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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 471-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Primary Aluminum Industry

On October 23, 1974 (39 FR 37730), under sections 111 and 114 of the Clean Air Act (42 U.S.C. 1857c-6, 1857c-9), as amended, the Administrator proposed standards of performance for new and modified primary aluminum reduction plants. Interested persons participated in the rulemaking by submitting written comments to EPA. The comments have been carefully considered and, where determined by the Administrator to be appropriate, changes have been made in the regulations as promulgated.

These regulations will not, in themselves, require control of emissions from existing primary aluminum reduction plants. Such control will be required only after EPA establishes emission guidelines for existing plants under section 111(d) of the Clean Air Act, which will trigger the adoption of State emission standards for existing plants. General regulations concerning control of existing sources under section 111(d) were proposed on October 7, 1975 (39 FR 36102) and were promulgated on November 17, 1975 (40 FR 53339).

The bases for the proposed standards are presented in the first two volumes of a background document entitled "Background Information for Standards of Performance: Primary Aluminum Industry." Volume 1 (EPA 450/2-74-020a, October 1974) contains the rationale for the proposed standards and Volume 2 (EPA 450/2-74-020b, October 1974) contains a summary of the supporting test data. An inflation impact statement for the standards and a summary of the comments received on the proposed standards along with the Agency responses are contained in a new Volume 3 (EPA 450/2-74-020c, November 1975) of the background document. Copies of all three volumes of the background documents are available on request from the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711, Attention: Mr. Don R. Goodwin.

SUMMARY OF REGULATIONS

The standards of performance promulgated herein limit emissions of gaseous and particulate fluorides from new and modified affected facilities within primary aluminum reduction plants. The standard for fluorides limits emissions from each potroom group within Soderberg plants to 2.0 pounds of total fluorides per ton of aluminum produced (lb TF/TAP), from each potroom group within prebake plants to 1.9 lb TF/TAP, and from each anode bake plant within prebake plants to 0.1 lb TF/TAP. Primary and secondary emission from potroom groups are limited to less than 10 percent opacity, and emissions from anode bake plants are limited to less than 20 percent opacity. The regulations require monitoring of raw material feed rates, cell or potline voltages, and daily production rate of aluminum and anodes. Also included with the standards is Reference Method 14 which specifies equipment and sampling procedures for emission testing of potroom roof monitors. Fluoride samples collected during performance tests will be analyzed according to Reference Method 13A or 13B which were promulgated along with standards of performance for the phosphate fertilizer industry on August 6, 1975 (40 FR 33152).

SIGNIFICANT COMMENTS AND CHANGES MADE TO THE PROPOSED REGULATIONS

Most of the comment letters received by EPA contained multiple comments. Copies of the comment letters received and a summary of the comments and Agency responses are available for public inspection and copying at the U.S. Environmental Protection Agency, Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, S.W., Washington, D.C. 20460. In addition, copies of the issue summary and Agency responses may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street, SW., Washington, D.C. 20460 [specify "Background Information for Standards of Performance: Primary Aluminum Industry Volume 3: Supplemental Information" (EPA 45/2-74-020c)]. The most significant comments and changes made to the proposed regulations are discussed below.

(1) *Designation of Affected Facility.* Several comments questioned the "applicability and designation of affected facility" section of the proposed regulations (§ 60.190) in view of regulations previously proposed by EPA with regard to modification of existing plants (39 FR 36946, October 15, 1974). In § 60.190 as proposed, the entire primary aluminum reduction plant was designated as the affected facility. The commentators argued that, as a result of this designation, addition or modification of a single potroom at an existing plant would subject all existing potrooms at the plant to the standards for new sources. The commentators argued that this situation would unfairly restrict expansion. The Agency considered these comments and agreed that there would be an adverse economic impact on expansion of existing plants unless the affected facility designation were revised.

To alleviate the problem, a new affected facility designation has been incorporated in § 60.190(a). The affected facilities within primary aluminum plants are now each "potroom group" and each anode bake plant within prebake plants. This redesignation in turn required splitting the fluoride standard for prebake plants into separate standards for potroom groups and anode bake plants (see discussion in next section). As defined in § 60.191(d), the term "potroom group" means an uncontrolled potroom, or a potroom which is controlled individually, or a group of potrooms ducted to the same control system. Under this revised designation, addition or modification of a potroom group at an existing plant will not subject the entire plant to the standards (unless the plant consists of only one potroom group). Similarly, addition or modification of an anode bake plant at an exiting prebake facility will not subject the entire prebake facility to the standards. Only the new or modified potroom group or anode bake plant must meet the applicable standards in such cases.

(2) *Fluoride Standard.* Many commentators questioned the level of the proposed standard; i.e., 2.0 lb TF/TAP. A number of industrial commentators suggested that the standard be relaxed or that it be specified in terms of a monthly or yearly emission limit. Some commentators argued that the test data did not support the standard and that statistical techniques should have been applied to the test data in order to arrive at an emission standard.

Standards of performance under section 111 are based on the best control technology which (taking into account control costs) has been "adequately demonstrated." "Adequately demonstrated" means that the Administrator must determine, on the basis of all information available to him (including but not limited to tests and observations of existing plants and demonstration projects or pilot applications) and the exercise of sound engineering judgment, that the control technology relied upon in setting a standard of performance can be made available and will be effective to enable sources to comply with the standards. In other words, test data for existing plants are not the only bases for standard setting. As discussed in the background document, EPA considered not only test data for existing plants, but also the expected performance of newly constructed plants. Some existing plants tested did average less than 2.0 lb TF/TAP. Additionally, EPA believes new plants can be specifically designed for best control of air pollutants and, therefore, that new plant emission control performance should exceed that of well-controlled existing plants. Finally, relatively simple changes in current operating methods (e.g., cell tapping) can produce significant reductions in emissions. For these reasons, EPA believes the 2.0 lb TF/TAP standard is both reasonable and achievable. A more detailed discussion of the rationale for selecting the 2.0 lb TF/TAP standard is contained in Volume 1 of the background document, and EPA's responses to specific comments on the fluoride standard are contained in Volume 3.

As a result of the revised affected facility designation, the 2.0 lb TF/TAP standard for prebake plants has been split into separate standards for potroom groups (1.9 lb TF/TAP) and anode bake plants (0.1 lb TF/TAP). The proposed 2.0 lb TF/TAP limitation for prebake plants always consisted of these two components, but was published as a combined standard to be consistent with the original affected facility designation (i.e., the entire primary aluminum plant). At the time of proposal, the Agency had not foreseen the potential problems with modification of a two part affected facility. Data supporting each component of the standard as proposed is contained in the background document (Volumes 1 and 2). In support of the potroom component of the standard, for example, two existing prebake potrooms tested by the Agency averaged less than 1.9 lb TF/TAP. Because no well controlled anode bake plants existed at the time of aluminum plant testing, the components for anode bake plants was based on a conservatively assumed control efficiency for technology demonstrated in the phosphate fertilizer industry. Using the highest emission rate observed at two anode bake plants which were not controlled for fluorides and applying the assumed control efficiency, it was projected that these plants would emit approximately 0.06 lb TF/TAP (0.12 lb TF/ton of carbon anodes produced). In addition, as indicated in Volume 1 of the background document, it may be possible to meet the standard for anode bake plants simply by better cleaning of anode remnants. The Agency also has estimates of emission rates for a prebake facility to be built in the near future. The estimates indicate that the anode bake plant at the facility will easily meet the 0.1 TF/TAP standard.

One commentator questioned why the standard was not more stringent considering the fact that Oregon has promulgated the following standards for new primary aluminum plants: (a) a monthly average of 1.3 pounds of fluoride ion per ton of aluminum produced, and (b) an annual average of 1.0 pound of fluoride ion per ton of aluminum produced.

There are several reasons why the Agency elected not to adopt standards equivalent to the Oregon standards. Perhaps most important, EPA believes that the Oregon standards would require the installation of relatively inefficient secondary scrubbing systems at most if not all new primary aluminum plants. By contrast, EPA's standard will require use of secondary control systems only for vertical stud Soderberg (VSS) plants (which are unlikely to be built in any event) and side-work prebake plants. A standard requiring secondary control systems on most if not all plants would have a substantial adverse economic impact on the aluminum industry, as is indicated in the economic section of the background document. Accordingly, EPA has concluded that considerations of cost preclude establishing a standard comparable to the Oregon standards.

A second reason for not adopting standards equivalent to the Oregon standards stems from the fact that the latter were based on test data consisting of six monthly averages (calculated by averaging from three to nine individual tests each month) from a certain well controlled plant (which incorporates both primary and secondary control). Oregon applied a statistical method to these data to derive the emission standards it adopted. As discussed in the comment summary, EPA also performed a statistical analysis of the Oregon test data, which yielded results different from those presented in the Oregon technical report. If the Agency's results had been used, less stringent emission standards might have been promulgated in Oregon.

A third consideration is that the test methods used by Oregon were not the same as those used by the Agency to collect emission data in support of the respective standards. Therefore, Oregon's test data and the Agency's test data are not directly comparable.

Finally, a comment on the standard for fluorides questioned whether or not EPA had considered a new, potentially non-polluting primary aluminum reduction process developed by Alcoa. The commentator argued that if the process had become commercially available, the standard should be set at a level sufficiently stringent to stimulate the development of this new process. In response to this comment, EPA has investigated the process and has determined that it is not yet commercially available. Alcoa plans to test the process at a small pilot plant which will begin production early next year. If the pilot plant performs successfully, it will be expanded to full design capacity by the early 1980's. EPA will monitor the progress of this process and other processes under development and will reevaluate the standards of performance for the primary aluminum industry, as appropriate, in light of the new technology.

(3) *Opacity.* Some of the industrial commentators objected to the proposed opacity standards for potrooms and anode bake plants. They argued that good control of total fluorides will result in good control of particulate matter, and therefore that the opacity standards are unnecessary. EPA agrees that good control of total fluorides will result in good control of particulate matter; however, the opacity standards are intended to serve as inexpensive enforcement tools that will help to insure proper operation and maintenance of the air pollution control equipment. Under 40 CFR 60.11(d), owners and operators of affected facilities are required to operate and maintain their control equipment properly at all times. Continuous monitoring instruments are often required to indicate compliance with 60.11(d), but this is not possible in the primary aluminum industry because continuous total fluoride monitors are not commercially available. The data presented in the background document indicate that the opacity standards can be easily met at well controlled plants that are properly operated and maintained. For these reasons, the opacity standards have been retained in the final regulations.

EPA recognizes, however, that in unusual circumstances (e.g., where emissions exit from an extremely wide stack) a source might meet the mass emission limit but fail to meet the opacity limit. In such cases, the owner or operator of the source may petition the Administrator to establish a separate opacity standard under 40 CFR 60.11(e) as revised on November 12, 1974 (39 FR 39872).

(4) *Control of Other Pollutants.* One commentator was concerned that EPA did not propose standards for carbon monoxide (CO) and sulfur dioxide (SO_2) emissions from aluminum plants. The commentator argued that aluminum smelters are significant sources of these pollutants, and that although fluorides are the most toxic aluminum plant emissions, standards for all pollutants should have been proposed. As discussed in the preface to Volume 1 of the background document, fluoride control was selected as one area of emphasis to be considered in implementing the Clean Air Act. In turn, primary aluminum plants were identified as major sources of fluoride emissions and were accordingly listed as a category of sources for which standards of performance would be proposed. Naturally, the initial investigation into standards for the primary aluminum industry focused on fluoride control. However, limited testing of CO and SO_2 emissions was also carried out and it was determined (a) that although primary aluminum plants might be a significant source of SO_2, SO_2 control technology had not been demonstrated in the industry, and (b) that CO emissions from such plants were insignificant. For these reasons, standards of performance were not proposed for SO_2 and CO emissions.

It is possible that SO_2 control technology used in other industries might be applicable to aluminum plants, and recent information indicates that CO emissions from such plants may be significant. At present, however, EPA has insufficient data on which to base SO_2 and CO emission standards for aluminum plants. EPA will consider the factors mentioned above and other relevant information in assigning priorities for future standard setting and invites submission of pertinent information by any interested parties. Thus, standards for CO and SO_2 emissions from primary aluminum plants may be set in the future.

(5) *Reference Methods 13A and 13B.* These methods prescribe sampling and analysis procedures for fluoride emissions and are applicable to the testing of phosphate fertilizer plants in addition to primary aluminum plants. The methods were originally proposed with the primary aluminum regulations but have been promulgated with the standards of performance for the phosphate fertilizer industry (published August 6, 1975, 40 FR 33152) because the fertilizer regulations were promulgated before those for primary aluminum. Comments on the methods were received from both industries and mainly concerned possible changes in procedures and equipment specifications. As discussed in the preamble to the phosphate fertilizer regulations, some minor changes were made as a result of these comments.

Some commentators expressed a desire to replace Methods 13A and 13B with totally different methods of analysis. They felt that they should not be restricted to using only those methods published by the Agency. In response to these comments, an equivalent or alternative method may be used if approved by the Administrator under 40 CFR 60.8(b) as revised on March 8, 1974 (39 FR 9308).

(6) *Reference Method 14.* Reference Method 14 specifies sampling equipment and sampling procedures for measuring fluoride emissions from roof monitors. Most comments concerning this method suggested changes in the prescribed manifold system. A number of commentators objected to the requirement that stainless steel be used as the structural material for the manifold and suggested that other, less expensive structural materials would work as well. Data submitted by one aluminum manufacturer supported the use of aluminum for manifold construction. The Agency reviewed these data and concluded that an aluminum manifold will provide satisfactory fluoride samples if the manifold is conditioned prior to testing by passing fluoride-laden air through the system. By using aluminum instead of stainless steel, the cost of installing a sampling manifold would be substantially reduced. Since the Agency had no data on other possible structural materials, it was not possible to endorse their use in the method. However, the following wording addressing this subject has been added to the method text (§ 2.2.1): "Other materials of construction may be used if it is demonstrated through comparative testing that there is no loss of fluorides in the system."

Some commentators also objected to the requirement that the mean velocity measured during fluoride sampling be within ±10 percent of the previous 24-hour average velocity recorded through the system. In order to reduce the number of rejected sampling runs due to failure to meet the above criteria, the requirement has been amended such that the mean sampling velocity must be within ±20 percent of the previous 24-hour average velocity. EPA believes that the relaxation of this requirement will not compromise the accuracy of the method.

(7) *Economic Impact.* Some comments raised questions regarding the economic impact of the proposed regulations. The Agency has considered these comments and responded to them in the comment summary cited above. As indicated previously, an analysis of the inflationary and energy impacts of the standards appears in Volume 3 of the background document. Copies of these documents may be obtained as indicated previously.

Effective date. In accordance with section 111 of the Act, these regulations are effective January 26, 1976 and apply to sources the construction or modification of which commenced after proposal of the standards; i.e., after October 23, 1974.

(It is hereby certified that the economic and inflationary impacts of this regulation have been carefully evaluated in accordance with Executive Order 11821)

Dated: January 19, 1976.

RUSSELL E. TRAIN,
Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations, is amended as follows:

1. The table of sections is amended by adding a list of sections for Subpart S and by adding Reference Method 14 to the list of reference methods in Appendix A as follows:

Subpart S—Standards of Performance for Primary Aluminum Reduction Plants

Sec.
60.190 Applicability and designation of affected facility.
60.191 Definitions.
60.192 Standard for fluorides.
60.193 Standard for visible emissions.
60.194 Monitoring of operations.
60.195 Test methods and procedures.

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APPENDIX A—REFERENCE METHODS

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METHOD 14—DETERMINATION OF FLUORIDE EMISSIONS FROM POTROOM ROOF MONITORS OF PRIMARY ALUMINUM PLANTS

AUTHORITY: Secs. 111 and 114, Clean Air Act, as amended by sec. 4(a), Pub. L. 91-604, 84 Stat. 1678, 42 U.S.C. 1857 C-6, C-9.

2. Part 60 is amended by adding subpart S as follows:

Subpart S—Standards of Performance for Primary Aluminum Reduction Plants

§ 60.190 Applicability and designation of affected facility.

The affected facilities in primary aluminum reduction plants to which this subpart applies are potroom groups and anode bake plants.

§ 60.191 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Primary aluminum reduction plant" means any facility manufacturing aluminum by electrolytic reduction.

(b) "Anode bake plant" means a facility which produces carbon anodes for use in a primary aluminum reduction plant.

(c) "Potroom" means a building unit which houses a group of electrolytic cells in which aluminum is produced.

(d) "Potroom group" means an uncontrolled potroom, a potroom which is controlled individually, or a group of potrooms ducted to the same control system.

(e) "Roof monitor" means that portion of the roof of a potroom where gases not captured at the cell exit from the potroom.

(f) "Aluminum equivalent" means an amount of aluminum which can be produced from a ton of anodes produced by an anode bake plant as determined by § 60.195(e).

(g) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.195 or by equivalent or alternative methods [see § 60.8(b)].

(h) "Primary control system" means an air pollution control system designed to remove gaseous and particulate fluorides from exhaust gases which are captured at the cell.

(i) "Secondary control system" means an air pollution control system designed to remove gaseous and particulate fluorides from gases which escape capture by the primary control system.

§ 60.192 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of:

(1) 1 kg/metric ton (2 lb/ton) of aluminum produced for vertical stud Soderberg and horizontal stud Soderberg plants;

(2) 0.95 kg/metric ton (1.9 lb/ton) of aluminum produced for potroom groups at prebake plants; and

(3) 0.05 kg/metric ton (0.1 lb/ton) of aluminum equivalent for anode bake plants.

§ 60.193 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere:

(1) From any potroom group any gases which exhibit 10 percent opacity or greater, or

(2) From any anode bake plant any gases which exhibit 20 percent opacity or greater.

§ 60.194 Monitoring of operations.

(a) The owner or operator of any affected facility subject to the provisions of this subpart shall install, calibrate, maintain, and operate monitoring devices which can be used to determine daily the weight of aluminum and anode produced. The weighing devices shall have an accuracy of ±5 percent over their operating range.

(b) The owner or operator of any affected facility shall maintain a record of daily production rates of aluminum and anodes, raw material feed rates, and cell or potline voltages.

§ 60.195 Test methods and procedures.

(a) Except as provided in § 60.8(b), reference methods specified in Appendix A of this part shall be used to determine compliance with the standards prescribed in § 60.192 as follows:

(1) For sampling emissions from stacks:

(i) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(ii) Method 1 for sample and velocity traverses,

(iii) Method 2 for velocity and volumetric flow rate, and

(iv) Method 3 for gas analysis.

(2) For sampling emissions from roof monitors not employing stacks or pollutant collection systems:

(i) Method 14 for the concentration of total fluorides and associated moisture content,

(ii) Method 1 for sample and velocity traverses,

(iii) Method 2 and Method 14 for velocity and volumetric flow rate, and

(iv) Method 3 for gas analysis.

(3) For sampling emissions from roof monitors not employing stacks but equipped with pollutant collection systems, the procedures under § 60.8(b) shall be followed.

(b) For Method 13A or 13B, the sampling time for each run shall be at least eight hours for any potroom sample and at least four hours for any anode bake plant sample, and the minimum sample volume shall be 6.8 dscm (240 dscf) for any potroom sample and 3.4 dscm (120 dscf) for any anode bake plant sample except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for each affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined using applicable methods specified under paragraph (a) of this section.

(d) The rate of aluminum production shall be determined as follows:

(1) Determine the weight of aluminum in metric tons produced during a period from the last tap before a run starts until the first tap after the run ends using a monitoring device which meets the requirements of § 60.194(a).

(2) Divide the weight of aluminum produced by the length of the period in hours.

(e) For anode bake plants, the aluminum equivalent for anodes produced shall be determined as follows:

(1) Determine the average weight (metric tons) of anode produced in the anode bake plant during a representative oven cycle using a monitoring device which meets the requirements of § 60.194(a).

(2) Determine the average rate of anode production by dividing the total weight of anodes produced during the representative oven cycle by the length of the cycle in hours.

(3) Calculate the aluminum equivalent for anodes produced by multiplying the average rate of anode production by two. (Note: an owner or operator may establish a different multiplication factor by submitting production records of the tons of aluminum produced and the concurrent tons of anode consumed by potrooms.)

(f) For each run, potroom group emissions expressed in kg/metric ton of aluminum produced shall be determined using the following equation:

$$E_{pg}=\frac{(C_sQ_s)_1 10^{-6}+(C_sQ_s)_2 10^{-6}}{M}$$

where:

E_{pg}=potroom group emissions of total fluorides in kg/metric ton of aluminum produced.

C_s=concentration of total fluorides in mg/dscm as determined by Method 13A or 13B, or by Method 14, as applicable.

Q_s=volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2 and/or Method 14, as applicable.

10^{-6}=conversion factor from mg to kg.

M=rate of aluminum production in metric ton/hr as determined by § 60.195(d).

$(C_sQ_s)_1$=product of C_s and Q_s for measurements of primary control system effluent gas streams.

$(C_sQ_s)_2$=product of C_s and Q_s for measurements of secondary control system or roof monitor effluent gas streams.

(g) For each run, as applicable, anode bake plant emissions expressed in kg/metric ton of aluminum equivalent shall be determined using the following equation:

$$E_{bp}=\frac{C_sQ_s 10^{-6}}{M_e}$$

Where:

E_{bp}=anode bake plant emissions of total fluorides in kg/metric ton of aluminum equivalent.

C_s=concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s=volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-6}=conversion factor from mg to kg.

M_e=aluminum equivalent for anodes produced by anode bake plants in metric ton/hr as determined by § 60.195(e).

3. Part 60 is amended by adding Reference Method 14 to Appendix A as follows:

METHOD 14—DETERMINATION OF FLUORIDE EMISSIONS FROM POTROOM ROOF MONITORS OF PRIMARY ALUMINUM PLANTS

1. *Principle and applicability.*

1.1 *Principle.* Gaseous and particulate fluoride roof monitor emissions are drawn into a permanent sampling manifold through several large nozzles. The sample is transported from the sampling manifold to ground level through a duct. The gas in the duct is sampled using Method 13A or 13B—DETERMINATION OF TOTAL FLUORIDE EMISSIONS FROM STATIONARY SOURCES. Effluent velocity and volumetric flow rate are determined with anemometers permanently located in the roof monitor.

1.2 *Applicability.* This method is applicable for the determination of fluoride emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards.

2. *Apparatus.*

2.1.1 *Anemometers.* Vane or propeller anemometers with a velocity measuring threshold as low as 15 meters/minute and a range up to at least 600 meters/minute. Each anemometer shall generate an electrical signal which can be calibrated to the velocity measured by the anemometer. Anemometers shall be able to withstand dusty and corrosive atmospheres.

One anemometer shall be installed for every 85 meters of roof monitor length. If the roof monitor length divided by 85 meters is not a whole number, round the fraction to the nearest whole number to determine the number of anemometers needed. Use one anemometer for any roof monitor less than 85 meters long. Permanently mount the anemometers at the center of each equal length along the roof monitor. One anemometer shall be installed in the same section of the roof monitor that contains the sampling manifold (see section 2.2.1). Make a velocity traverse of the width of the roof monitor where an anemometer is to be placed. This traverse may be made with any suitable low velocity measuring device, and shall be made during normal process operating conditions. Install the anemometer at a point of average velocity along this traverse.

2.1.2 *Recorders.* Recorders equipped with signal transducers for converting the electrical signal from each anemometer to a continuous recording of air flow velocity, or to an integrated measure of volumetric flow. For the purpose of recording velocity, "continuous" shall mean one readout per 15-minute or shorter time interval. A constant amount of time shall elapse between readings. Volumetric flow rate may be determined by an electrical count of anemometer revolutions. The recorders or counters shall permit identification of the velocities or flow rate measured by each individual anemometer.

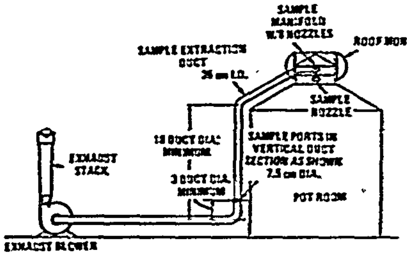

Figure 14-1. Roof Monitor Sampling System.

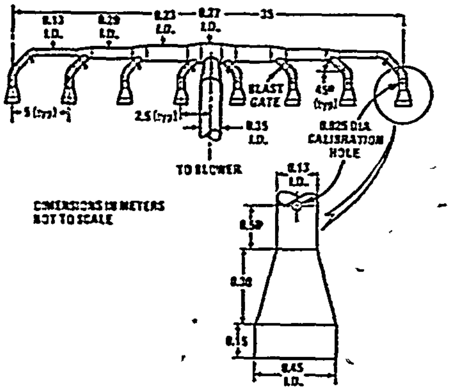

Figure 14-2. Sampling Manifold and Nozzles.

2.2 Roof monitor air sampling system.

2.2.1 *Sampling ductwork.* The manifold system and connecting duct shall be permanently installed to draw an air sample from the roof monitor to ground level. A typical installation of duct for drawing a sample from a roof monitor to ground level is shown in Figure 14-1. A plan of a manifold system that is located in a roof monitor is shown in Figure 14-2. These drawings represent a typical installation for a generalized roof monitor. The dimensions on these figures may be altered slightly to make the manifold system fit into a particular roof monitor, but the general configuration shall be followed. There shall be eight nozzles, each having a diameter of 0.40 to 0.50 meters. The length of the manifold system from the first nozzle to the eighth shall be 35 meters or eight percent of the length of the roof monitor, whichever is greater. The duct leading from the roof monitor manifold shall be round with a diameter of 0.30 to 0.40 meters. As shown in Figure 14-2, each of the sample legs of the manifold shall have a device, such as a blast gate or valve, to enable adjustment of flow into each sample nozzle.

Locate the manifold along the length of the roof monitor so that it lies near the midsection of the roof monitor. If the design of a particular roof monitor makes this impossible, the manifold may be located elsewhere along the roof monitor, but avoid locating the manifold near the ends of the roof monitor or in a section where the aluminum reduction pot arrangement is not typical of the rest of the potroom. Center the sample nozzles in the throat of the roof monitor. (See Figure 14–1.) Construct all sample-exposed surfaces within the nozzles, manifold and sample duct of 316 stainless steel. Aluminum may be used if a new ductwork system is conditioned with fluoride-laden roof monitor air for a period of six weeks prior to initial testing. Other materials of construction may be used if it is demonstrated through comparative testing that there is no loss of fluorides in the system. All connections in the ductwork shall be leak free.

Locate two sample ports in a vertical section of the duct between the roof monitor and exhaust fan. The sample ports shall be at least 10 duct diameters downstream and two diameters upstream from any flow disturbance such as a bend or contraction. The two sample ports shall be situated 90° apart. One of the sample ports shall be situated so that the duct can be traversed in the plane of the nearest upstream duct bend.

2.2.2 *Exhaust fan.* An industrial fan or blower to be attached to the sample duct at ground level. (See Figure 14–1.) This exhaust fan shall have a maximum capacity such that a large enough volume of air can be pulled through the ductwork to maintain an isokinetic sampling rate in all the sample nozzles for all flow rates normally encountered in the roof monitor.

The exhaust fan volumetric flow rate shall be adjustable so that the roof monitor air can be drawn isokinetically into the sample nozzles. This control of flow may be achieved by a damper on the inlet to the exhauster or by any other workable method.

2.3 Temperature measurement apparatus.

2.3.1 *Thermocouple.* Installed in the roof monitor near the sample duct.

2.3.2 *Signal transducer.* Transducer to change the thermocouple voltage output to a temperature readout.

2.3.3 *Thermocouple wire.* To reach from roof monitor to signal transducer and recorder.

2.3.4 *Sampling train.* Use the train described in Methods 13A and 13B—Determination of total fluoride emissions from stationary sources.

3. Reagents.

3.1 *Sampling and analysis.* Use reagents described in Method 13A or 13B—Determination of total fluoride emissions from stationary sources.

4. Calibration.

4.1 *Propeller anemometer.* Calibrate the anemometers so that their electrical signal output corresponds to the velocity or volumetric flow they are measuring. Calibrate according to manufacturer's instructions.

4.2 *Manifold intake nozzles.* Adjust the exhaust fan to draw a volumetric flow rate (refer to Equation 14–1) such that the entrance velocity into each manifold nozzle approximates the average effluent velocity in the roof monitor. Measure the velocity of the air entering each nozzle by inserting an S type pitot tube into a 2.5 cm or less diameter hole (see Figure 14–2) located in the manifold between each blast gate (or valve) and nozzle. The pitot tube tip shall be extended into the center of the manifold. Take care to insure that there is no leakage around the pitot probe which could affect the indicated velocity in the manifold leg. If the velocity of air being drawn into each nozzle is not the same, open or close each blast gate (or valve) until the velocity in each nozzle is the same. Fasten each blast gate (or valve) so that it will remain in this position and close the pitot port holes. This calibration shall be performed when the manifold system is installed. (Note: It is recommended that this calibration be repeated at least once a year.)

5. Procedure.

5.1 *Roof monitor velocity determination.*

5.1.1 *Velocity value for setting isokinetic flow.* During the 24 hours preceding a test run, determine the velocity indicated by the propeller anemometer in the section of roof monitor containing the sampling manifold. Velocity readings shall be taken every 15 minutes or at shorter equal time intervals. Calculate the average velocity for the 24-hour period.

5.1.2 *Velocity determination during a test run.* During the actual test run, record the velocity or volume readings of each propeller anemometer in the roof monitor. Velocity readings shall be taken for each anemometer every 15 minutes or at shorter equal time intervals (or continuously).

5.2 *Temperature recording.* Record the temperature of the roof monitor every two hours during the test run.

5.3 *Sampling.*

5.3.1 *Preliminary air flow in duct.* During the 24 hours preceding the test, turn on the exhaust fan and draw roof monitor air through the manifold duct to condition the ductwork. Adjust the fan to draw a volumetric flow through the duct such that the velocity of gas entering the manifold nozzles approximates the average velocity of the air leaving the roof monitor.

5.3.2 *Isokinetic sample rate adjustment.* Adjust the fan so that the volumetric flow rate in the duct is such that air enters into the manifold sample nozzles at a velocity equal to the 24-hour average velocity determined under 5.1.1. Equation 14–1 gives the correct stream velocity which is needed in the duct at the sample ports in order for sample gas to be drawn isokinetically into the manifold nozzles. Perform a pitot traverse of the duct at the sample ports to determine if the correct average velocity in the duct has been achieved. Perform the pitot determination according to Method 2. Make this determination before the start of a test run. The fan setting need not be changed during the run.

$$V_d=\frac{8\,(D_n)^2}{(D_d)^2}\,(V_m)\,\frac{1\text{ minute}}{60\text{ sec}}$$

where:

V_d=desired velocity in duct at sample ports, meter/sec.

D_n=diameter of a roof monitor manifold nozzle, meters.

D_d=diameter of duct at sample port, meters.

V_m=average velocity of the air stream in the roof monitor, meters/minute, as determined under section 5.1.1.

5.3.3 *Sample train operation.* Sample the duct using the standard fluoride train and methods described in Methods 13A and 13B—Determination of total fluoride emissions from stationary sources. Select sample traverse points according to Method 1. If a selected sampling point is less than one inch from the stack wall, adjust the location of that point to one inch away from the wall.

5.3.4 *Each test run shall last eight hours or more.* If a question exists concerning the representativeness of an eight-hour test, a longer test period up to 24 hours may be selected. Conduct each run during a period when all normal operations are performed underneath the sampling manifold, i.e. tapping, anode changes, maintenance, and other normal duties. All pots in the potroom shall be operated in a normal manner during the test period.

5.3.5 *Sample recovery.* Same as Method 13A or 13B—Determination of total fluoride emissions from stationary sources.

5.4 *Analysis.* Same as Method 13A or 13B—Determination of total fluoride emissions from stationary sources.

6. Calculations.

6.1 *Isokinetic sampling test.* Calculate the mean velocity measured during each sampling run by the anemometer in the section of the roof monitor containing the sampling manifold. If the mean velocity recorded during a particular test run does not fall within ±20 percent of the mean velocity established according to 5.3.2, repeat the run.

6.2 *Average velocity of roof monitor gases.* Calculate the average roof monitor velocity using all the velocity or volumetric flow readings from section 5.1.2.

6.3 *Roof monitor temperature.* Calculate the mean value of the temperatures recorded in section 5.2.

6.4 *Concentration of fluorides in roof monitor air in mg F/m³.* This is given by Equation 13A–5 in Method 13A—Determination of total fluoride emissions from stationary sources.

6.5 Average volumetric flow from roof is given by Equation 14–2.

$$Q_m=\frac{V_{mt}\,(A)\,(M_d)\,P_m\,(294^\circ\mathrm{K})}{(T_m+273^\circ)\,(760\text{ mm Hg})}$$

where:

Q_m=average volumetric flow from roof monitor at standard conditions on a dry basis, m³/min.

A=roof monitor open area, m².

V_{mt}=average velocity of air in the roof monitor, meters/minute, from section 6.2.

P_m=atmospheric pressure, mm Hg.

T_m=roof monitor temperature, °C, from section 6.3.

M_d=mole fraction of dry gas, which is given by $M_d=\frac{100-100\,(B_{wo})}{100}$

B_{wo}=is the proportion by volume of water vapor in the gas stream, from Equation 13A–3, Method 13A—Determination of total fluoride emissions from stationary sources.

[Sections 111 and 114 of the Clean Air Act, as amended by section 4(a) of Pub. L. 91–604, 84 Stat. 1678 (42 U.S.C. 1857c–6, c–9)].

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