the screened section; or
2. Mid-point of the transmissive interval when the screened section is greater than the thickness of transmissive zone.

Water level drawdown provides the best indication of the stress (drawdown) imparted by a given flow rate for a given hydrogeological situation. Flow rates during low-flow purging will be used to regulate drawdown to less than 0.1 meter (0.3 feet). While these flow rates will typically range between 0.1 to 0.5 liter/minute (L/min), the flow rate for an individual well may vary due to site-specific hydrogeology. For example, sand channel lenses may support flow rates of up to 1 L/min without causing drawdown greater than 0.3 feet. Alternatively, wells that screen clayey, silty layers may not produce groundwater at 0.1 L/min without having drawdown greater than 0.3 feet.

For monitor wells with low water productivity that have drawdown greater than 0.3 feet, there are two possible situations:

- Drawdown is greater than 0.3 feet, but stabilizes at a level above the pump intake; or
- Drawdown continues to occur even at the slowest possible pumping rate (*e.g.,* using a peristaltic pump).

For these situations, the following purging and sampling procedures will be followed and documented on the sampling record.

- If drawdown is greater than 0.3 feet, but stabilizes at a level above the pump intake; record water levels in well and continue to monitor water quality indicator parameters until they stabilize. Collect groundwater sample upon stabilization of water quality indicator parameters.

- If drawdown is greater than 0.3 feet and continues to drop, then pump the well until the water level reaches the bottom of the screened interval. Stop pumping and allow recovery to a minimum of 80% of the original water level before collecting a groundwater sample using the same low flow rate. If the water level drops to the bottom of the screened section before all sample bottles have been filled, allow the well to recovery to a minimum of 80% of the original water level before continuing to fill the remaining sample bottles. If possible, the well should be sampled no more than 24 hours after the completion of purging, regardless of the recovery.

Groundwater samples will be collected from the monitor wells using the following low-flow (micropurge) procedures.

- Wells with DTW measurements less than 29 feet below TOC will be purged and sampled using a non-submersible peristaltic pump. Wells requiring a peristaltic pump for sample collection are listed in **Table 1.** Insert clean disposable polyethylene tubing into the well casing with the intake placed at the appropriate depth discussed above**.** Remember to include enough slack in tubing to allow for drawdown of the water level to the bottom of screen. Silicon tubing will be connected to the polyethylene tubing and threaded through the pumping apparatus on the peristaltic pump.
- Wells with DTW measurements greater than 29 feet below TOC will be purged and sampled using a submersible pump. Wells requiring a submersible pump for sample collection are listed in **Table 1.** The submersible pump should be fitted with clean disposable polyethylene tubing and the tubing inserted into the well with the intake placed at the appropriate depth discussed above.
- If dedicated polyethylene and silicon tubing were utilized and left in the monitor well from a previous groundwater sampling event, skip the first two bullets above. Before sampling, check tubing for any damage and replace as necessary using the above mentioned methodology.
- The selected pump will be used to purge groundwater at a low-flow rate, generally less than approximately 0.5 L/min (100-500 milliliter/min).
- The well should be pumped at a sustainable flow rate to allow the lowest drawdown of water level (see above) until water quality parameters stabilize or the water level drops below the bottom of the screened interval.
- Groundwater quality indicator parameters will be monitored during low-flow purging to determine stabilization. **Table 4** summaries the water quality indicator parameters to be monitored and their stability criteria.

Measurements of water quality indicator parameters will be recorded every 3 to 5 minutes until stabilization is achieved. These measurements, along with flow rate and depth to water, will be recorded be recorded in the field log book or on a Monitor Well Sampling Record (**Form 3**). Stabilization is achieved when at least 3 of the 5 parameters have stabilized for three successive readings. If the minimum three water quality indicator parameters do not stabilize within 45 minutes of low-flow purging, a groundwater analytical sample will be collected from the well.

See Section 9.0 for equipment decontamination procedures, IDW management, and IDW sampling.

5.2 SAMPLE COLLECTION

Groundwater will be collected from the well and transferred to the appropriate sampling containers in a manner that reduces the amount of exposure to the ambient environment. The sequence of sample collection will be as follows:

- Metals,
- Water Chemistry (cations, anions, TDS, pH, etc.), and
- Radioactive elements (if required).

All samples will be collected in clean, laboratory-supplied sample containers with the appropriate preservative for the analytical method.

Metals analysis will measure total recoverable metals, which captures both particulate and dissolved fractions. Groundwater samples **will not** be field-filtered prior to analysis. Samples will be collected and analyzed for constituents identified in a given groundwater monitoring program's list of analytes. Analytical parameter classes, container size and type, preservatives, and holding times (before which the analysis must be performed) are listed in **Table 5**. Any required preservatives will be added to the bottles by the laboratory prior to delivery to the sampling personnel.

A sample label will be affixed to each sample container. Complete the label on each sample container with the typical information:

- Project name,
- Sample identification (well ID),
- Date and time of collection,
- Sample type, requested analysis,
- Type of preservative (if any), and
- Sampler's initials.

Sampler shall record the sample ID, sampling procedure, date, and time of sample collection on the Monitor Well Sampling Record (**Form 3**) or field log book. Sampler shall record the sample ID (well ID), time and date of collection, sample media, and specified analyses to be conducted by the laboratory, if not already provided, on the chain-of-custody record. See Section 3.3 for details on sample custody information.

Sampler shall check that the sample container caps are tight; then place the filled sample containers into a sample cooler containing bagged ice in a manner to prevent breakage. The cooler will be packed with sufficient ice to maintain the proper preservation temperature. See Section 6.0 for details on sample packing and shipment.

After sampling is completed at a particular well, the tubing will be removed from the well and placed in an appropriate disposal container (See Section 9.0). The well will be secured before proceeding to the next well.

See Section 9.0 for equipment decontamination procedures, IDW management, and IDW sampling.

5.3 QUALITY CONTROL SAMPLING

Quality control (QC) and quality assurance (QA) samples will be collected and analyzed along with monitor well samples to assess the variability introduced in sampling, handling, shipping, and analysis. The analytical program for the QC samples will follow the analytical program for the associated investigative samples. The following sample types will be collected.

- **Blind Duplicate** - One duplicate sample will be collected at each CCR Unit for each sampling event; a total of three blind duplicates will be collected per event. The blind duplicate will be analyzed for identical parameters as the monitor well samples. The duplicate sample(s) will be collected from randomly selected wells; and will be labeled with an appropriate identification number other than the well number. The sample bottles for regular and duplicate analysis will be filled in alternate succession for each required analysis (e.g. fill the metals sample container, then the metals duplicate container). The identification number will be recorded in the field log book, or in a separate Monitor Well Sampling Record.
- **Matrix Spike/Matrix Spike Duplicates (MS/MSDs)** – One MS/MSD will be collected during each sampling event to test the potential effects of matrix interference on the laboratory results. To reduce the possible adverse impact to the laboratory equipment, wells selected for the MS/MSD samples will be those that historically have shown low or non-detect constituent concentrations (to the extent practical). The sample is collected as a triplicate (the original sample plus two additional sets). The matrix spike sample will be labeled with the well number followed by an "MS". Similarly, the matrix spike duplicate will be labeled with the well number followed by "MSD".
- **Field Blank** - One field blank sample will be collected at each CCR unit for each sampling event; a total of three field blanks will be collected per event. Field blank samples provide information about potential contamination of the samples during exposure to ambient conditions at the site during sample collection. Field blanks will be prepared at a specified well site by pouring commercially-available distilled water into sample bottles and vials in the

same quantities as the groundwater samples. The samples should be labeled appropriately and stored in the same manner as the groundwater samples.

- **Equipment Blank** – An equipment blank sample will be collected during the groundwater sampling event <u>only</u> if non-dedicated sampling equipment is used. After the non-dedicated equipment has been cleaned and rinsed (see Section 9.0 for decontamination procedures), distilled water will be passed over (*e.g.*, poured over) the decontaminated equipment and the water will be collected in appropriate sample containers. The equipment blanks will be analyzed for the same suite of parameters as the monitor well samples. Equipment blanks will not be collected if dedicated equipment is used for sample collection.

6.0 *SAMPLE PACKING AND SHIPPING*

Samples for chemical analyses will be placed into the correct laboratory-supplied sample containers, labeled appropriately, and immediately placed in a cooler with ice. The field sampler will document the appropriate information on the chain-of-custody form (see Section 3.3 for details). Prior to packing coolers and shipping to the laboratory, the outside surfaces of the sample containers will be cleaned if necessary (by wiping carefully with a paper towel) and repacked in the cooler. Sample containers will not be opened after they have been sealed. The containers will be placed inside a sealed plastic Ziploc-style bag and will then be placed in coolers containing sufficient ice (or packs of frozen gel) to maintain a sample temperature of approximately 4° C. Sample coolers should be lined with a new, large plastic trash bag to reduce the potential of melt water leaks. Care must be taken to avoid leakage of water from melted ice because overnight delivery service (*e.g.*, FedEx) will not accept leaking coolers.

The sampler will be responsible for properly packaging and dispatching samples to the analytical laboratory. This responsibility includes using the proper shipping container, shipping labels, shipping papers, and filling out, dating, and signing the appropriate portion of the chain-of-custody form. Samples will be packed with cushioning material sufficient to reduce the potential for breakage of glass sample containers during transport. The chain-of-custody form will be placed inside a sealed plastic Ziploc-style bag and the bag placed inside the cooler on top of the cushioning material.

If a laboratory with a local or nearby field-service center is contracted to perform analytical services, samples and coolers will be transported directly to the laboratory service-center or to a secure drop-off location by field personnel on the same day as sampling. The insulated coolers containing groundwater samples will be delivered to or picked-up by the laboratory and signed over to the laboratory personnel in accordance with chain of custody procedures for storage and analysis.

If a distant laboratory is contracted to perform analytical services, then samples and coolers will be shipped via overnight delivery service (*e.g.,* FedEx). Shipments will be accompanied by the chain-of-custody form and it will be sealed in an airtight, resealable plastic bag inside the cooler. The cooler will be taped shut with clear packaging tape and a tamper-evident custody seal will be attached across the lid. This seal will only be broken by the recipient at the laboratory.

7.0 ANALYTICAL PROCEDURES

Groundwater samples collected under the Detection Monitoring Program will be analyzed for the constituents specified in **Table 2**. Groundwater samples collected under the Assessment Monitoring Program will be analyzed for the constituents specified in **Table 2** and **Table 3**. IDW samples (further described in Section 9.0) will be analyzed for the constituents specified in **Table 6**. Analytical parameter classes, container size and type, preservatives, and holding times (before which the analysis must be performed) are listed in **Table 5** and **Table 7**. A NELAC-accredited laboratory will perform the groundwater analyses.

Groundwater analyses will be performed in accordance with the most recent edition of *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA SW 846), ASTM Standard Test Methods*, or other EPA-approved methods. Detection limits will be those recommended for the procedure and analytical instrument specified.

8.0 QUALITY ASSURANCE

This section briefly summarizes the quality assurance measures during field and laboratory activities associated with groundwater monitoring.

8.1 FIELD QUALITY ASSURANCE

Sample collection will be conducted according to the procedures outlined in Section 5.2. These procedures are designed to minimize potential sources of contamination and include the following key elements:

- Using dedicated or disposable tubing for each well to reduce the potential for cross-contamination between wells.
- Completing purging using low-flow (micropurge) sampling techniques. If the screened water-bearing unit has low hydraulic conductivity that results in drawdown greater than the guidelines for low-flow sampling, the well should be allowed to recover to at least 80 percent of the static water level prior to sampling.
- Using duplicates, matrix spikes, matrix spike duplicates, field blanks, and equipment blank samples to assess potential cross-contamination during sample collection, transport, and analysis as well as providing a check on the data quality from the laboratory (see Section 5.3).
- Handling samples, preservatives, and sample containers carefully to minimize exposure time and potential for evaporative loss and/or airborne contamination.
- Using containerized ice whenever possible to maintain 4°C sample temperatures during transit and cushioning materials to minimize breakage.

8.2 LABORATORY QUALITY ASSURANCE

The laboratory documentation system will comply with the requirements of the USEPA analytical protocols, as appropriate. The laboratory will perform internal QC checks for the analytical method. Depending on the analytical method, the QC checks may include analyzing sample spikes, surrogate spikes, reference samples, laboratory control samples, storage blanks, and/or method blanks.

The laboratory will document internally that instrument and analytical QC criteria have been met. The data package will contain all of the information required to evaluate compliance with the analytical methods' required and recommended QC checks, instrument tuning, calibration, and sample analysis. If errors or deficiencies are identified in an analytical system, corrective actions are implemented to return the system to normal operation.

8.3 DATA REVIEW AND EVALUATION

A data validation will be performed to assess whether the dataset meet the project requirements in terms of following the appropriate analytical methods, sample locations, and sampling procedures. All sample collection procedures and laboratory reports will be reviewed to verify that the field and laboratory QA/QC requirements have been met.

The final reportable data, laboratory checklist, associated exception report(s), laboratory quality control data, and chain-of-custody will be reviewed in accordance with applicable EPA guidance, including, but not limited to the *National Functional Guidelines for Inorganic Superfund Data Review* (EPA 540-R-013-001), August 2014. Data precision and accuracy will be assessed based on control limits of 70-130% for laboratory control samples (except for antimony which will be assessed based on control limits of 50-150%) and 75-125% for spike sample analysis. A control limit of 20% for the relative percent difference (RPD) shall be used for original and duplicate sample values.

9.0 DECONTAMINATION AND WASTE MANAGEMENT

This section of the SAP provides information about equipment cleaning procedures and management of IDW during monitoring events.

9.1 EQUIPMENT DECONTAMINATION PROCEDURES

The decontamination of sampling equipment is necessary to reduce the potential for the spread of constituents to clean areas, to reduce exposure of personnel to constituents of concern, and to reduce the potential cross-contamination when equipment is used more than once.

The water level tape and probe which have contact with groundwater in the well will be wiped clean with a disposable material (*e.g.*, paper towel), washed with solution of non-phosphate detergent (Liquinox® or equivalent) and distilled water, rinsed with distilled water, and wiped dry with a disposable material after use at each well.

To reduce the potential for cross-contamination between monitor wells during purging and sampling, well-dedicated or disposable equipment will be used to the extent practical. If non-dedicated pumps, discharge, and safety lines are used at a well, such equipment will be washed with non-phosphate detergent and distilled water solution, then rinsed with distilled water.

9.2 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Common IDW from the groundwater sampling events are purge water, decontamination water, and trash (i.e., non-reusable plastic tubing, nitrile gloves, paper towels, etc.).

Well purge water will be managed by CPS Energy. The purge water and decontamination water will be containerized in 55-gallon DOT-approved drums for management and disposal by CPS Energy personnel in accordance with CPS Energy procedures. Purge water from each well should be temporarily containerized at the wellhead in 5-gallon plastic buckets. Upon completion of sampling at each well, water from the 5-gallon bucket(s) should be transferred to a temporary DOT-approved 55-gallon drum(s). Drums should be labeled and secured by CPS Energy personnel.

Disposable equipment and supplies (i.e., domestic trash) will be placed in heavy-duty plastic bags and the full bags placed in Power Station-designated receptacles. If it becomes necessary to place affected materials in a 55-gallon DOT-approved drum(s), then the drums will be labeled and secured. Further management of the drums and containerized waste will be handled by CPS Energy.

9.3 *INVESTIGATION-DERIVED WASTE SAMPLE COLLECTION*

Following the transfer of purge water and decontamination wash water to a temporary DOT-approved 55-gallon drum(s), a sample will be collected in order to properly characterize and profile the liquid waste for proper disposal.

The IDW sample will be collected directly from the drum(s) using a disposable plastic bailer or similar disposable container (e.g., un-preserved laboratory container), and immediately placed in a clean, laboratory-supplied sample container with the appropriate preservative for the selected analytical method. If multiple drums are needed to containerize the liquid IDW, a representative amount of water should be collected from each drum, and placed into the laboratory-provided sampling container.

The IDW sample will be analyzed for the specified metals listed in **Table 6**. Analytical parameter classes, container size and type, preservatives, and holding times (before which the analysis must be performed) are listed in **Table 7**. Sample analyses will be performed in accordance with the procedures previously discussed in Section 7.0.

Samples will be labeled, handled, and packaged in accordance with the procedures described previously in Section 5.2. Sampler shall record the sample ID, sampling procedure, date, and time of sample collection in the fieldbook. Sample custody information will be recorded in accordance with the procedures described previously in Section 3.3.

Forms

Environmental Resources Management
206 East 9th Street, Suite 1700
Austin, Texas 78701
(512) 459-4700

FORM 1

MONITOR WELL GAUGING RECORD
Groundwater Sampling and Analysis Plan
CPS Energy - Calaveras Power Station
San Antonio, Texas

PROJECT INFORMATION	
Client:	CPS Energy - Calaveras Power Station
Site Loc.:	San Antonio, Texas
Purpose:	CCR Groundwater Monitoring
Proj. ID.:	GW Sampling Event #
Sampler(s):	
Date:	
Weather Conditions:	

GAUGING RECORD	
Measuring Point:	Top of Casing
Instrument ID:	

CCR Unit	Well ID	DTW (Ft.)	TD (Ft.)	Notes
Fly Ash Landfill	JKS-31			
	JKS-33			
	JKS-45			
	JKS-46			
	JKS-57			
	JKS-58			
	JKS-59			
	JKS-60			
Evaporation Pond	JKS-36			
	JKS-47			
	JKS-61			
	JKS-62			
	JKS-63			
	JKS-64			
SRH Ponds / Bottom Ash Ponds	JKS-48			
	JKS-49			
	JKS-50R			
	JKS-51			
	JKS-52			
	JKS-53			
	JKS-54			
	JKS-55			
	JKS-56			

FORM 2

MONITOR WELL INSPECTION RECORD
Groundwater Sampling and Analysis Plan
CPS Energy – Calaveras Power Station
San Antonio, Texas

Client: CPS Energy - Calaveras Power Station	**Well ID:**
Site Location: San Antonio, Texas	
CCR Unit (circle one): Fly Ash Landfill Evaporation Pond SRH Ponds/Bottom Ash Ponds	
Date/Time:	**Stick-Up** ☐ **Flush-Mounted** ☐
Is the well site clear of weeds and debris? *Comments*:	Yes No
Has the grass been mowed? *Comments:*	Yes No
Are there bollards or protective barriers around the well? *Comments:*	Yes No
Is the well identification clearly visible and in good condition? *Comments:*	Yes No
Is the outer casing (or vault) in good condition? *Comments:*	Yes No
Is the outer casing (or vault) equipped with a protective cap? *Comments:*	Yes No
Does the well have a concrete surface pad? *Comments:*	Yes No
If yes, what is the condition of the pad? *Comments:*	Good Cracked Broken
What is the condition of the inner casing? *Comments:*	Good Cracked Broken
Does the inner casing have a cap? *Comments:*	Yes No
Is the well locked? *Comments:*	Yes No
If yes, what is the condition of the lock? *Comments:*	Good Poor
Is the annulus between the inner and outer casing free of standing water? *Comments:*	Yes No
Is the survey measuring point marked on the TOC? *Comments:*	Yes No
Expected Depth of Well:	**Measured Depth of Well:**
General Observations:	

Name of Sampler:________________________________ **Signature:**______________________________________

Company:____ **Date:**____

FORM 3

MONITOR WELL SAMPLING RECORD
Groundwater Sampling and Analysis Plan
CPS Energy - Calaveras Power Station
San Antonio, Texas

PROJECT INFORMATION

Well ID:		**Client:**	CPS Energy - Calaveras Power Station
Well Diameter:		**Site Loc.:**	San Antonio, Texas
CCR Unit:		**Purpose:**	CCR Groundwater Monitoring
Date:		**Proj. ID.:**	GW Sampling Event #
Weather Conditions:		**Sampler(s):**	

INITIAL MEASUREMENTS

Measuring Point:	Top of Casing	**Water Column Ht. (H1 = D2-D1):**	
Measuring Point Elevation:		**Max. Drawdown (D1 + 0.33 ft.):**	
Depth to Water (D1):		**DTW at 80% Rec. (D2 - (0.80*H1)):**	
Total Well Depth (D2):		**Tubing Intake Depth:**	

PURGING RECORD

Purge Method:

Instrument ID:

Time (Hr:Min)	**Pump Rate** (mL/min)	**DTW** (ft. btoc)	**Temp.** (°C)	**pH** (Std Units)	**ORP** (mV)	**SC** (mS/cm2)	**DO** (mg/L)	**Turbidity** (NTU)
Stabilization Criteria:		± 0.3 Ft.	--	± 0.1 Units	± 10 mV	± 3%	± 10%	± 10%

Total groundwater purged (gallons):

SAMPLING RECORD

Analysis Requested	**Container/Preservative**

Sample Date/Time:

Sampling Remarks:

Tables

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TABLE 1

WELL INFORMATION SUMMARY

Groundwater Sampling and Analysis Plan
CPS Energy - Calaveras Power Station
San Antonio, Texas

CCR Unit	Well ID	Well Function	Top of Casing Elevation (ft. msl)	Screened Interval (ft. btoc)	Required Pump for Sample Collection
Fly Ash Landfill	JKS-31	Downgradient Monitoring	507.45	57.2 - 67.2	Peristaltic
	JKS-33	Downgradient Monitoring	498.71	20 - 30	Peristaltic
	JKS-45	Background Monitoring	531.46	43.2 - 58.2	Submersible
	JKS-46	Downgradient Monitoring	499.08	18.3 - 28.3	Peristaltic
	JKS-57	Background Monitoring	506.91	15.1 - 30.1	Peristaltic
	JKS-58	Groundwater Elevation Observation	504.45	23.5 - 33.5	--
	JKS-59	Groundwater Elevation Observation	496.45	14.9 - 29.9	--
	JKS-60	Downgradient Monitoring	495.70	13 - 28	Peristaltic
Evaporation Pond	JKS-36	Downgradient Monitoring	508.41	41.5 - 51.5	Peristaltic
	JKS-47	Background Monitoring	513.63	28.4 - 43.4	Submersible
	JKS-61	Downgradient Monitoring	505.51	21 - 36	Peristaltic
	JKS-62	Downgradient Monitoring	509.84	23.1 - 33.1	Peristaltic
	JKS-63	Background Monitoring	526.86	33.3 - 53.3	Submersible
	JKS-64	Background Monitoring	507.84	18.5 - 33.5	Peristaltic
SRH Pond	JKS-51	Background Monitoring	496.92	9.9 - 24.9	Peristaltic
	JKS-52	Downgradient Monitoring	493.15	18.6 - 28.6	Peristaltic
	JKS-53	Downgradient Monitoring	494.74	18.4 - 28.4	Peristaltic
	JKS-54	Downgradient Monitoring	496.40	15.7 - 25.7	Peristaltic
Bottom Ash Ponds	JKS-48	Downgradient Monitoring	497.19	22 - 32	Peristaltic
	JKS-49	Background Monitoring	498.63	10.5 - 20.5	Peristaltic
	JKS-50R	Downgradient Monitoring	498.48	13 - 23	Peristaltic
	JKS-52	Downgradient Monitoring	493.15	18.6 - 28.6	Peristaltic
	JKS-55	Downgradient Monitoring	493.81	18.7 - 28.7	Peristaltic
	JKS-56	Downgradient Monitoring	496.66	13.6 - 28.6	Peristaltic

NOTES:

ft: feet
msl: mean sea level
btoc: below top of casing
--: No sample collected

TABLE 2

CONSTITUENTS FOR DETECTION MONITORING

Groundwater Sampling and Analysis Plan
CPS Energy - Calaveras Power Station
San Antonio, Texas

Constituents for Detection Monitoring
Boron
Calcium
Chloride
Fluoride
Sulfate
pH
Total Dissolved Solids (TDS)

NOTE:

From Appendix III to 40 CFR Part 257 - Constituents for Detection Monitoring

TABLE 3

CONSTITUENTS FOR ASSESSMENT MONITORING

Groundwater Sampling and Analysis Plan
CPS Energy - Calaveras Power Station
San Antonio, Texas

Constituents for Assessment Monitoring
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
Radium 226 & 228 (Combined)

NOTE:

From Appendix IV to 40 CFR Part 257 - Constituents for Detection Monitoring

TABLE 4

WATER QUALITY INDICATOR PARAMETERS

Groundwater Sampling and Analysis Plan
CPS Energy - Calaveras Power Station
San Antonio, Texas

Water Quality Indicator Parameters	Stabilization Ranges (Three successive readings)
Temperature	Not used for stabilization
pH	± 0.1 standard units
Specific Conductivity	± 3%
Dissolved Oxygen	± 10%
Oxidation Reduction Potential	± 10 millivolts
Turbidity	± 10 %

TABLE 5

SUMMARY OF GROUNDWATER SAMPLE CONSTITUENT GROUPS AND ANALYTICAL INFORMATION

Groundwater Sampling and Analysis Plan
CPS Energy - Calaveras Power Station
San Antonio, Texas

Laboratory Parameters	Lab Method	Parameter Group	Practical Quantitation Limit (PQL) mg/L	Container Size and Type	Preservative	Holding Time
Metals						
Antimony	SW-846 Method 6010B	Assessment Monitoring	0.01	1 - 500-mL HDPE (high density polyethylene)	HNO3 to pH<2; <6ºC	180 Days (a)
Arsenic	SW-846 Method 6010B	Assessment Monitoring	0.01			
Barium	SW-846 Method 6010B	Assessment Monitoring	0.01			
Beryllium	SW-846 Method 6010B	Assessment Monitoring	0.004			
Boron	SW-846 Method 6010B	Detection Monitoring	0.05			
Cadmium	SW-846 Method 6010B	Assessment Monitoring	0.005			
Calcium	SW-846 Method 6010B	Detection Monitoring	0.2			
Chromium	SW-846 Method 6010B	Assessment Monitoring	0.01			
Cobalt	SW-846 Method 6010B	Assessment Monitoring	0.01			
Lead	SW-846 Method 6010B	Assessment Monitoring	0.01			
Lithium	SW-846 Method 6010B	Assessment Monitoring	0.02			
Mercury	SW-846 Method 7470A	Assessment Monitoring	0.0002			
Molybdenum	SW-846 Method 6010B	Assessment Monitoring	0.01			
Selenium	SW-846 Method 6010B	Assessment Monitoring	0.02			
Thallium	SW-846 Method 6010B	Assessment Monitoring	0.02			
Radiochemistry						
Radium 226 & 228 (Combined)	EPA Method 903.0/904.0	Assessment Monitoring	Radium-226 by EPA 903.0 or 903.1: 1 pCi/L Radium-228 by EPA 904.0: 1 pCi/L	1 - Gallon Plastic	HNO3 to pH<2; <6ºC	180 Days
Anions						
Chloride	EPA Method 300.0	Detection Monitoring	0.5	1 - 250-mL HDPE	<6ºC	28 Days
Fluoride	EPA Method 300.0	Assessment/Detection Monitoring	0.5			
Sulfate	EPA Method 300.0	Detection Monitoring	0.5			
Other						
Total Dissolved Solids (TDS)	SM2540C	Detection Monitoring	5	1 - 1-L HDPE	<6ºC	7 Days
Field Parameters						
pH	Multiparameter probe	Detection Monitoring	(b)	(b)	(b)	(b)
Temperature	Multiparameter probe	(b)	(b)			
Oxidation-Reduction Potential	Multiparameter probe	(b)	(b)			
Dissolved Oxygen	Multiparameter probe	(b)	(b)			
Turbidity	Multiparameter probe	(b)	(b)			
Specific Conductance	Multiparameter probe	(b)	(b)			

NOTES:

(a) 180 days for all metals except mercury which is 28 days.
(b) Standard field measurement collected during sampling (no Parameter Group and no PQLs).
Actual PQLs reported by the laboratory may vary due to the nature of individual samples.
Methods may be updated or substituted by an appropriate EPA or TCEQ-approved method with comparable detection limits that meet action levels.

TABLE 6

CONSTITUENTS FOR IDW CHARACTERIZATION AND PROFILING

Groundwater Sampling and Analysis Plan
CPS Energy - Calaveras Power Station
San Antonio, Texas

Constituents for IDW Characterization and Profiling
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Lead
Mercury
Nickel
Selenium
Silver

TABLE 7

SUMMARY OF IDW SAMPLE CONSTITUENT GROUPS AND ANALYTICAL INFORMATION

Groundwater Sampling and Analysis Plan
CPS Energy - Calaveras Power Station
San Antonio, Texas

Laboratory Parameters	Lab Method	Parameter Group	Practical Quantitation Limit (PQL) mg/L	Container Size and Type	Preservative	Holding Time
Metals						
Antimony	SW-846 Method 6010B	Assessment Monitoring	0.01	1 - 500-mL HDPE (high density polyethylene)	HNO3 to pH<2; <6ºC	180 Days (a)
Arsenic	SW-846 Method 6010B	Assessment Monitoring	0.01			
Barium	SW-846 Method 6010B	Assessment Monitoring	0.01			
Beryllium	SW-846 Method 6010B	Assessment Monitoring	0.004			
Cadmium	SW-846 Method 6010B	Assessment Monitoring	0.005			
Chromium	SW-846 Method 6010B	Assessment Monitoring	0.01			
Lead	SW-846 Method 6010B	Assessment Monitoring	0.01			
Mercury	SW-846 Method 7470A	Assessment Monitoring	0.0002			
Nickel	SW-846 Method 6010B	Assessment Monitoring	0.002			
Selenium	SW-846 Method 6010B	Assessment Monitoring	0.02			
Silver	SW-846 Method 6010B	Assessment Monitoring	0.002			

NOTES:

(a) 180 days for all metals except mercury which is 28 days.
Actual PQLs reported by the laboratory may vary due to the nature of individual samples.
Methods may be updated or substituted by an appropriate EPA or TCEQ-approved method with comparable detection limits that meet action levels.

Figures

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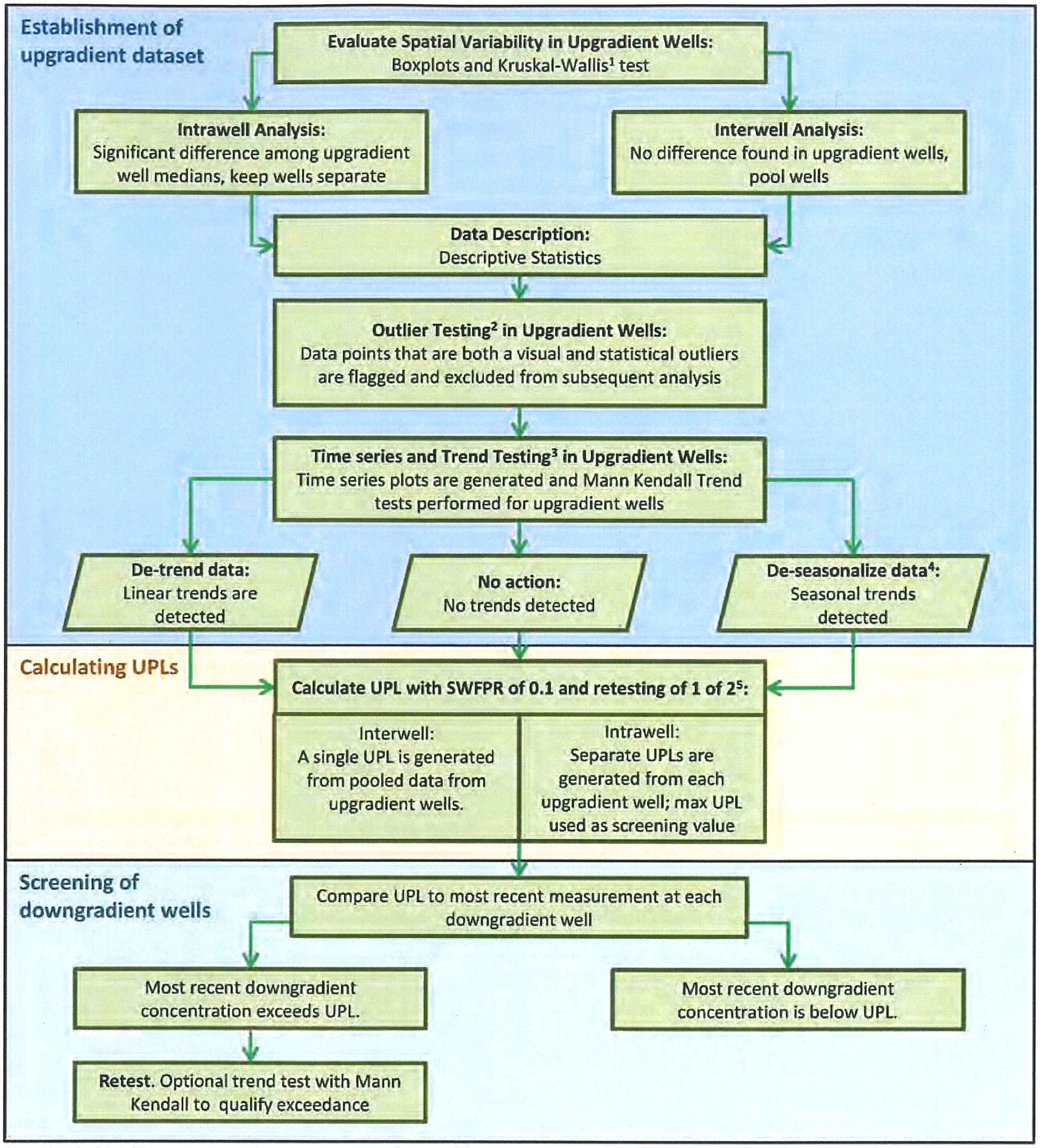
Environmental Resources Management

FIGURE 1
CCR WELL NETWORK LOCATION MAP

CPS Energy - Calaveras Power Station
San Antonio, Texas

DESIGN:	NH	DRAWN:	EFC	CHKD.:	WZ
DATE:	2/6/2017	SCALE:	AS SHOWN	REVISION:	0
W.O.NO.:	P:\Projects\0366643 CPS Energy Calaveras CCR Well Network.WZ\GIS\MXD\CPSCalv_WellsLocs.mxd				

ERM



[1]For Kruskal-Wallis test, a $p<0.05$ indicates a significant difference among upgradient wells. A $p\geq0.05$ indicates there is no difference. Boxplots provide a visual for the comparison.

[2]Test each upgradient dataset for outliers using Dixon's test if number of data points (N) is < 25 and Rosner's test if $N \geq 25$. Data points with outlier test results with $p < 0.05$, as well as visual outliers (using QQ plots) are excluded from subsequent analysis.

[3]For linear trend testing using Mann Kendall test, $p<0.05$ indicates a significant trend while $p>=0.05$ indicates no trend. Testing for seasonality requires at least three years of data and a seasonal Mann Kendall test.

[4]A minimum of five years of data are needed to perform season al trend tests

[5]UPL calculated with a 1 of 2 retesting scheme, site wide annual false positive rate of 0.1 and event site-wide false positive rate of 0.05. Calculate UPL using Sanitas with recommended SAP procedure (handling of <8 detected values, no detected values, bootstrapping, etc.)

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FIGURE 2
DECISION FRAMEWORK

CPS Energy - Calaveras Power Station
San Antonio, Texas

DESIGN:	DRAWN: MH	CHKD.:
DATE: 9/26/2017	SCALE: AS SHOWN	REV.:

ERM

Statistical Method Certification

Appendix A

Environmental Resources Management
206 East 9th Street, Suite 1700
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(512) 459-4700

STATISTICAL METHOD CERTIFICATION

40 CFR §257.93(f)(6)

Calaveras Power Station

San Antonio, Texas

CPS Energy

CERTIFICATION

I hereby certify that the selected statistical method identified in this document is appropriate for evaluating groundwater monitoring data for the CCR units in accordance with the requirements of 40 CFR §257.93.

STATE OF TEXAS
JEFFERY L. BAUGUSS
86195
LICENSED
PROFESSIONAL ENGINEER

10/16/17

Jeffery L. Bauguss, P.E.

Texas Licensed Professional Engineer No. 86195

Groundwater Sampling Field Equipment List

Appendix B

Environmental Resources Management
206 East 9th Street, Suite 1700
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APPENDIX B

GROUNDWATER SAMPLING FIELD EQUIPMENT LIST

Groundwater Sampling and Analysis Plan
CPS Energy – Calaveras Power Station
San Antonio, Texas

Sampling Equipment needed for collecting representative samples of groundwater:

1) Temperature, pH, specific conductivity, dissolved oxygen, oxidation reduction potential, and turbidity meters or multi-meter (2)
2) Peristaltic pumps (2)
3) Submersible pump (1), with flow controller
4) 100-foot Water level indicator probe (2)
5) 20 feet of 3/16" (I.D.) silicon tubing (*initial installation*) for use with peristaltic pump.
   Note – After first installation, have 5 feet on hand in case tubing replacement needed.
6) 600 feet of 0.17" (I.D.) LDPE tubing (*initial installation*) for use with peristaltic pump.
   Note – After first installation, have 200 – 300 feet on hand for in case tubing replacement needed.
7) 200 feet of 3/8" (I.D.) LDPE tubing (*initial installation*) for use with peristaltic pump.
   Note – After first installation, have 200 – 300 feet on hand for in case tubing replacement needed.
8) Field logbooks (2), clipboards (2), black ink pens
9) Powder-free nitrile gloves
10) Graduated 5-gallon bucket (2)
11) Graduated Cylinders – 500mL capacity (2)
12) One sampling bottle kit per well, plus QA/QC samples, and extras in case of breakage
13) Sample bottle labels, custody seals, and chain-of-custodies
14) Waterproof marking pen for labeling sample bottles
15) Sample shipping coolers
16) Ice for each cooler
17) Distilled water – one gallon (2)
18) Scrub brush (or sponge) and spray wash bottles
19) Phosphate–free cleaner (e.g., Liquinox)
20) Box of large plastic garbage bags and paper towel rolls
21) 5-gallon buckets with lids (8), for temporarily containerizing purge water and submersible pump decontamination
22) 55-gallon drums for containerizing purge water (2)