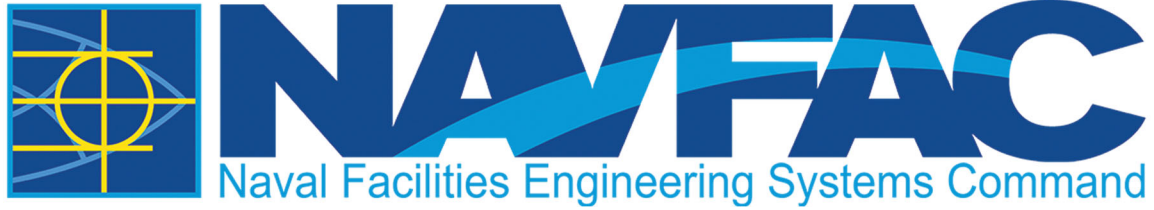


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STANDARD OPERATING PROCEDURE

SOP 4.2 Fluoride Feed System

Abstract: Fluoride feed systems are installed at the water supply pump stations to introduce fluoride for prevention of dental caries.

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Revision Tracking Sheet

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1. SOP Acknowledgement and Training Form
2. Operator's Daily Log Sheet - Fluoride Feed System
3. Sodium Fluoride SDS and Specifications
4. (b) (3) (B) Metering Pumps Installation and Maintenance Information
5. (b) (3) (B) DC Motor Controller (b) (3) (B) Information
6. (b) (3) (B) Fluoride Saturator Manual
7. (b) (3) (B) Metering Pump Instruction Manual
8. (b) (3) (B) Instruction Manual for All Electronic Metering Pumps
9. (b) (3) (B) Total Fluoride ISE System Information
10. (b) (3) (B) Dual Channel Transmitter Information

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1. DEFINITIONS/ACRONYMS

1.1. Definitions

- Calibration: A process that ensures the accuracy of a device or system by comparing its actual performance to a known standard.
- Calibration column: A cylindrical vessel used to check the accuracy of a chemical metering pump or the feed system by measuring how much volume is dispensed.
- Fluoride residual analyzer: An instrument that automatically measures the amount of free available fluoride ions in water.
- Fluoride probe: an instrument that automatically and accurately senses and measures the fluoride ion (F^-) concentration in the finished water stream.
- Injection point: The location where the saturated fluoride solution is introduced into the water supply.
- Metering pump: A device designed to deliver repeatable and adjustable volumes of liquid. The flow rate can be controlled by changing either the pump speed or the piston stroke length.
- Potable water: Water that is suitable for drinking.
- Safety Data Sheet (SDS): An Occupational Safety and Health Administration (OSHA) standardized hazard communication document detailing a chemical's properties and hazards (physical, health, and environmental); protective measures; and safety precautions for handling, storing, and transporting the chemical.
- Speed controller: A device that changes the metering pump speed.

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1.2. Acronyms and Abbreviations

- AC alternating current
- API American Petroleum Institute
- DoD Department of Defense
- DSO Water Distribution System Operator
- F⁻ fluoride ion
- HDPE high density polyethylene
- hp horsepower
- JBPHH Joint Base Pearl Harbor-Hickam
- L liter(s)
- lb pound
- mg/L milligrams per liter
- mL milliliters (0.001 L)
- mL/min milliliters per minute
- NaF sodium fluoride
- NAVFAC Naval Facilities Engineering Systems Command
- OIT Operator(s)-in-training
- OSHA Occupational Safety and Health Administration
- PPE personal protective equipment
- PRP32A Potable Water Branch
- SAE Society of Automotive Engineers
- SDS Safety Data Sheet
- SOP Standard Operating Procedure

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2. OVERVIEW

2.1. Scope and Purpose

This standard Operating Procedure (SOP) covers the maintenance of fluoride feed systems, including the monitoring of fluoride levels, the maintenance and calibration of metering pumps, and the treatment of water with fluoride. In addition, this SOP addresses sodium fluoride bulk delivery and its addition to the saturator tank. Note chemicals, including fluoride, added to the Joint Base Pearl Harbor Hickam (JBPHH) water system must be NSF 60 compliant.

2.2. Operating Summary

2.2.1. Fluoride Addition Process

At JBPHH, fluoride is added using a fluoride saturator feed system. This system generates a saturated sodium fluoride (NaF) solution (up to 18,000 milligrams per liter [mg/L] F^-) by passing potable water through a bed of solid NaF. The saturated fluoride solution is then pumped into the treated water to achieve the target water fluoride concentration (see *Section 2.2.2* for detailed information). Note, while not considered essential for human health, the fluoridation process is mandated by Department of Defense policy.

The fluoride systems at each location operate on the same principle of saturator-based fluoride addition but differ in their tank configuration.

2.2.1.1. Aiea-Halawa Shaft Fluoride Addition Process

The fluoride system at the Aiea-Halawa Shaft utilizes a single-tank design, combining the saturator and the feed tank functions. *Figure 2-1* shows a single-tank fluoride saturator as used at the Aiea-Halawa Shaft. Solid NaF is added manually to the tank, while a float switch on the tank controls the refilling of water via a solenoid valve on the potable water line. When the feed tank is full, the float switch closes the solenoid valve, stopping additional water flow to the saturator/feed tank. The saturator tank lid has space for mounting a single metering pump and is designed to work with a (b) (3) (B) metering pump.

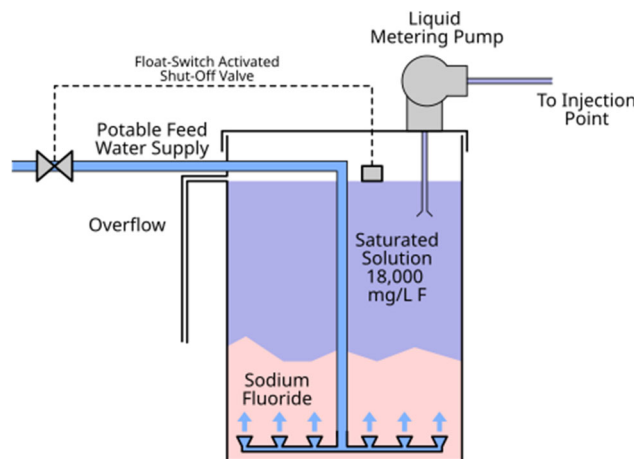


Figure 2-1 Single Tank Fluoride Saturator

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2.2.1.2. Waiawa Shaft Fluoride Addition Process

The fluoride system at the Waiawa Shaft operates with a saturator tank and a feed tank. The NaF is added to the saturator tank and filled with potable water to create the saturated solution. This solution overflows into the feed tank. A metering pump draws from the feed tank to add the saturated solution to the treated water. A float switch in the feed tank controls refilling of the saturator tank via a solenoid valve on the potable water line. When the feed tank level reaches the high mark, the float switch closes the solenoid valve, stopping water supply to the saturator tank, and overflows to the feed tank.

2.2.2. Target Concentration Monitoring

The fluoride feed system maintains a target concentration of 0.7 mg/L in the distribution system. The supervisory control and data acquisition system automatically adjusts the chemical feed pumps based on the flow of the water supply pump station to achieve this target.

The fluoride feed rate is determined by the finished water production rate of each vertical turbine pump. These pumps are flow-paced based on the measured flow rate at the water supply pump stations. Online instrumentation provides continuous monitoring of fluoride concentration. Operators verify these readings through manual sampling and, when necessary, manually adjust the fluoride feed pumps to maintain the 0.7 mg/L limit. For manual fluoride measurement procedures, refer to *SOP 8.2 Spot Monitoring*.

Each fluoride feed pump has piston speed and stroke length adjustment controls (0-100% each). The operation of the feed pump involves the following considerations:

- Pump speed should not exceed 50% if only one well shaft supply pump is operating.
- Stroke length should be adjusted incrementally (one notch at a time), with a 1-hour waiting period between adjustments.

Table 2-1 presents the required daily NaF usage and saturated fluoride solution feed rates for Waiawa Shaft and Aiea-Halawa Shaft, assuming a fluoride dose of 0.7 mg/L and 98.5% percent purity of the NaF. The source water contains only negligible amounts of fluoride. If sodium fluoride usage or the metering feed rates are 10 percent above or below the guideline values, refer to the Troubleshooting Guide in *Section 7*.

Table 2-1 Fluoride Usage and Dosing Guidelines

	Approximate Flow Rate (gallons per minute)	Sodium Fluoride Usage (pounds per day)	Metering Pump Feed Rate (milliliters [mL] per minute)
Waiawa - One Pump	(b) (3) (B)		
Waiawa - Two Pumps			
Waiawa Average Flow (2024)			
Aiea-Halawa - One Pump			

2.2.3. Fluoride Feed Equipment

The fluoride feed equipment is located in the chemical feed building. *Table 2-2* details the components utilized at each location.

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Table 2-2 Fluoride Feed Equipment Specifications

Component	Waiawa Shaft	Aiea-Halawa Shaft
NaF powder, 98.5%	Manufacturer: Shanghai Mintchem Development CO Ltd. Supplier: BEI Hawaii Account # 456657 Federal Reference #: 35695162-17451469-1 See <i>Attachment 3</i> for SDS information	Same
Saturation tank	Manufacturer: (b) (3) (B) Item # (b) (3) (B) Type: Open top, cylindrical, single wall high density polyethylene (HDPE) Capacity: (b) (3) (B) gallons	Manufacturer: (b) (3) (B) (<i>Attachment 7-8</i>) Acts also as a feed tank Capacity: (b) (3) (B) gallons
Feed tank	Manufacturer: (b) (3) (B) Item # (b) (3) (B) Type: Open top, cylindrical, single wall HDPE Capacity: (b) (3) (B) gallons	N/A
Metering pump	Manufacturer: (b) (3) (B) Model: (b) (3) (B) (<i>Attachment 4</i>) Maximum feed rate: (b) (3) (B) gallons per hour Discharge pressure: (b) (3) (B) pounds per square inch	Manufacturer: (b) (3) (B) Model: (b) (3) (B)
Metering pump motor	Manufacturer: (b) (3) (B) Model: (b) (3) (B) Power: 0.33 (1/3) horsepower (hp) Speed: 1750 revolutions per minute Volts / Amps: 90 / 3.2 S/N: (b) (3) (B)	None
Motor speed controller	Manufacturer: (b) (3) (B) (<i>Attachment 5</i>) Model: DC Motor Speed Control, (b) (3) (B)	None
Fluoride probe	Manufacturer: (b) (3) (B) (<i>Attachment 6</i>) Model: (b) (3) (B) Fluoride (F-)	Same
Fluoride chart recorder	Manufacturer: (b) (3) (B) Model: (b) (3) (B)	Same

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3. RESPONSIBILITIES AND QUALIFICATIONS

3.1. Responsibilities

The JBPHH Public Works Department owns and operates the JBPHH drinking water system. Operation and maintenance of the system is the responsibility of the Utilities Maintenance Potable Water Branch (PRP32A). The fluoride feed system operation and maintenance within JBPHH is performed by Production Work Center WHHP6A. Refer to *Figure 3-1* for details.

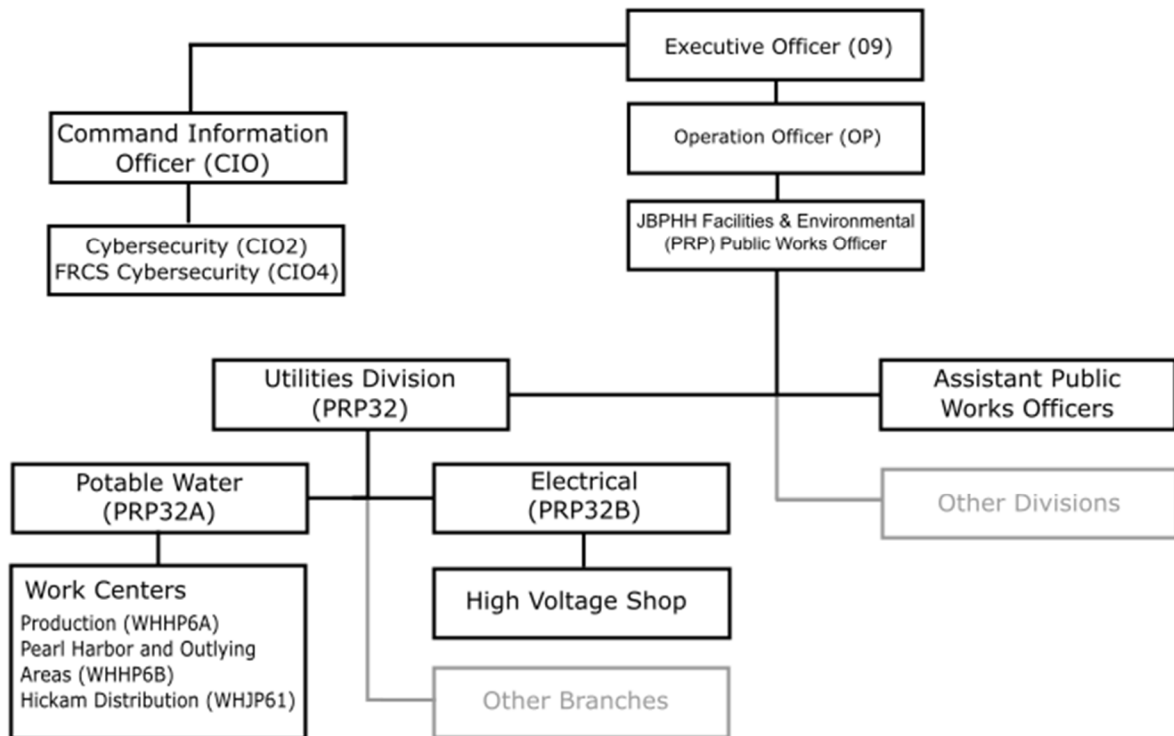


Figure 3-1 Public Works Department Organization

Lead operators and supervisors in PRP32A must ensure that the operators are trained and qualified prior to using this SOP. To support this process, a copy of this SOP should be made readily available to all users. Senior operators are required to update the SOP to reflect any changes in equipment, procedures, or regulations, and train the subordinate operators and maintenance crew(s) accordingly. It is important for senior operators to approve, coordinate, and maintain records of any major repairs on the equipment highlighted in this SOP. Training shall consist of in-depth, hands-on training for all new employees or employees new to this SOP and annual refresher meetings facilitated by the lead operator. All training should be documented using *Attachment 1 SOP Acknowledgement and Training Form*.

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3.2. Qualifications

All personnel involved in operations and maintenance activities for the fluoride feed systems must be trained and qualified to perform their assigned tasks:

- If required, personnel are responsible for obtaining and maintaining a Water Distribution System Operator (DSO) certification, Grade 1 or higher from the State of Hawaii, Department of Health, Safe Drinking Water Branch.
- Unlicensed and uncertified operators or Operators-in-Training (OIT) shall not make process control or system integrity decisions about water quality or quantity that affect public health.
- Follow Navy and base-specific safety regulations and directives and obtain appropriate safety training (see *Section 4*).
- Be familiar with the following:
 - Emergency protocols and communications
 - Operation of tools and equipment
 - Procedures outlined in this SOP

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4. HEALTH AND SAFETY

4.1. General Guidelines

With respect to health and safety, operators shall implement the following:

- Comply with the JBPHH Safety Manual.
- Use engineering, operational, or administrative controls or other means of performing work to eliminate or minimize health and safety hazard risk. Eliminating or minimizing health and safety hazard risk is preferred over the use of personal protective equipment (PPE). Use PPE to reduce hazard exposure when the hazard cannot be eliminated.
- Follow all OSHA requirements for work in confined spaces, trenching, roadways, etc.
- Pay specific attention to the hazards outlined in *Section 4.2*.
- Be familiar with all applicable SDSs. Ensure SDSs are up to date. Ensure the SDSs displayed / available match the chemical being used (i.e., do not use an SDS for the same chemical from another manufacturer).

4.2. Anticipated Hazards

- Eye, skin, and respiratory irritation from sodium fluoride powder
- Injury due to moving parts and equipment (e.g., forklift, chemical bags)
- Confined space
- Electricity
- Work environment (hot weather, excessive heat, sun exposure, wet or humid environment, wet slippery grounds, elevated platform, uneven/unstable ground, noise, etc.)

4.3. Personal Protective Equipment

Utilize the following PPE based on anticipated activities:

- Full-face air respirator (required during fluoride handling and tank filling)
- Safety steel toe shoes with anti-slip soles
- Chemical resistant gauntlet style gloves (natural rubber, neoprene, or nitrile rubber)
- Work gloves for non-chemical tasks
- Full face shield / eye goggles
- Chemical resistant apron or suit (natural rubber, neoprene, or nitrile rubber)
- Hearing protection
- Class 2 safety vest (class 3 vest is required when visibility conditions are limited)

4.4. First Aid

Stocked first aid kits shall be kept in two primary locations: service trucks and water supply pump stations. Operators should promptly remove any expired stock from first aid kits and replace. Operators shall follow detailed instructions in the JBPHH Safety Manual and EM-385-1-1, *Section 3* regarding first aid kit requirements, documentation, and follow up procedures.

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5. EQUIPMENT AND MATERIALS

The section lists the equipment and materials that are relevant to perform this SOP. For detailed information regarding location and quantity of each item, please refer to the JBPHH inventory provided as an attachment to *SOP 1.1 Introduction and Overview*.

Parts:

- Spare pump and motor unit (b) (3) (B)
- Metering pump valve, valve guide, valve seat
- Metering pump O-rings and gaskets
- Metering pump diaphragm (b) (3) (B)
- Metering pump drive unit (1/3 hp electric motor)
- Spare pump and motor unit (b) (3) (B)
- Metering pump diaphragm (b) (3) (B)
- Spare Parts Kit SP (b) (3) (B)
- Fluoride probe O-Rings Material of Construction: (b) (3) (B)

Equipment:

- Access keys
- Safety gear and equipment
- Tool kit

Consumables:

Gear Oil: Esso/Exxon GP80W-90, Shell Spirax/EP80, Mobil Pegasus Gear Oil 80 (Automobile Gear Oil Society of Automotive Engineers [SAE]-80, American Petroleum Institute [API] Grade GL-4), or Castrol Hypoy Gear Oil

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6. SCHEDULE AND PROCEDURES

6.1. Schedule

Refer to *Table 6-1* for a routine fluoride feed system operation and maintenance schedule. Detailed procedures are discussed in subsequent sections. All calibration procedures provided below are conducted by the machinist.

Table 6-1 Fluoride Feed System Schedule

Frequency	Task	Section
Daily	Perform manual fluoride level check; site inspection; monitor fluoride tank levels.	6.2
Weekly	Monitor metering pump operations; calibrate probe.	6.3
Monthly	Perform pump calibration, tank cleaning, and inspection.	6.4
Semi-Annual	Conduct metering pump maintenance.	6.5
Annual	Perform metering pump drive unit oil change.	6.6
	Perform refresher training on this SOP.	6.7

6.2. Daily Fluoride Feed Monitoring

Visit the chemical feed rooms daily to perform the following tasks.

6.2.1. Manual Fluoride Level Check

- Manually analyze fluoride levels; refer to *SOP 8.2 Spot Monitoring*. If the sample results differ from the online analyzer by $> \pm 0.1$ mg/L, calibrate the fluoride analyzer probe following manufacturers' recommendations. Refer to *Section 4.4 in Attachment 7*.
- Document Results in *Attachment 2*.

6.2.2. Site Inspection and Pest Prevention

- Inspect all exterior grounds for cleanliness, orderliness, and proper storage of materials.
- Verify that stored materials do not block operator movement, access to equipment, or interfere with daily operations.
- Ensure adequate lighting is present in all areas.
- Check for any potential safety hazards, such as tripping hazards.
- Seal any openings or potential entry points to prevent pests from entering the building. If any signs of pest activity are found (droppings, nests, etc.), implement appropriate pest control measures.
- Check hoses, tubing, pipes, and fittings for cracks and leaks. Ensure that any openings to the chemical feed tanks, vents, and overflow pipes are covered with a 24-mesh corrosion resistant screen.

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6.2.3. Fluoride Tank Level Monitoring

Check and record the levels of the fluoride feed tank(s). If the tank level is below the 100-pound (lb) mark (Aiea-Halawa) or the sodium fluoride layer at the bottom of the saturator tank is less than 6 inches deep (Waiawa), refill using the following steps:

- Add 50 lbs. of sodium fluoride.
- Add finished water to the fluoride feed tank until it reaches its maximum capacity.
- Stir the contents with a paddle.
- Verify that solid sodium fluoride powder remains at the bottom of the tank.
- Switch the lead and standby metering pumps to ensure balanced run times and prolong pump lifespan.
- Change the circular chart recorder paper. Write the date and time of the paper change on the old and new charts.
- Documentation (*Attachment 2*)
 - Record the fluoride feed tank level in lbs.
 - Record the number of NaF bags added.
 - Note any maintenance issues, repairs, or unusual findings, including specific issues and actions taken. Take photographs for visual documentation.
- Perform data analysis:
 - Review daily log entries.
 - Compare current values to historical data to identify potential pump issues.

6.3. Weekly Metering Pump and Analyzer Operations

Inspect the metering pumps at least once a week and perform the following tasks (in addition to the daily tasks):

- Perform housekeeping in the chemical feed building, including wiping surfaces, removing trash, and mopping the floors.
- Inspect metering pumps for smooth and quiet operation. Any abnormal noise, vibration, or leakage requires immediate shutdown, activation of the standby pump, and initiation of repairs. Refer to the metering pump troubleshooting section for corrective measures.
- Check the metering pump discharge pressure, discharge flow rate, and motor power supply voltage for fluctuations during pump operation. If significant fluctuations are observed, refer to the metering pump troubleshooting section for corrective measures.
- Calibrate the fluoride probe following manufacturers' recommendations. Refer to *Section 4.4* in *Attachment 7*.
- Documentation (*Attachment 2*)
 - Record pump operation times.
 - Record pre- and post-calibration fluoride concentrations.
 - Note any maintenance issues, repairs, or unusual findings, including specific issues and actions taken. Take photographs for visual documentation.

6.4. Monthly Metering Pump Calibration, Tank Cleaning, and Inspection

In addition to the daily and weekly tasks listed above, perform the following actions at least once per month.

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6.4.1. Metering Pump Calibration

There is currently no calibration cylinder installed for the fluoride feed systems. To perform the calibration described below, the suction tube from the fluoride tank could be inserted into a 2-liter (L) graduated cylinder filled with saturated fluoride solution.

- Coordinate metering pump calibration with pump station operation to perform the calibration at a minimum of two distinct operating points (i.e., one or two water supply pumps operating).
- If a calibration column is installed:
 - Open the valve at the bottom of calibration column to fill it to the 2 L mark (*Figure 6-1*).
 - Close the valve from the fluoride supply line.
 - Record the time it takes to withdraw 1,000 mL (1 L) of fluoride solution from the column.
 - After the calibration column is drained as much as possible, re-open the supply valve and close the valve at the bottom of the calibration column.
- If no calibration column is installed:
 - Fill a 2-L graduated cylinder with saturated fluoride solution.
 - Insert the suction tube from the feed tank into the graduated cylinder.
 - Record the time it takes to withdraw 1,000 mL of fluoride solution from the cylinder.
 - Remove the suction tube from the cylinder and re-insert it into the feed tank.
 - Note: The fluoride feed will be briefly interrupted during this process. Ensure that the metering pump remains primed. Refer to the troubleshooting guide (*Table 7-1* provides general troubleshooting guidelines. For troubleshooting the metering pump, refer to *Table 7-2* and *Attachment 4*. For issues with the pump motor controllers, refer to *Table 7-3* and *Attachment 5*.
 - Note: Ensure sanitary conditions are maintained during this process.
- Record the metering pump's motor speed and stroke length settings.
- Compute the metering pump's feed rate by dividing 1,000 mL by the recorded time in seconds. Divide the result by 60 to obtain the feed rate in mL/min. Compare the result to the guideline values in *Table 2-1*.
- Documentation (*Attachment 2*)
 - Note metering pump calibration findings.
 - Note any maintenance issues, repairs, or unusual findings, including specific issues and actions taken. Take photographs for visual documentation.

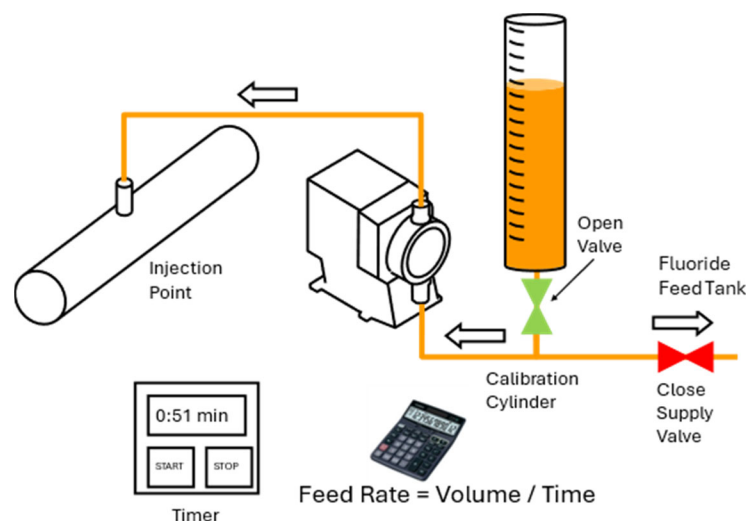


Figure 6-1 Calibration Schematic

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6.4.2. Tank Cleaning and Inspection

This task could be performed with a redundant feed tank. However, fluoridation is not essential and may be interrupted after coordination with the Potable Water Branch supervisor.

- Ensure that the fluoride system is offline.
- Empty the remaining solution from the tank.
- Remove distributor piping, suction tubes, and float valves.
- Scrub the inside of the tank with a bristle brush and mild soapy water to remove any buildup.
- Rinse the tank well with water until the cleaning solution is flushed.
- Refill the tank using the procedure provided in *Section 6.2.3*.
- Document any maintenance issues, repairs, or unusual findings, including specific issues and actions taken (*Attachment 2*). Take photographs for visual documentation.

6.5. Semi-Annual Metering Pump Maintenance

Conduct pump maintenance at least every 6 months per the manufacturer's guidelines in *Attachment 4*.

- Refer to manufacturer's recommended replacement intervals for components such as the diaphragm, O-Rings, and check valves.
- Documentation (*Attachment 2*): Note any maintenance issues, repairs, or unusual findings, including specific issues and actions taken. Take photographs for visual documentation.

6.6. Annual Metering Pump Oil Change

Conduct an annual oil change for the metering pumps by following the steps below. For additional information, refer to *Attachment 4*.

- Position funnel with hose to bucket or bucket under the drain plug. Remove the drain plug and drain the drive unit completely.
- Flush the internal components with a small amount of new oil to remove any residual contaminants.
- Reinstall the drain plug securely.
- Fill the drive unit with new SAE 80W-90 gear oil that meets or exceeds API service GL-4 specifications, up to the specified level indicated on the oil gauge. Note: using the incorrect oil can significantly shorten the lifespan of the gear unit. For the recommended oils, refer to *Section 5*.
- Document any maintenance issues, repairs, or unusual findings, including specific issues and actions taken (*Attachment 2*). Take photographs for visual documentation.

6.7. Annual SOP Refresher Training

- Schedule Training
 - Review operator schedules to identify a convenient time and date for most or all operators to attend the training session.
 - Provide Refresher Training.
- Review key aspects of this SOP
 - Hands on metering pump calibration training
 - Hands on fluoride analyzer probe calibration training
 - Hands on semi-annual pump maintenance training
 - Visual guidance on location and usage of
 - Stroke length adjustment
 - Oil drain plug

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- Address operators' questions or concerns.
 - Identify areas to improve the SOP.
- Documentation
 - Record the date, time, and attendees of the training sessions (see *Attachment 1*).
 - Note any updates or revisions made to the SOP.

6.8. Chemical Delivery

Order NaF well in advance of stock depletion. NaF is delivered to the plant in 50 lb bags. Adhere to the following procedure during the delivery of NaF to the site.

- Exercise safety precautions as follows:
 - Follow the health and safety guidelines as described in *Section 4.1*.
 - Don the appropriate PPE.
- Verify the following:
 - The quantity of bags and the chemical delivered matches the delivery order.
 - NaF bags have no damage.
- Obtain the chemical lot analysis from the vendor and keep it in file.
- Store in a dry, well-ventilated place that is only accessible by authorized personnel.
- Documentation
 - Note the date and time of the delivery.
 - Keep a copy of the receipt.
 - Keep a copy of the chemical lot analysis (if available).
 - Note any relevant findings.

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7. TROUBLESHOOTING

Table 7-1 provides general troubleshooting guidelines. For troubleshooting the metering pump, refer to Table 7-2, and see *Attachment 4* for further details. For issues with the pump motor controllers, refer to Table 7-3 and *Attachment 5*.

Table 7-1 General Troubleshooting Guide

Issue	Potential Related Issue or Cause	Remedy
Excessive NaF use	Chemical purity is too low.	Ensure NSF-certified sodium fluoride with >98.5% purity is used.
Metering pump flow rate too high to maintain 0.7 mg/L residual	- Too little or no NaF in saturator - Fluoride residual in finished water too high - Flow-pace control issue	- Replenish NaF in saturator. - Check fluoride residuals manually. Calibrate fluoride probe. - Check flow pace controls.
Metering pump flow rate too low	- Fluoride residual in finished water too low - Flow-pace control issue	- Check fluoride residuals manually. Calibrate fluoride probe. - Check flow pace controls.
Low fluoride residual	- Injection point clogging - Tank nozzle plug-up	- Clean/flush injection point - Clean tank nozzles

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Table 7-2 Metering Pump Troubleshooting Guide

Issue	Potential Cause	Remedy
No flow; discharge capacity (low, high, unstable); pump does not prime	Clogged valve ball, valve seat, suction pipe, or strainer	Disassemble and clean.
	Valve seat and/or valve ball is worn	Replace according to manufacturer's instructions.
	Worn-out gaskets and O-rings	Replace worn-out gaskets and O-rings according to manufacturer's instructions.
	Damaged parts	Repair or replace damaged hydrant parts, if cracked. Severe damage may require full replacement.
	Air leak	Inspect suction tubing, piping, and connections. Retighten, replace, or repair as necessary.
	Wrong stroke length	Readjust dial to the right length.
Excessive vibration and loud noise	Clogged suction pipe or strainer	Disassemble and clean.
	Defective motor	Replace according to manufacturer's instructions.
Excessive motor amperage	Wrong wiring or defective contact	Check wiring and replace switch if necessary.
Oil leak	Defective oil seal or O-ring	Replace seal or O-ring according to manufacturer's instructions.
High gearbox temperature	Incorrect lubricating oil	Check oil type, quantity, and level; replenish/replace as needed.
	Overload (excessive discharge pressure)	Check discharge line and lower pressure.

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Table 7-3 Motor Controller Troubleshooting Guide

Issue	Potential Cause	Remedy
Not running, stop LED on	Start/Stop switch in stop position	Move switch to start position.
	Main speed potentiometer set to zero	Set potentiometer to desired speed.
	Open connections in main speed potentiometer, signal input, or motor	Verify connections and signal input.
	Inhibit asserted or enable open	Remove inhibit signal or enable drive.
Motor runs then stops/drive trips (TCL Fault)	Drive overload	Restart the motor drive by cycling alternating current (AC) power; reduce load.
Overload (OL) LED On	Motor overload	Check motor amps (DC ammeter in series with armature); correct problem (check shunt type field if applicable).
	Motor shorts or grounds	Check motor; replace if defective.
	CL trimmer potentiometer set too low	Adjust CL trimmer potentiometer.
	No AC power	Correct AC input power problem.; replace fuse or reset breaker.

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8. REFERENCES

- American Water Works Association Standard B701-24: Sodium Fluoride. 13 March 2024
- Unified Facilities Criteria 3-230-02 Operation and Maintenance: Water Supply Systems. 1 November 2023.
- JBPHH Safety Manual
- EM-385-1-1 Safety and Occupational Health Requirements Manual. 15 March 2024.
- OPNAV M-5100.23: Navy Safety and Occupational Health Manual. 5 June 2020.

Notes: _____

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9. ATTACHMENTS

- Attachment 1 - SOP Acknowledgement and Training Form
- Attachment 2 - Operator's Daily Log Sheet - Fluoride Feed System
- Attachment 3 - Sodium Fluoride SDS and Specifications
- Attachment 4 - (b) (3) (B) Metering Pumps Installation and Maintenance Information
- Attachment 5 - (b) (3) (B) DC Motor Controller (b) (3) (B) Information
- Attachment 6 - (b) (3) (B) Fluoride Saturator Manual
- Attachment 7 - (b) (3) (B) Metering Pump Instruction Manual
- Attachment 8 - (b) (3) (B) Instruction Manual for All Electronic Metering Pumps
- Attachment 9 - (b) (3) (B) Total Fluoride ISE System Information
- Attachment 10 - (b) (3) (B) Dual Channel Transmitter Information

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Attachment 1:
SOP Acknowledgement and Training Form

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SOP ACKNOWLEDGEMENT AND TRAINING FORM

This SOP must be read and signed each time training is provided, or modifications are made to the SOP. This form should accompany the current SOP version.

Document Title:	Fluoride Feed System
Document Revision Number:	
Document Revision Date:	

Please sign below in accordance with the following statement: "I have read and understood the above referenced document. I agree to perform the procedures described in this SOP in accordance with the document until such time that it is superseded by a more recent, approved revision."

Print Name	Signature	Date

Notes: _____

SOP Acknowledgement and Training Form (continued)

Trainee:

Sign below to acknowledge that training on this SOP was received, understood, and all questions/concerns were addressed by the trainer.

Trainer:

Sign below to acknowledge that training on this SOP was completed for the individual listed and that the trainee is competent to perform the procedures described within.

Date of Training [mm/dd/yyyy]	Trainee Print Name	Trainee Signature	Trainer Print Name	Trainer Signature

Notes: _____

Attachment 2:
Operator's Daily Log Sheet – Fluoride Feed
System

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Attachment 3:
Sodium Fluoride SDS and Specifications

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SAFETY DATA SHEETS

According to the Hazard Communication Standard (29 CFR 1910.1200)

SECTION 1: Identification

1.1 Product identifier

Product name: SODIUM FLUORIDE

Product Code: -

1.2 Recommended use of the chemical and restrictions on use

Identified uses: It is used as an insecticide. It is also used as additive in water treatment, as a wood preservative, in cleaning compounds, manufacture of glass, and for many other uses

Uses advised against: no data available

1.3 Product supplier

Name: SHANGHAI MINTCHEM DEVELOPMENT CO.,LTD

Address: R406 Hunan Building No. 1988 Dongfang Road, Pudong, Shanghai, China

Tel: +86 21 6845 1592

1.4 Emergency phone number

Emergency telephone number: +86 731 8551 8261

Service time: Monday to Friday, 9am-5pm (Pacific time zone: UTC/GMT +8 hours).

SECTION 2: Hazard(s) identification

2.1 GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301

Skin irritation (Category 2), H315

Eye irritation (Category 2A), H319

Acute aquatic toxicity (Category 3), H402

2.2 GHS Label elements, including precautionary statements

Pictogram:



Signal word: Danger

Hazard statement(s):
H301 Toxic if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H402 Harmful to aquatic life.

Precautionary statement(s):
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P280 Wear eye protection/ face protection.
P280 Wear protective gloves.
P301 + P310 + P330 IF SWALLOWED: Immediately call a POISON

CENTER or doctor/physician. Rinse mouth.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P337 + P313 If eye irritation persists: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Contact with acids liberates very toxic gas.

SECTION 3: Composition/Information on ingredients

3.1 Substances

Chemical name: sodium fluoride
Common name: sodium fluoride
CAS No. 7681-49-4
EC No. 231-667-8

Hazardous components

Component	Classification	Concentration
sodium fluoride	Acute Tox. 3; Skin Irrit. 2; Eye Irrit. 2A; Aquatic Acute 3; H301, H315, H319, H402	-

All intentionally added ingredients are either listed on TSCA or are exempt from listing.

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First-aid measures

4.1 Description of necessary first-aid measures

General advice

Hydrofluoric (HF) acid burns require immediate and specialized first aid and medical treatment. Symptoms may be delayed up to 24 hours depending on the concentration of HF. After decontamination with water, further damage can occur due to penetration/absorption of the fluoride ion. Treatment should be directed toward binding the fluoride ion as well as the effects of exposure. Skin exposures can be treated with a 2.5% calcium gluconate gel repeated until burning ceases. More serious skin exposures may require subcutaneous calcium gluconate except for digital areas unless the physician is experienced in this technique, due to the potential for tissue injury from increased pressure. Absorption can readily occur through the subungual areas and should be considered when undergoing decontamination. Prevention of absorption of the fluoride ion in cases of ingestion can be obtained by giving milk, chewable calcium carbonate tablets or Milk of Magnesia to conscious victims. Conditions such as hypocalcemia, hypomagnesemia and cardiac arrhythmias should be monitored for, since they can occur after exposure. Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11.

4.3 Indication of immediate medical attention and special treatment needed

no data available

SECTION 5: Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media

Dry powder.

5.2 Specific hazards arising from the chemical

no data available

5.3 Special protective equipment and precautions for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Do not flush with water. Keep in suitable, closed containers for disposal.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Never allow product to get in contact with water during storage. Do not store near acids. Moisture sensitive. Keep in a dry place. Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters

no data available

8.2 Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

8.3 Individual protection measures, such as personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

SECTION 9: Physical and chemical properties

Appearance:	white powder
Odor:	no data available
Odor threshold:	no data available
pH:	no data available
Melting point/freezing point:	993 °C
Initial boiling point and boiling range:	1695 °C at 760 mmHg
Flash point:	Not considered to be a fire hazard.
Evaporation rate:	no data available
Flammability (solid, gas):	non flammable
Upper/lower flammability or explosive limits:	no data available
Vapor pressure:	1.9 hPa (1.4 mmHg)
Vapor density:	no data available
Relative density:	2.558 g/cm ³ at 20 °C
Solubility(ies) :	4 g/100 mL (25 °C) in water
Partition coefficient	no data available
n-octanol/water:	
Auto-ignition temperature:	no data available
Decomposition temperature:	no data available

Viscosity: no data available

SECTION 10: Stability and reactivity

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

Hydrolyzed by water. Reacts with mineral acids to generate highly toxic hydrogen fluoride.

10.4 Conditions to avoid

Avoid humidity. Avoid electro-static discharge.

10.5 Incompatible materials

Incompatible with glass.

10.6 Hazardous decomposition products

Hydrogen fluoride, Sodium oxides.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity:

Oral:	LD50 - rat (female) - 148.5 mg/kg
Inhalation:	no data available
Dermal:	LD50 - rat – >2000 mg/kg
Other information on acute toxicity:	no data available

Skin corrosion/irritation:

Irritating to skin.

Serious eye damage/irritation:

Eyes - Rabbit

Result: Eye irritation - 24 h

Remarks: Moderate eye irritation

Respiratory or skin sensitization:

no data available

Germ cell mutagenicity:

no data available

Carcinogenicity:

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	3 - Group 3: Not classifiable as to its carcinogenicity to humans (Sodium fluoride)
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity:

no data available

STOT-single exposure:

no data available

STOT-repeated exposure:

no data available

Aspiration hazard:

no data available

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish:	LC50 - Oncorhynchus mykiss (rainbow trout) - 200 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates:	EC50 - Daphnia magna (Water flea) - 98 mg/l - 48 h
Toxicity to algae:	no data available
Toxicity to microorganisms:	no data available

12.2 Persistence and degradability

No biodegradation in water.

12.3 Bioaccumulative potential

Salmo trutta - 10 d - 5 mg/l

12.4 Mobility in soil

no data available

12.5 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Harmful to aquatic life.

SECTION 13: Disposal considerations

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Packaging that cannot be cleaned should be disposed of as product waste.

SECTION 14: Transport information

DOT (US)

UN number: 1690 Class: 6.1 Packing group: III

Proper shipping name: Sodium fluoride, solid

Reportable Quantity (RQ): 1000 lbs

IMDG

UN number: 1690 Class: 6.1 Packing group: III EMS-No: F-A, S-A

Proper shipping name: Proper shipping name: SODIUM FLUORIDE, SOLID

IATA

UN number: 1690 Class: 6.1 Packing group: III

Proper shipping name: Sodium fluoride, solid

SECTION 15: Regulatory information

TOXIC SUBSTANCE CONTROL ACT (TSCA) Inventory

Listed.

SARA Title III (EPCRA) 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA Title III (EPCRA) 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold reporting levels established by SARA Title III, Section 313.

SARA Title III (EPCRA) 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard.

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

US State Regulations

- New Jersey Right To Know - Right to Know Hazardous Substance List (RTKHSL) Listed.
Sodium fluoride, CAS: 7681-49-4, Revision Date: 2007-03-01
- Massachusetts Right To Know - MASSACHUSETTS SUBSTANCE LIST (MSL) Listed
Sodium fluoride, CAS: 7681-49-4, Revision Date: 2007-03-01
- Pennsylvania RTK - HAZARDOUS SUBSTANCE LIST Listed.
Sodium fluoride, CAS: 7681-49-4, Revision Date: 2007-03-01

SECTION 16: Other information, including date of preparation of the last revision.

16.1 Version

This edition Safety Data Sheets (hereinafter referred to as SDS) is authored on Nov.15, 2014 according as to:

- The revised Hazard Communication Standard (29 CFR 1910.1200)
- GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING OF CHEMICALS (GHS), third revised edition.

16.2 Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Eye Irrit.	Eye irritation
Skin Irrit.	Skin irritation
H301	Toxic if swallowed.
H315	Suspected of causing cancer.
H319	May cause long lasting harmful effects to aquatic life.
H402	Harmful to aquatic life.

16.3 Training Advice

Provide sufficient information, guidance and training to operating personnel.

16.4 Statement of responsibility

This SDS is authorized by "E-chem Consulting Co., Ltd.". The information contained herein is based on the present state of our knowledge. It does not represent a guarantee of any properties of the product. You can contact E-chem Consulting Co., Ltd. via email: sds@e-chem123.com.

The information provided in this SDS characterizes the product with regard to the appropriate safety precautions. But the users shall look for more comprehensive information for the specific use. For any harm or influence caused by the operation or contact with the product, the compiler and supplier of this SDS take no legal responsibility.

SHANGHAI MINTCHEM DEVELOPMENT CO., LTD

Specification Sheet

Sodium Fluoride

Physical Properties:

Formula	Na F	Molecular Weight	41.99	CAS NO	7681-49-4
U.N-NO	1690	Class	6.1	H.S-NO	2826110010

Character: White crystal or powder. Relative Density 2.558. It's odorless. Soluble in water and HF. Insoluble in ethanol. Melting point 993°C and boiling point 1695°C. Non flammable but toxic.

Chemical Parameters:

NO.	Technological Specification	Granular Standard%		Powder Standard%	
1	NaF purity	98.5%min		98.5%min	
2	Sodium Carbonate	0.5%max.		0.5%max.	
3	Na ₂ SiF ₆	1.5%max		1.5%max	
4	Silicon Dioxide	0.5%max.		0.5%max.	
5	Sulphate	0.3%max.		0.3%max.	
6	HF	0.1%max,		0.1%max,	
7	H ₂ O(moisture)	0.5%max.		0.5%max.	
8	Heavy Metal(As Pb)	0.04%max.		0.04%max.	
9	Available Fluoride	43.8%min.		43.8%min.	
10	Water Insoluble matter	0.6%max.		0.6%max.	
11	Particle Size	-20 mesh	98%min	+80 mesh	4 % max
12		+100 mesh	50%min	+200 mesh	25 % max
13		-325 mesh			

APPLICATION: It is mainly used as fluxing agent, timber preservative and water treatment etc.

PACKAGE: Packing in plastic weaved bag 25kg each.

TRANSPORTATION: DG, Class 6.1, UN 1690

MANUFACTURER: SHANGHAI MINTCHEM DEVELOPMENT CO., LTD

上海办 Shanghai Office

上海市浦东新区牡丹路 89 弄 4 号 602 室
R602,4#,89Nong, Mudan Road Pudong
Shanghai, China
Tel: 0086 21 6845 1592
Fax: 0086 21 6845 0923

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Hunan,China
Tel: 0086 731 8552 9244/8552 9245/ 8552 9246
Fax: 0086 731 8551 8 167/8553 0 767

Attachment 4:

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Metering Pumps
Installation and Maintenance Information

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Attachment 5:

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Information

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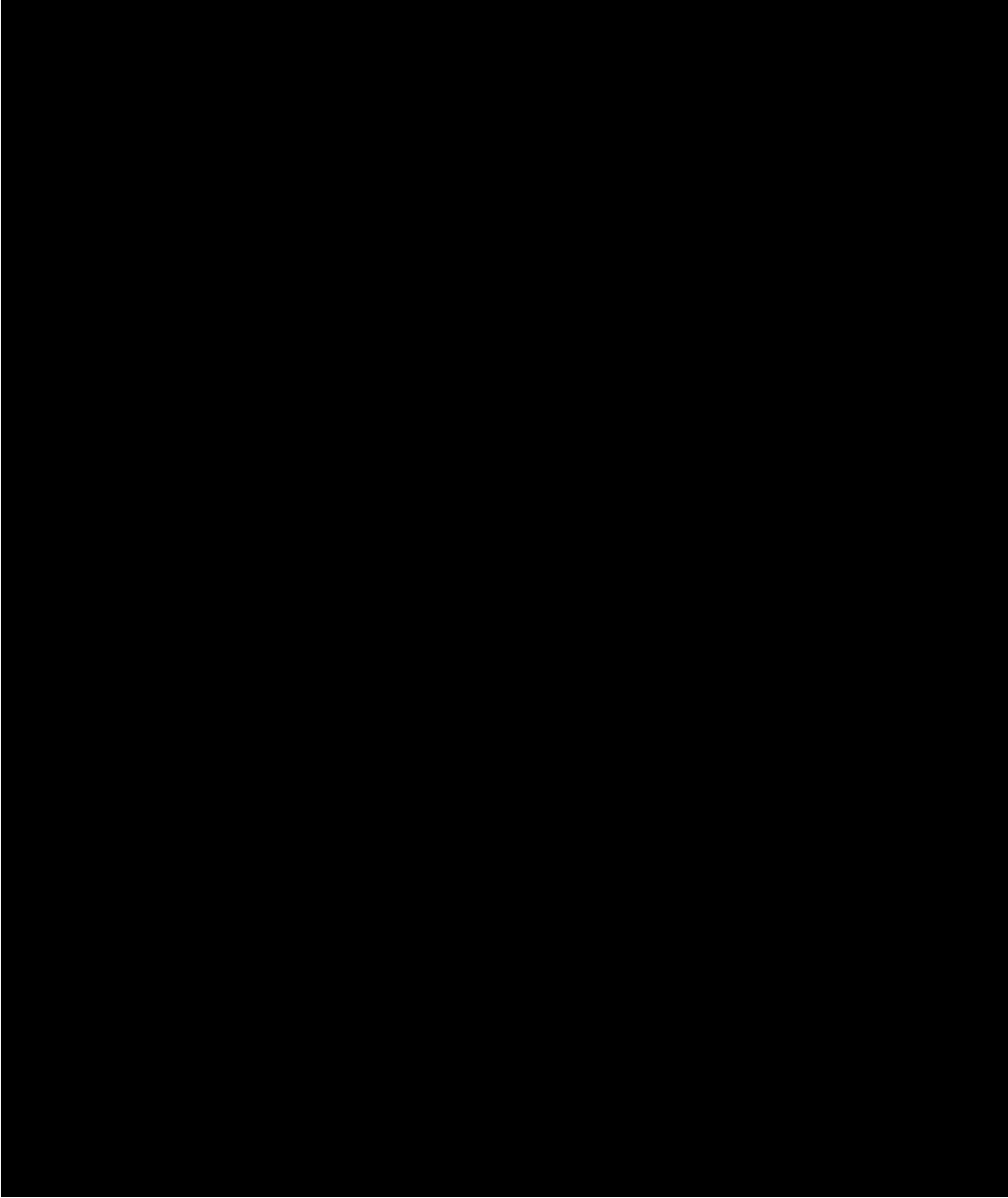
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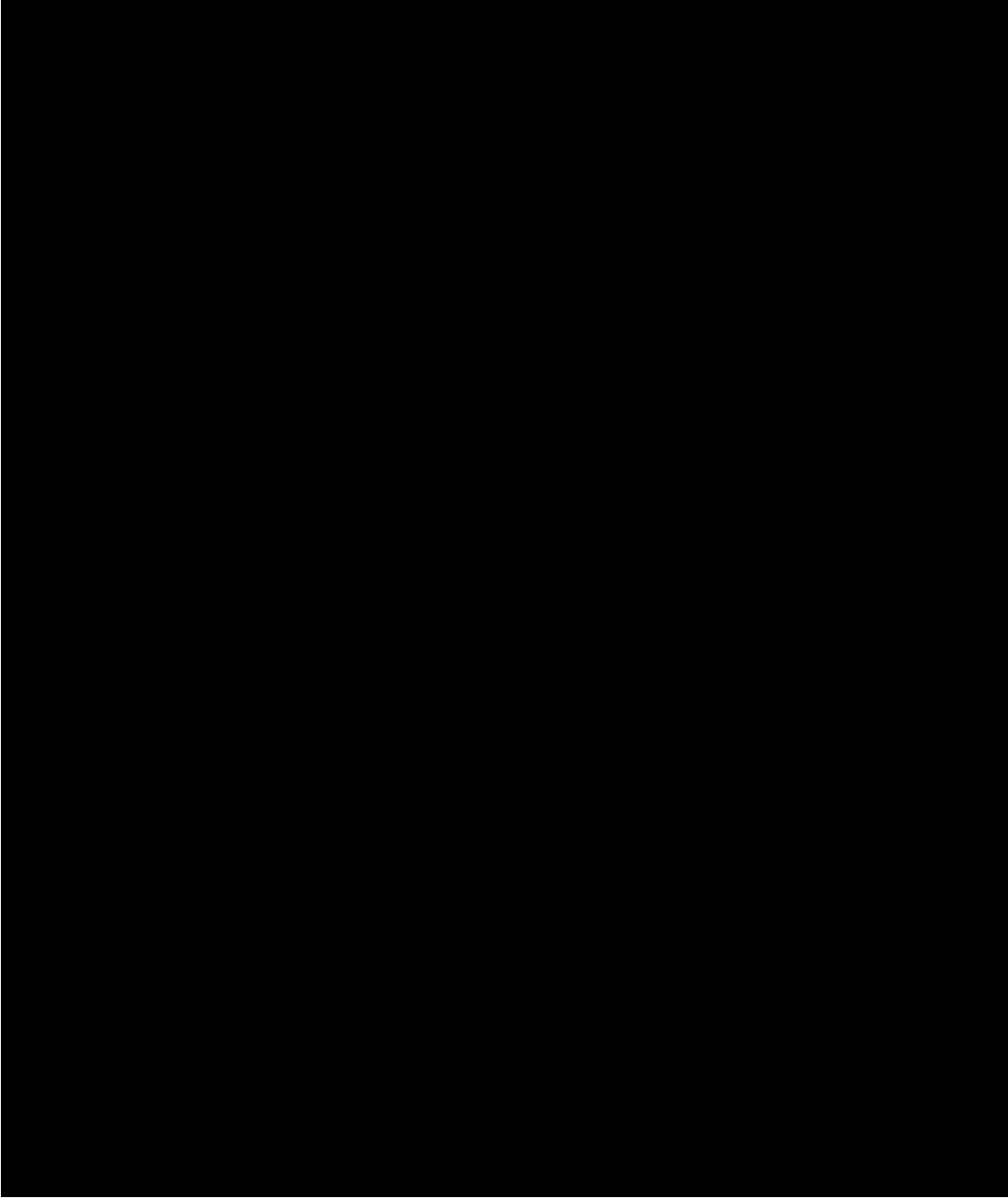
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Fluoride Saturator Manual

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Attachment 7:

(b) (3) (B) Metering Pump
Instruction Manual

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Attachment 8:
(b) (3) (B) Instruction Manual for All
Electronic Metering Pumps

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Attachment 9:

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Total Fluoride ISE System Information

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Attachment 10:

(b) (3) (B) Dual Channel
Transmitter Information

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