Proposal to Assess the Viability and Functionality of Landfill Gas Wellfield Automated Remote Monitoring System

Chiquita Canyon Landfill
Castaic, California
SCAQMD Facility No. 119219

Waste Connections
29201 Henry Mayo Drive
Castaic, CA 91384

Submitted to:

South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765
909-396-2000

SCS ENGINEERS

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15521 Midlothian Turnpike, Suite 305
Midlothian, VA 23113
804-378-7440

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INTRODUCTION

Chiquita Canyon, LLC (Chiquita) operates a municipal solid waste (MSW) landfill/solid waste disposal facility located in Castaic, California, under South Coast Air Quality Management District (SCAQMD) Facility No. 119219. The Reaction Committee prepared this Proposal to Assess the Viability and Functionality of Landfill Gas Wellfield Automated Remote Monitoring System on behalf of Chiquita in accordance with Condition No. 66(a)(vi) of the Modified Stipulated Order of Abatement (SOFA) (Case No. 6177-4) pertaining to the Chiquita Canyon Landfill (CCL, Facility, or Landfill). This Proposal presents the proposed Work Plan to conduct a field test to assess the viability and functionality, as well as feasibility, of certain instrumentation, equipment, telemetry, and control components that may be suitable for a remote monitoring system (RMS) for the automated remote measurement of temperature and pressure within landfill gas (LFG) extraction wells with pumps located within the Reaction Area. Accordingly, this Proposal serves as a test protocol outlining the proposed activities anticipated for this pilot feasibility study and is referenced herein as the Test Protocol.

Condition No. 66(a)(vi) of the Modified SOFA requires:

> *By January 31, 2025, the Reaction Committee shall submit a proposal to assess the viability and functionality of a remote monitoring system which measures temperature and pressure within a well with a pump located within the Reaction Area, including assessment of multiple depths within the well (e.g. shallow, middle, and deep). The Proposal shall be submitted to Baitong Chen [bchen@aqmd.gov]; Nathaniel Dickel [ndickel@aqmd.gov]; Christina Ojeda [cojeda@aqmd.gov] for review. Upon approval by South Coast AQMD, Respondent shall conduct the feasibility assessment. The Reaction Committee shall submit a final report to the South Coast AQMD (to Baitong Chen [bchen@aqmd.gov]; Nathaniel Dickel [ndickel@aqmd.gov]; Christina Ojeda [cojeda@aqmd.gov]) detailing the results of the feasibility study, and recommendations on further deployment of the remote monitoring system not later than 150 days from the approval of the feasibility proposal.*

Previous documentation prepared in accordance with various provisions of the Modified SOFA that address automated RMS equipment for LFG wells and wellheads, and which serve as references to this Test Protocol and provide background information on the anticipated viability, functionality, and feasibility, of certain components, include the following:

- **LFG Wellfield Automated Remote Monitoring Plan, prepared by SCS Engineers, dated 4/19/24.** This Plan was prepared in accordance with a prior version of SOFA Condition 66 and identified the applicable operational parameters of LFG extraction wells and wellheads, outlined the purpose and objectives for the remote monitoring of these operational parameters, discussed specific monitoring instrumentation and equipment, and presented the Reaction Committee's recommendations for implementation of a remote monitoring system at the Landfill.

- **Response to South Coast Air Quality Management Stipulated Order for Abatement in Case No. 6177-4 Condition 66(a)(ii), prepared by SCS Engineers, dated 9/17/24.** This correspondence outlined the anticipated issues and concerns associated with the design, specification, installation, and implementation of remote monitoring of the LFG wellfield and identified the six primary system components being considered. The correspondence included evidence of communication with system, device, and component vendors/manufacturers and/or contractors, and also commented on supply chain and lead times.

- **Response to South Coast Air Quality Management Stipulated Order for Abatement in Case No. 6177-4 Condition 66(a)(iii), prepared by SCS Engineers, dated 10/11/24**. This correspondence provided documentation of continued communications with vendors, manufacturers, and distributors of RMS components.

- **Landfill Gas Well Selection for Installation of Remote Monitoring System Equipment, prepared by the Reaction Committee, dated 10/15/24.** This correspondence presented the Reaction Committee's determination on the locations for installation of the initial RMS equipment, which involved twenty (20) LFG wells to be equipped with temperature measurement instrumentation and associated telemetry equipment, in accordance with Condition 66(a)(v). This determination included a review of background information and a discussion of the criteria and field conditions that were considered by the Reaction Committee in selecting these locations.

This Test Protocol presents the proposed activities, including field installation as well as data review and validation, planned to facilitate the assessment of the viability, functionality, and feasibility of the six (6) primary RMS components (along with ancillary instrumentation, equipment, and controls) that have been specified and selected as described in the reference documentation noted above. This Test Protocol also presents a proposed schedule to accomplish the pilot feasibility study.

The objectives of this pilot feasibility study are noted below:

- Assess the technical feasibility of installation of RMS components into wells and wellheads with a pump positioned within the Reaction Area, including assessment of multiple depths within the well (e.g., shallow, middle, and deep);

- Evaluate the viability, functionality, performance, and reliability of RMS instrumentation and equipment under varying operational conditions;

- Identify potential criteria for selection of well locations;

- Assess and validate measurements and monitoring data received from RMS instrumentation; and,

- Assess operational protocols for RMS components to be implemented beyond this pilot feasibility study.

INSTALLED REMOTE MONITORING SYSTEM EQUIPMENT

Chiquita and SCS Engineers (SCS) have previously installed the following RMS equipment to enable automated remote measurement of certain LFG system operational parameters, as well as in-situ subsurface waste temperatures within separate temperature monitoring probes at the Landfill:

- RMS equipment was installed and is in operation to measure temperature in 20 wellheads operated in the Initial Reaction Area, in accordance with SOFA Condition 66(a)(v), consistent with the Reaction Committee's October 15, 2024 submittal. Stainless steel-encased temperature transmitters were installed at the twenty (20) LFG wellheads in December 2024 to measure and record the temperature of landfill gas flowing through these wellheads. A battery-powered cellular IIoT device is installed and in operation at each wellhead.

- Pressure transmitters were installed at five (5) locations within header pipes in October 2024 to measure vacuum within the LFG collection piping network. A cellular IIoT device and solar power system are installed and in operation at each sensor insertion point.

- High-temperature thermocouples equipped with magnesium oxide-filled stainless-steel tubing to house the signal wire are positioned at various depth intervals within twenty (20) temperature monitoring probes (TMPs) that were installed in March and April 2024. Some of the TMPs are co-located within a common borehole with vertical LFG extraction well riser pipes. A cellular IIoT device, remote input card, and solar power system are installed and in operation at each probe.

- Submersible liquid level transmitters were inserted into six (6) wells/TMPs to enable measurement of liquid levels in October through December 2024.

PROPOSED PILOT FEASIBILITY STUDY ASSESSING RMS INSTRUMENTATION, EQUIPMENT, AND CONTROLS

The Reaction Committee proposes to assess this RMS through this pilot feasibility study, which involves procurement and installation of the referenced RMS instrumentation, equipment, and controls, and other components, will be procured and installed within approximately five (5) wells within the Reaction Area that are equipped with pumps at the locations identified in this Test Protocol. The data will be reviewed and analyzed as outlined in this Test Protocol and the viability, functionality, and performance of the components in use will be assessed. Future implementation of these components will be assessed and a report will be prepared and submitted to the SCAQMD. The pilot feasibility study will assess the viability, functionality, and feasibility of the following six (6) primary system components as further described in the reference documentation noted above. These six components are summarized as:

- Component 1: three (3) down-well thermocouples to measure temperature at varying depths.

- Component 2: one (1) down-well liquid level transmitter to measure liquid level within the well.

- Component 3: one (1) top-mounted pressure transmitter to measure vacuum applied within the upper region of the well casing pipe; this is a single pressure transmitter on top of the well riser pipe, which is where the wellhead is positioned, and does not involve suspending multiple pressure transmitters into the well casing pipe.

- Component 4: one (1) industrial cellular IIoT device to gather data from the sensors and transmit it to SCS' cloud-based Supervisory Control and Data Acquisition system for remote monitoring, alarming, and reporting.

- Component 5: remote input cards to gather data from the sensors and transmit it to the IIoT device.

- Component 6: one (1) solar power system to source DC power for the sensors and IIoT device.

ASSESS TECHNICAL FEASIBILITY OF INSTALLATION AND FUNCTIONALITY OF RMS INSTRUMENTS AND EQUIPMENT

Down-Well Temperature Measurement

As discussed in the reference documentation, the selected Component 1 devices are thermocouples encased in a stainless steel tubing jacket with powdered magnesium oxide in the interstitial space and suspended into the well casing pipe at multiple depths to measure fluid (gas or liquid) temperatures. These thermocouples have been observed to yield suitable performance for greater than one year but have exhibited failures due to a variety of factors at other elevated temperature landfill temperature monitoring locations. Thermocouples will be suspended at 40-foot, 80-foot, and 120-foot-depth intervals. The thermocouples will be encased within stainless steel tubing within the well so that the wiring is not exposed to landfill gas or landfill liquids. The tubing will be attached to the well using compression fittings in the top flange to prevent leaks and reduce the potential for fugitive emissions/odors. The wiring will be connected into the RMS panel.

Liquid Level Measurement

As discussed in the reference documentation, the selected Component 2 device is a submersible electronic level transmitter to measure the hydrostatic head pressure of liquid present above the sensor elevation. This accomplishes pressure measurement from a position below the leachate surface within the well rather than applied vacuum above the leachate surface. The transmitter will be suspended no closer than 20 feet above the well bottom and be equipped with a signal cable attached to the well using a compression fitting in the top flange to prevent leaks and reduce the potential for fugitive emissions or odors. The cable will connect into the RMS panel.

Pressure Measurement

As discussed in the reference documentation, the selected Component 3 device is a fixed electronic pressure transmitter to measure the applied vacuum on the well side of the wellhead control valve. Gas cooling adapters will be utilized to provide additional protection against high temperature failure of the pressure transmitters. This single transmitter device will be positioned within the wellhead or top flange of the well cap, which is at the top of (and within) the well casing pipe and obtains measurements within the interior of the well, but is not suspended below ground surface. A fixed pressure sensor will be utilized to seek to avoid potential interference during routine tuning and balancing efforts as well as common pump servicing and replacement and other maintenance activities involving the wellhead components. One pressure transmitter will be installed at each selected wellhead. The transmitter will be threaded into the wellhead and the cable from it will connect into the RMS panel. Recognizing the selected wellheads are constructed of steel piping, a new well cap will likely need to be equipped with the necessary fittings to avoid drilling, tapping, and threading into steel pipe.

Industrial IIoT Device and Remote Input Cards

Remote input cards will be utilized to collect the data from the transmitters and send it to the cellular IIoT device. The cellular IIoT device will transmit data back to SCS' SCSRMC.com cloud-based Supervisory Control and Data Acquisition platform. SCS is already utilizing these devices at CCL and multiple other landfill sites.

Solar Power System

SCS has designed the solar power systems for this project to provide power to the sensors and the cellular IIoT devices at each location. Solar-powered systems designed by SCS are also already being utilized at CCL and multiple other landfill sites.

ASSESS PERFORMANCE, VIABILITY, AND RELIABILITY OF INSTRUMENTS UNDER VARYING REACTION AREA CONDITIONS

The above-described reference documents raise issues and concerns associated with the viability, functionality, and feasibility of installation and operation of the RMS instrumentation, equipment, and controls at the Landfill. The suspension of the Component 1 thermocouples down the well casing piping, the insertion of the Component 2 liquid level transducer to a position near the bottom of the wells, and the insertion of the Component 3 pressure transducer into the wellheads present short- and long-term risks, including but not limited to potential malfunctioning and/or failure attributable to the various conditions within the wells and wellheads, interference with pumping systems, and disturbances associated with well maintenance.

The potential Reaction Area conditions to be observed and assessed include, but are not limited to:

- **Elevated Temperatures:** Component 1, 2, and 3 devices will be exposed to gaseous-phase and liquid-phase fluids with temperatures exceeding 200 degrees Fahrenheit or greater. This Pilot Feasibility Study will observe and assess the performance, reliability, viability, longevity, and resilience of these sensors and the associated signal wires to withstand the atypical heat that is present within wells located within the Reaction Area.

- **Fouling and Debris Build-Up:** Component 1, 2, and 3 devices will be exposed to liquids and/or foam with excessive solids (suspended and dissolved) content. These sensors are likely to experience formation and accumulation of precipitate, calcification, sludge, gelatinous “goo”, grit, grime, and/or aggregation of other solid material that may impede accurate measurement of temperature and pressure. This Pilot Feasibility Study will observe and assess the performance, reliability, viability, longevity, and resilience of these sensors and the associated signal wires to withstand the potential fouling and build-up of solids that are present within wells located within the Reaction Area

- **Chemical Compatibility:** Component 1, 2, and 3 devices will be exposed to liquids, gases, and/or foam that have been known to cause premature failure of equipment and sensors due to chemical compatibility issues and may therefore be incompatible with these RMS component devices. The sensors may corrode, deteriorate, or otherwise be rendered non-functional due to the chemicals present in the liquids and/or foam. Even commonly used and trusted corrosion-resistant materials used for electronic instrumentation such as Type 316 stainless steel have been known to dissolve or experience pitting in similar elevated temperature landfill situations. This Pilot Feasibility Study will observe and assess the performance, reliability, viability, longevity, and resilience of these sensors and the associated signal wires to withstand the potential chemical compatibility issues that are present within wells located within the Reaction Area.

- **Entanglement and Interference with Dewatering Pump Operations and Maintenance:** Component 1, 2, and 3 devices will be suspended in active dual phase extraction wells

where pumps and pumping infrastructure are present and in operation. These pumps require maintenance so that they can continue to operate effectively. To maintain the pumps, they must be removed from the well, cleaned and/or replaced, and reinserted. Component 1, 2, and 3 devices could potentially be damaged by these necessary pump maintenance activities. Furthermore, the pump and its associated tubing, wiring, etc., may become entangled with the down-well sensors, Components 1 and 2, which could damage and/or destroy the pump in addition to Components 1 and 2, potentially rendering the pump unmovable and causing the dual phase extraction well to be ineffective, forcing its abandonment. This Pilot Feasibility Study will observe and assess any entanglement and interference with dewatering pump operations and maintenance within wells located within the Reaction Area.

LOCATION AND CRITERIA FOR SELECTION OF WELLS

The Committee has evaluated the existing LFG wells at the Landfill that serve as potential candidates to receive the RMS equipment for the pilot study. Criteria to select wells for RMS pilot implementation included spatial variability, presence of a pump, range of temperature, pressurized leachate release, and well piping material. Based on this criteria, the following wells are selected for pilot study:

- CV-2306
- CV-2338
- CV-24038
- CV-24126
- CV-24140

VALIDATION OF DATA RECEIVED FROM RMS

Data integrity checks will be performed every four weeks on an interim basis during the Assessment Period phase, which is after installation and commissioning of the RMS and during the duration of this pilot study. The checks will be performed by, for example, comparing the temperature, pressure, and liquid level measurements recorded using the automated remote instrumentation with the manual measurements and the historical trends. These manual measurement results will be compared to the data reported by the RMS directly preceding the manual measurements. These data integrity checks are distinctly different than the Data Review and Validation and Report phase performed after the conclusion of the Assessment Period.

The real time data from transmitters and thermocouples will be monitored for stability and repeatability, and any outliers or inconsistencies will be used to improve the system.

Sensors will be factory-calibrated as appropriate before installation.

ASSESS FUTURE RMS IMPLEMENTATION

The Reaction Committee will review the results of the pilot feasibility study, prepare a report detailing the results of the study, and make recommendations regarding further use of the RMS at CCL. This report with recommendations will be submitted not later than 150 days from the SCAQMD's approval of this feasibility proposal.

PILOT FEASIBILITY STUDY SCHEDULE

The timeframes associated with each task presented below are referenced from the date of the SCAQMD's approval of this Test Protocol and assume the quantity for deployment of RMS components under this pilot feasibility study will be approximately five (5) wells:

- 8 weeks - Procurement of RMS instrumentation, equipment, and controls
- 2 weeks – Field Installation
- 8 weeks – Assessment Period
- 3 weeks – Data Review and Validation and Report