SANITATION DISTRICTS OF LOS ANGELES COUNTY

INDUSTRIAL WASTE SECTION
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INDUSTRIAL WASTEWATER FLOW MEASUREMENT REQUIREMENTS

INTENT AND SCOPE

The Districts have established these flow measurement guidelines under Section 414 of the *Wastewater Ordinance* which requires some industrial wastewater dischargers to meter their effluent to provide accurate flow data for surcharge reporting or for other specific purposes as described herein. Meters for influent water measurement are covered by a separate policy entitled, “Guidelines for the Use of Internal Water Meters”.

Flow Criteria

An automatic full-time flow measurement system is required for any industrial wastewater discharge that exceeds 50,000 gallons per day average flow, or 100 gallons per minute peak flow for any five-minute period. Systems must provide continuous flow indication, recording, totalizing, and a contact closure pulse signal generating device (i.e. sampler pacing socket) to activate automatic wastewater samplers. Digital totalizers must have emergency backup power and surge protection, and any totalizer “reset” buttons must be removed, deactivated, or covered.

Where the total of multiple discharge points from a single facility exceeds 50,000 gallons per day average flow, or 100 gallons per minute peak flow, continuous flow measurement will be required on any individual discharge point which exceeds 25,000 gallons per day average flow, or 50 gallons per minute peak flow.

Other Criteria

Companies under the above flow thresholds may still be required to provide a flow measurement system for any of the following reasons: effluent derived from an unmetered source (i.e. groundwater, oil wells), discharge subject to mass based limits, insufficient documentation of water loss calculations using the adjusted metered supply method, or any other reason deemed appropriate. Any company that utilizes "direct measurement" as the means of determining flow for their annual surcharge statement will be required to install and maintain an effluent flow measurement system as described herein.

FLOW MEASUREMENT SYSTEM DESIGN AND INSTALLATION

Design

Design of flow measurement installations shall be performed under the supervision of a California registered professional engineer of suitable discipline (as defined herein) competent in this field. Design and construction drawings and calculations shall be stamped with the authorized seal of the supervising professional engineer, or signed over his/her registration number, to indicate review and approval of the work.

A minimum of four (4) sets of detailed construction drawings for any new or significantly modified discharge flow measurement system must be submitted for Districts' approval prior to any construction. A minimum of six (6) sets of detailed construction drawings must be submitted if the proposed installation is under jurisdiction of Los Angeles County Department of Public Works. These drawings must show relevant slopes, elevations and locations of piping, types and locations of instrumentation, details of flow measurement elements, estimated flow range (maximum, minimum and average), and details of upstream and downstream piping, structures, and devices which could influence flow conditions.

Manufacturer's calculations, catalog cuts and data sheets must be included with construction drawings for any manufactured equipment to be installed as part of the flow measurement system. Complete rating data and calculations shall be submitted for any engineered flow measurement device.

Primary Measurement Devices

The Districts will accept both open channel (flume, weir) or closed-pipe (magnetic) flow measurement systems. Magnetic flow meters are preferred for industries that have difficulty maintaining open channel flow measurement accuracy (i.e. textile finishers and food manufacturers). Mechanical closed-pipe systems (i.e. propeller, turbine) may be accepted in limited cases. The Districts will prohibit any flow measurement element that is adversely affected by wastewater characteristics. Flow measurement devices should be installed downstream of final pretreatment facilities and as close as possible to the point of connection with the public sewer. Above-ground flow measurement installations may require a platform for automatic samplers so that the top of the sampler will be higher than the water level in the primary element. Because it is often difficult to set automatic samplers for pressurized closed pipe systems, the Districts may require that a well-mixed side stream be routed through an open channel device (i.e. a sample box).

To function correctly, flumes and weirs must be properly installed in accordance with dimensional specifications. Additionally, flumes must be set level with smooth joints where the influent pipe meets the manhole or vault channel. To ensure accuracy of an open channel flow measurement system, the upstream channel must be designed to prevent excessive velocity and turbulence, while the downstream channel must be designed to prevent excessive submergence and backflow. Any additional monitoring equipment (i.e. pH probe) must not adversely affect hydraulics of the open channel element. All open channel installations below grade must be directly beneath the vault or manhole access cover to facilitate inspections and field checks. All open channel installations at or above grade must have a staff gauge for accuracy checks.

Closed pipe meters must be appropriate for the type of wastewater and range of flow rates, and must be installed to flow full at all times. The Districts will allow a closed pipe meter equipped with only a flow indicator and totalizer on a case-by-case basis, typically for companies which file a short form surcharge statement. Typical examples are groundwater cleanup projects, oil production facilities, and companies that choose to file surcharge using direct measurement (i.e. not required by Districts). Such meters are not subject to professional engineer design criteria.

Secondary Measurement Devices

Depth measurement for open channel systems (bubbler, ultrasonic, pressure transducer) should be appropriate for wastewater conditions. All flow meters should be located as close as possible to the legal sampling point and be equipped with all required instrumentation. Remote installations should have a local/auxiliary indicator and totalizer to facilitate setup of composite samplers. The sampler socket frequency must provide at least 50 sampling aliquots in a 24 hour period, resulting in a maximum frequency of one (1) contact closure per 100 gallons for a facility that discharges 50,000 gallons per day. The contact closure device must not provide any power. The closure duration should be from 50 milliseconds to one (1) second. The control signal shall be fed to an MS 3102E18-10S socket with an MS 25043-18D cap and chain or their equivalent. The contact signal shall be connected to pins A and B (or 1 and 2) of the socket. The socket should <u>never</u> be connected to any 110 voltage AC current. The socket shall be mounted in a suitable weatherproof receptacle box and located within 10 feet of the legal sampling point. The Industrial Waste Permit Number and the contact closure frequency, in gallons discharged between closures, shall be indicated on a permanent label near the socket. If feasible, the socket should be installed outside of a below-grade installation (i.e. manhole or vault). If the socket must be installed inside of a manhole or vault, the socket and cap shall be located no more than 12 inches from the top and not in-line with a ladder rung. The socket should be attached to a 2-3 ft. long cable (called a “pigtail”) that can be hung in the vault and removed without breaking the plane of the confined space. All electrical equipment and wiring installed in a confined space exposed to sewer gases shall adhere to all applicable codes and practices.

The Districts will allow completely electronic (i.e. paperless) flow meters as long as the discharger satisfies

conditions of data availability, accessibility, and integrity. Specifically, Districts staff must be able to readily access, retrieve and review current and historical flow data at the site, and the system must generate a secure electronic file which cannot be modified. Sufficient memory should exist for a minimum data sampling frequency of 1/minute.

Installation

The Districts shall be notified in writing when installation of a flow measurement system is completed. Because new systems must be calibrated after installation, a calibration report must also be prepared and submitted with this written notification. The initial calibration must be a full-flow hydraulic calibration conducted in accordance with the requirements set forth herein and using the Districts' calibration report forms.

Manufacturer's or laboratory certified calibration curves and/or a certificate of calibration must be submitted for any manufactured flow metering device used to calibrate the system. Accuracy of the flow measurement system must be within 5% of actual flow at each flow rate tested throughout the entire operating flow range (maximum, minimum and average flow rates). Where unusual flow conditions exist, or where a proposed flow measurement installation departs from recognized published standards, engineering calculations shall be submitted to support proposed calibration data. Where required, certified calibration curves or data must be submitted which show measured head or signal output for a minimum of five flow rates over the design flow range.

FLOW MEASUREMENT SYSTEM MAINTENANCE AND CALIBRATION

General

To ensure proper operation and continued accuracy of industrial wastewater flow measurement systems, the Districts require that all companies with such systems conduct routine maintenance and periodic calibration checks in accordance with Section 414 of the Districts' *Wastewater Ordinance*. All flow data generated and stored from any District=s approved flow measurement device must be maintained for at least four (4) years. Flow charts must be automatically or manually time and date-stamped on a regular basis (preferably daily but no less than weekly). Recorded data shall be made available to District's personnel for review and inspection upon request. The recorder's chart speed must not be lower than 0.5 inch per hour for strip charts and 7 days per cycle for circular charts. The flow meter's totalizer must be non-resettable and should advance frequently enough to allow accuracy checks in the field (i.e. using a stopwatch). Finally, the totalizer should have sufficient digits not to exceed a full cycle more than once per year.

Maintenance Records

All companies that have installed wastewater flow measurement systems to meet Districts' requirements must keep accurate records of any cleaning or maintenance and must regularly check accuracy and record totalizer readings. Records must be retained for four (4) years and copies should be regularly submitted to the Districts. The Districts' "Flow Monitoring System Maintenance Records" form (or similar form) should be used for this purpose. Cleaning should be performed as necessary and noted on this form. The "zero level" of the indicator and recorder should be checked each time the recorder chart is changed to ensure that flows are measured and recorded correctly. Totalizer readings must be taken and recorded on this form at a minimum of once per month.

The "Flow Monitoring System Maintenance Records" form must be maintained by the company or consultant at the recorder location or another location easily accessible for inspection by Districts' employees. Maintenance activities, recorded on the above mentioned form, shall be submitted to the Districts with all calibration reports.

Calibration Check and Report

All flow measurement systems used to obtain information for submittal to the Districts must be calibrated annually (as described herein). A detailed summary of the calibration must be submitted as part of a calibration report on the "Flow Monitoring System Calibration Check Record" form.

The calibration procedure and methods shall be approved by a California registered professional engineer of suitable discipline (as described herein) competent in his or her field. The approval and results of the calibration shall be reported and certified by the engineer in accordance with the format and forms described below. All calibration reports must be submitted to the Districts for review.

Calibration reports must be completed and submitted in a timely manner on or before the due date and as close to the actual date of calibration as possible. A late calibration report may result in enforcement actions against the discharger unless an extension is granted by the Districts. Significant aspects of the calibration report are as follows.

- **Flow Measurement System Description** – List all separate system components, including instrument model numbers and programmed settings, such as totalizer multiplier and flow recorder range. If the system includes a pump, state rate of discharge and pump cycle frequency/duration.

- **Calibration Results** - The system must be tested at a minimum of 3 different flow rates (actual flow for hydraulic calibrations and simulated flow for instrument calibrations). The calibration flow rates should approximate average, minimum and maximum flow rates normally discharged by the facility. The procedure for checking the flow totalizer and recorder must also be approved by a California registered professional engineer and submitted with the calibration results. The calibration must demonstrate no more than 5% error over the entire flow range. A copy of all data collected, any calculations performed and any other pertinent information must be submitted with the "Flow Monitoring System Calibration Check Record". The calibration engineer should report the current average and peak flows from reviewing the previous month's recorder charts. Finally, the report must indicate the condition of the system before any adjustments were made by stating error in the system at different flow rates, zero level offset, unusual hydraulic conditions, cleanliness of the system, etc. The report must also describe any corrective actions necessary to bring the system into compliance with accuracy requirements.

- **Method of Calibration (General)** - A detailed description of the method of calibration must be provided, including any equipment used and (if necessary for clarity) a schematic of the complete calibration setup showing all significant features and equipment. Manufacturer's certified calibration data or laboratory calibration certificate must be submitted for any manufactured device used to calibrate the flow measurement system. Comparison of an effluent flow measurement system with incoming water meter readings is not a valid calibration.

  The calibrating method and equipment must be within 2% of actual flow rate throughout the entire operating flow range of the company's flow meter. Cumulative errors of the calibrating equipment and the company's flow meter should not exceed a total of 5% at each flow rate tested throughout the entire operating flow range (maximum, minimum and average). Data obtained from the calibrating system should be compared with readings obtained simultaneously from the company's existing flow meter. Where practical, the installed flow measurement system should be adjusted to record and totalize the correct flows as indicated by the calibrating system.

  All flow measurement systems must be calibrated annually with hydraulic calibrations performed at least once every three years. Intervening calibration checks may be instrumentation calibrations (as described below) as long as the system has been properly maintained and physical changes to the flume or weir (wear, warpage, corrosion, etc.) have not altered the original flow curve. All mechanical closed-pipe meters must be hydraulically calibrated once every year. A flow measurement system maintained in an active status must be calibrated even when there is no discharge. Annual instrument calibrations may be performed indefinitely until discharge resumes, at which time a hydraulic calibration must be performed.

- **Method of Calibration (Hydraulic)** – Hydraulic calibration requires zeroing the instrument and then introducing known flow rates into the system. The most common method of hydraulic calibration is to measure known flows through the element with an independent calibrating meter (certified to within 2%) while introducing test water from an outside source (i.e. fire hydrant or water line) at controlled rates upstream of the system. This should be done with no background flow from the facility (i.e. during shutdown, diversion, or impoundment) and should replicate actual flow conditions to the maximum extent practical. Other acceptable methods are insertion of a certified meter in a spool piece of a full flowing closed pipe portion of the system upstream of the device, or measuring level change in a vessel of known volume; these methods may use the facility's own wastewater for calibration. Photographs taken at or near both average and maximum flow conditions should be provided for new open channel systems. These should include a plan view and inlet and outlet views where possible.

  When hydraulic calibration of an open channel system produces a smooth, accurate flow curve (i.e. height versus flow in gpm) different from the standard equation for the particular device, a flow performance curve or data table for the device should be generated and posted at the flow meter. The unique curve should be used to set or correct instrumentation to accurately measure and record flow. The new flow curve should be submitted to the Districts with the calibration report.

  Laboratory bench testing of an existing closed-pipe meter will satisfy the hydraulic calibration requirement as long as a laboratory certificate of meter accuracy is submitted. The primary device must be certified within 2% of actual flow throughout the operating range. Calibration of associated instrumentation such as indicator, recorder and totalizer (as described below) would then be performed and reported on the "Flow Monitoring System Calibration Check Record" form. Cumulative errors must not exceed 5% throughout the entire operating flow range.

- **Method of Calibration (Instrument)** – The instrumentation calibration must confirm that flow rates are accurately sensed by the secondary measuring device and transmitted to the flow recorder and totalizer, but does not require testing of the primary element performance with an independent flow metering method or device. The instrumentation should be checked at a minimum of three flow rates covering the range of normal operation. It is recommended that the entire range of the primary element be simulated, covering five flow rates from zero to the upper limit of accuracy. The use of water columns to test pneumatic level sensing devices is considered an instrumentation calibration and not a hydraulic calibration.

- **Laboratory Certified Calibration Meter** - All meters used for hydraulic calibration of effluent flow measurement systems shall have an accuracy of 2% of actual flow throughout the entire operating flow range of the company's system. In order to maintain accuracy greater than the system being calibrated, the calibrating meter must have been certified within the previous year. If this information is not reflected in a laboratory certificate, the calibration report will be rejected. The certificate must show traceability to either National Institute of Standards and Technology (NIST) or American Water Works Association (AWWA) standards. If the laboratory and/or its equipment has been certified by either organization, the certifying number must be indicated on the calibration certificate.

- **Corrective Measures** - All effluent flow measurement systems must indicate, record, and totalize within 5% of the actual discharge flow rate throughout the entire operating flow range. If the system does not perform within these limits, appropriate corrective action must be taken. Prior to any major system modifications, a description and plans of the proposed modifications should be submitted to the Districts for approval. Any minor adjustments or replaced parts should be described on the "Flow Monitoring System Calibration Check Record" form with an attached sketch.

  The percent error before any corrective measures are taken should be noted by the certifying engineer on the check record form. If the error is greater than 5%, the engineer should determine and document how long the system has been inaccurate. This information should also be provided in the annual surcharge

statement. At the Districts' discretion, water consumption data taken from plant influent water meter(s) may be used with or without allowance for losses to determine the company's surcharge flows during periods when effluent meters are out for repairs or are not operating accurately. Average flow rates, influent-effluent ratios, and data from comparable periods may also be used for this purpose at the Districts' discretion.

- **Certification of Calibration** – This form must be submitted as part of the calibration report and contain the original signatures of both a California registered professional engineer and an administrative official of the company together with the engineer's registration number and the company official's title.

- **Intermediate Calibration Checks** - The Districts may require intermediate calibration and reporting when a system malfunctions and needs extensive repair and/or has been inoperative or inaccurate for an extended period, if reported flows differ significantly from those independently determined by the Districts, or for any other appropriate reason. The date of the intermediate calibration will typically become the due date for the subsequent annual checks. However, the Districts may keep the original due date despite an intermediate check when ongoing problems with a company's system persist.

QUALIFICATIONS FOR DESIGN AND CALIBRATION OF FLOW MEASUREMENT SYSTEM

General

Section 414 of the Districts' *Wastewater Ordinance* states that "Plans for all monitoring facilities, including flow measurement and sampling systems, judged by the Chief Engineer to require engineering design, shall be prepared and signed by an engineer of suitable discipline licensed by the State of California". Furthermore, the requirement for certifying the calibration check submittal by a California registered professional engineer of suitable discipline (as set forth below) is considered essential to correct flow measurement system problems and protect industrial companies from unqualified individuals. The disciplines considered suitable for preparation of flow measurement system plans and certification check submittal are given below.

Primary Disciplines

Three disciplines are deemed suitable based upon necessary registration qualifications. Additionally, these engineers must certify by their signatures and registration numbers on plans or calibration reports that they are knowledgeable in the field of industrial wastewater flow measurement. These disciplines are:

- Civil Engineering
- Chemical Engineering
- Mechanical Engineering

Alternate Disciplines

The Districts have identified five other disciplines possibly suitable for design and/or calibration of industrial wastewater flow measurement systems. Engineers registered in these fields are considered less likely to be familiar with industrial wastewater flow measurement requirements. Therefore, engineers registered in these disciplines must obtain a letter of certification from the Districts by submitting verifiable evidence and documentation of specific related projects that have been successfully designed and/or calibrated before they are considered qualified. These disciplines are:

- Control Systems Engineering
- Electrical Engineering
- Industrial Engineering
- Manufacturing Engineering
- Petroleum Engineering

California registered professional engineers in other disciplines must obtain a letter of certification by submitting a resume to the Districts for approval in addition to the above-stated evidence and verifications. The resume shall include proof of applicable educational qualifications and a summary of related experience.

The Districts may disqualify any registered engineer whose flow measurement plans or calibration check submittal is not prepared in a satisfactory manner.

The Districts appreciate your cooperation in implementing these requirements to ensure that wastewater discharge flow measurement systems are designed, installed and maintained in a professional manner to ensure satisfactory performance and reliable, accurate data. If you have any questions about these requirements, please contact the Districts' Industrial Waste Section at (562) 699-7411, extension 2900.