Final Regulation Order

AIRBORNE TOXIC CONTROL MEASURE TO REDUCE EMISSIONS OF HEXAVALENT CHROMIUM AND NICKEL FROM THERMAL SPRAYING

93101.5. Airborne Toxic Control Measure to Reduce Emissions of Hexavalent Chromium and Nickel from Thermal Spraying.

(a) ***Applicability***

This Airborne Toxic Control Measure (ATCM) shall apply to each thermal spraying operation at a stationary source that uses materials containing chromium, chromium compounds, nickel, or nickel compounds. This ATCM does not apply to portable thermal spraying operations.

(b) ***Definitions***

For the purposes of this section, the following definitions shall apply:

(1) "*Air Pollution Control System"* means equipment that is installed for the purpose of collecting and containing emissions of airborne particles from thermal spraying processes. "Air Pollution Control System" includes, but is not limited to, enclosures, exhaust hoods, ductwork, fans/blowers, particulate control devices, and exhaust stacks/vents.

(2) *"Control Device"* means a device that reduces emissions of particulate matter. "Control Device" includes, but is not limited to, dry filter cartridges, HEPA filters, water curtains, cyclones, baghouses, and scrubbers.

(3) *"Detonation Gun Spraying"* means a thermal spraying process in which the coating material is heated and accelerated to the workpiece by a series of detonations or explosions from oxygen-fuel gas mixtures.

(4) *"Dry Filter System"* means a dry particulate filter control system that uses filter media to remove particulate emissions from the exhaust air stream.

(5) *"Enclosure"* means a structure, such as a booth, that surrounds a thermal spraying process and captures and contains particulate emissions and vents them to a control device. Enclosures may have permanent or temporary coverings on open faces.

(6) *"Existing Thermal Spraying Operation"* means a thermal spraying operation that is in operation before January 1, 2005.

(7) *"Flame Spraying"* means a thermal spraying process in which an oxygen/fuel gas flame is the source of heat for melting the surfacing material.

(8) *"High Efficiency Particulate Air (HEPA) Filter"* means a disposable, dry filter that has a minimum particle collection efficiency of 99.97 percent when tested with a mono-disperse 0.3 um test aerosol.

(9) *"Hexavalent chromium"* means the form of chromium with a valence state of +6.

(10) *"High-Velocity Oxy-Fuel (HVOF) Spraying"* means a thermal spray process in which particles are injected into a high-velocity jet formed by the combustion of oxygen and fuel.

(11) *"Independent Tester"* means a person who engages in the testing of stationary sources to determine compliance with air pollution laws or regulations and who meets all of the following criteria:

(A) The independent tester is not owned in whole or in part by the owner/operator of the thermal spraying operation; and
(B) The independent tester has not received gross income from the owner/operator of the thermal spraying operation in excess of $100,000 or in excess of 10% of the tester's annual revenues, other than as a result of source test contracts; and
(C) The independent tester has not manufactured or installed any emission control device or monitor used in connection with the specific source to be tested; and
(D) When conducting the compliance test, the independent tester does not use any employee or agent who:
1. holds a direct or indirect investment of $1,000 or more in the owner/operator of the thermal spraying operation; or
2. has directly received income in excess of $250 from the owner/operator of the thermal spraying operation in the previous 12 months; or
3. is a director, officer, partner, employee, trustee, or holds any position of management in the owner/operator of the thermal spraying operation.

(12) *"Initial Startup"* means the first time a new thermal spraying operation begins production or the first time additional or modified thermal spraying operations begin operating at a modified source. If such production or operation occurs prior to the operative date of this section, "Initial Startup" means the operative date of this section. "Initial Startup" does not include operation solely for testing of equipment or subsequent startup of permit units following malfunction or shutdown.

(13) *"Intake Area"* means the area of the opening(s) in an enclosure from which make-up air is drawn from outside the enclosure during normal operations.

(14) *"Inward Face Velocity"* means the airflow into an enclosure that prevents escape of contaminated air from the enclosure. Inward face velocity is measured in feet per minute, in accordance with Appendix 2.

(15) *"Leak"* means the release of any particulate matter from any opening in the emission collection system/device other than the intended exhaust or emission point of that emission control system/device.

(16) *"Location"* means one or more contiguous or adjacent properties. Contiguous or adjacent properties are properties with two or more parcels of land in actual physical contact, or separated solely by a public roadway or other public right-of-way.

(17) *"Modification"* means:

(A) any existing thermal spraying operation that did not use materials containing chromium, chromium compounds, nickel or nickel compounds before January 1, 2005, but begins using any of these materials on or after January 1, 2005; or

(B) any physical change in, change in the method of operation of, or addition to an existing permit unit that requires an application for an authority to construct and/or a permit to operate issued by the permitting agency. Routine maintenance and/or repair is not considered a physical change. A "change in the method of operation" of equipment, unless previously limited by an enforceable permit condition, shall not include:

1. an increase in the production rate, unless such increase will result in an increase in emissions that causes a move from a lower tier to a higher tier in subsection (c)(1)(A) Table 1 or Table 2 of this regulation; or
2. an increase in the hours of operation; or
3. a change in ownership of a source; or

(C) the replacement of components for which the fixed capital cost exceeds 50 percent of the fixed capital cost that would be required to construct a comparable new source.

(18) *"Modified Thermal Spraying Operation"* means any thermal spraying operation which has undergone a modification.

(19) *"New Thermal Spraying Operation"* means any thermal spraying operation that begins initial operations on or after January 1, 2005. "New Thermal Spraying Operation" does not include the installation of a new permit unit at an existing thermal spraying operation or the modification of an existing thermal spraying operation.

(20) *"Operating Parameter"* means a parameter established for a control device or process parameter which, if achieved by itself or in combination with one or more

other operating parameter values, determines that an owner or operator is in compliance with the applicable emission limitation or standard.

(21) *"Permit Unit"* means any article, machine, piece of equipment, device, process, or combination thereof, which may cause or control the release of air emissions of hexavalent chromium or nickel from a thermal spraying operation and which requires a permit to operate issued by a permitting agency.

(22) *"Permitting Agency"* means the local air pollution control or air quality management district.

(23) *"Plasma Spraying"* means a thermal spraying process in which an electric arc is used to ionize a gas and produce a plasma jet that melts and propels the coating material to the workpiece.

(24) *"Point Source"* means a permit unit that releases air pollutants through an intended opening such as, but not limited to, a stack, chimney, or vent.

(25) *"Portable Thermal Spraying Operation"* means a thermal spraying operation that is temporarily used for field applications at offsite locations. A thermal spraying operation is not a "Portable Thermal Spraying Operation" if the thermal spraying operation or its replacement resides at the same location for more than 30 consecutive days.

(26) *"Potential to Emit"* means the maximum capacity of a stationary source to emit a regulated air pollutant based on its physical and operational design. Any physical or operational limitation on the capacity of the stationary source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design only if the limitations are listed as enforceable conditions in an air permit issued by the permitting agency.

(27) *"Sensitive Receptor"* means any residence including private homes, condominiums, apartments, and living quarters; education resources such as preschools and kindergarten through grade twelve (k-12) schools; daycare centers; and health care facilities such as hospitals or retirement and nursing homes. A sensitive receptor includes individuals housed in long term care hospitals, prisons, and dormitories or similar live-in housing.

(28) *"Stationary Source"* means any building, structure, facility or installation which emits any affected pollutant directly or as a fugitive emission. "Building, structure, facility, or installation" includes all pollutant emitting activities which meet all of the following criteria:

(A) are under the same ownership or operation, or which are owned or operated by entities which are under common control; and

(B) belong to the same industrial grouping either by virtue of falling within the same two-digit standard industrial classification code or by virtue of being part of a common industrial process, manufacturing process, or connected process involving a common raw material; and
(C) are located on one or more contiguous or adjacent properties.

(29) *"Substantial Use"* of an Authority to Construct means one or more of the following: (A) the equipment that constitutes the source has been purchased or acquired; (B) construction activities, other than grading or installation of utilities or foundations, have begun and are continuing; or (C) a contract to complete construction of the source within one year has been entered into.

(30) *"Thermal Spraying Operation"* means one or more of several processes in which metallic or nonmetallic surfacing materials are deposited in a molten or semi-molten condition on a substrate to form a coating. The surfacing material may originate in the form of powder, rod, or wire before it is heated, prior to spraying and deposition. Thermal spraying processes include: detonation gun spraying, flame spraying, high-velocity oxy-fuel spraying, plasma spraying, and twin-wire electric arc spraying. For the purposes of this section, "Thermal Spraying Operation" includes only those operations that are conducted at stationary sources and use materials containing chromium, chromium compounds, nickel, or nickel compounds. "Thermal Spraying Operation" does not include portable thermal spraying operations.

(31) *"Twin-Wire Electric Arc Spraying"* means a thermal spraying process where two electrically conducting wires are brought close together to create an electric arc. The molten material formed in the arc is then projected by a compressed gas stream towards a work piece on which it forms a coating.

(32) *"Volume Source"* means a permit unit, either controlled or uncontrolled, from which air pollutants undergo initial dispersion within a building or structure prior to their release into the outdoor ambient air. "Volume Source" also includes a thermal spraying process that is conducted outside of a building or structure and releases pollutants directly into the outdoor ambient air.

(33) *"Water Curtain"* means a particulate control system that utilizes flowing water (i.e., a conventional water curtain) or a pumpless system to remove particulate emissions from the exhaust air stream.

(c) *Standards*

(1) *Standards for Existing Thermal Spraying Operations*
Effective January 1, 2006, each owner or operator of an existing thermal spraying operation must control hexavalent chromium and nickel emissions by complying with the control efficiency requirements specified in subsection (c)(1)(A), the enclosure standards specified in subsection (c)(1)(B), and the

ventilation system standards specified in subsection (c)(1)(C). Annual hexavalent chromium and nickel emissions and maximum hourly nickel emissions must be determined in accordance with the emission calculation methods in Appendix 1 or may be based on the results of an emissions source test. The use of data from an emissions source test must be approved by the permitting agency and the test must be conducted by an independent tester.

(A) *Control Efficiency Requirements for Existing Thermal Spraying Operations*
All existing thermal spraying operations must control hexavalent chromium and nickel emissions as follows:

1. All hexavalent chromium and nickel emissions from thermal spraying operations must be routed through an air pollution control system that meets the enclosure and ventilation standards in subsections (c)(1)(B) and (c)(1)(C).
2. For point sources, maximum hourly emissions of nickel from all thermal spraying operations at a stationary source must not exceed 0.1 lb. For volume sources, maximum hourly emissions of nickel from all thermal spraying operations must not exceed 0.01 lb.
3. For point sources, the air pollution control system must include a control device that is certified by its manufacturer to meet the minimum control efficiency requirements specified in Table 1 of this subsection (c)(1)(A). For volume sources, the air pollution control system must include a control device that is certified by its manufacturer to meet the minimum control efficiency requirements specified in Table 2 of subsection (c)(1)(A). Emissions of hexavalent chromium and/or nickel from all thermal spraying operations at a stationary source must be included when determining the annual emissions from thermal spraying under subsection (c)(1)(A). If an existing control device meets the minimum control efficiency requirements specified in subsection (c)(1)(A), no additional controls are required by this regulation, but the owner or operator must still comply with the enclosure standards in subsection (c)(1)(B), and the ventilation system standards in subsection (c)(1)(C). If a thermal spraying operation has an air permit that limits the use of chromium and nickel to specific thermal spraying permit units, the control efficiency requirements, enclosure standards, and ventilation system standards only apply to those specific thermal spraying permit units.
4. All thermal spraying operations that are subject to more than one minimum control efficiency requirement under subsection (c)(1)(A) must comply with the most stringent applicable requirement.

Table 1: Point Sources -
Control Efficiency Requirements for Existing Thermal Spraying Operations

Tier	Annual Hexavalent Chromium Emissions from Thermal Spraying [1]	Annual Nickel Emissions from Thermal Spraying[1]	Minimum Control Efficiency Requirements [2]
1	≥ 0.004 lbs/yr and ≤ 0.04 lbs/yr	≥ 2.1 lbs/yr and ≤ 20.8 lbs/yr	90% by weight (e.g., a water curtain)
2	> 0.04 lbs/yr and ≤ 0.4 lbs/yr	> 20.8 lbs/yr and ≤ 208 lbs/yr	99.999% @ 0.5 microns (e.g., a high-efficiency dry filter)
3	> 0.4 lbs/yr	> 208 lbs/yr	99.97% @ 0.3 microns (e.g., a HEPA filter)

1. Emissions are controlled emissions from all thermal spraying operations at a stationary source, if the thermal spraying operation is already equipped with a control device.
   a. For non-permitted sources, annual emissions must be determined in accordance with the emission calculation methods specified in Appendix 1 or based on the results of an emissions source test that has been reviewed and approved by the permitting agency.
   b. For permitted sources, annual emissions must be calculated based on the potential to emit or in accordance with the allowable limits set forth in the permit conditions. Emissions must be determined in accordance with the emission calculation methods specified in Appendix 1 or based on the results of an emissions source test that has been reviewed and approved by the permitting agency.
2. Control efficiency requirements must be certified by the manufacturer/supplier of the control device and/or filter media. Thermal spraying operations are not required to conduct an emissions source test to verify the control efficiency at the listed particle sizes.

Table 2: Volume Sources -
Control Efficiency Requirements for Existing Thermal Spraying Operations

Tier	Annual Hexavalent Chromium Emissions from Thermal Spraying [1]	Annual Nickel Emissions from Thermal Spraying [1]	Minimum Control Efficiency Requirements [2]
1	≥ 0.001 lbs/yr and ≤ 0.01 lbs/yr	≥ 0.3 lbs/yr and ≤ 3.1 lbs/yr	99% by weight (e.g., a dry filter)
2	> 0.01 lbs/yr and ≤ 0.1 lbs/yr	> 3.1 lbs/yr and ≤ 31 lbs/yr	99.999% @ 0.5 microns (e.g., a high-efficiency dry filter)
3	> 0.1 lbs/yr	> 31 lbs/yr	99.97% @ 0.3 microns (e.g., a HEPA filter)

1. Emissions are controlled emissions from all thermal spraying operations at a stationary source, if the thermal spraying operation is already equipped with a control device.
   a. For non-permitted sources, annual emissions must be determined in accordance with the emission calculation methods specified in Appendix 1 or based on the results of an emissions source test that has been reviewed and approved by the permitting agency.
   b. For permitted sources, annual emissions must be calculated based on the potential to emit or in accordance with the allowable limits set forth in the permit conditions. Emissions must be determined in accordance with the emission calculation methods specified in Appendix 1 or based on the results of an emissions source test that has been reviewed and approved by the permitting agency.
2. Control efficiency requirements must be certified by the manufacturer/supplier of the control device and/or filter media. Thermal spraying operations are not required to conduct an emissions source test to verify the control efficiency at the listed particle sizes.

(B) *Enclosure Standards*

All existing thermal spraying operations that are subject to subsection (c)(1)(A) must use air pollution control systems that meet the following criteria by January 1, 2006. All modified or new thermal spraying operations that are

subject to subsection (c)(2)(A)2. or (c)(3)(A)1., respectively, must use air pollution control systems that meet the following criteria upon initial startup.

1. Enclosures must be exhaust ventilated such that a continuous inward flow of air is maintained from all designed make-up air openings during thermal spraying operations.
2. To ensure good capture of airborne pollutants, the average inward face velocity of air through the enclosure must either be:
   a. a minimum of 100 feet per minute; or
   b. the minimum velocity for metal spraying facilities as established in "Industrial Ventilation, A Manual of Recommended Practice", 25th Edition, published by the American Conference of Governmental Industrial Hygienists, which is incorporated by reference herein.

   The inward face velocity must be confirmed by a velocity measuring device approved by the permitting agency (e.g., a pitot tube or anemometer.) Measurement of inward face velocity must be performed in accordance with the methods set forth in Appendix 2 or an alternative method approved by the permitting agency. This subsection does not require the use of an independent tester to measure inward face velocity.
3. When thermal spraying is being performed, all air inlets and access openings must be covered to prevent the escape of dust or mist contaminants into areas outside the enclosure. This requirement does not apply to any designed or intended make-up air vents or openings. Coverings can be permanent (e.g., a door) or temporary (e.g., plastic flaps). Temporary coverings must be approved by the permitting agency.
4. Before the enclosure is opened, thermal spraying must cease and the exhaust system must be run for a sufficient period of time, as determined by the permitting agency, to remove contaminated air within the enclosure. A minimum of three air exchanges must be exhausted from the booth after thermal spraying ceases.
5. For the purposes of thermal spraying equipment calibration or research and development activities, permitting agencies may allow operators to open the enclosure door during thermal spraying operations, if all of the following conditions are met:
   a. The enclosure must be a four-sided booth equipped with a permanent door.
   b. The enclosure must be under negative pressure, as demonstrated in accordance with subsection (d)(1)(C).
   c. The owner or operator must verify that the average inward face velocity of air through the enclosure is at least 100 feet per minute while the door is open, in accordance with Appendix 2.
   d. The owner or operator must obtain approval from the permitting agency before beginning operations pursuant to this subsection.

(C) *Ventilation System Standards*

1. *Installation of Ventilation System for Existing, New, and Modified Thermal Spraying Operations*
   For existing thermal spraying operations, the exhaust gas stream from the air pollution control system required by subsection (c)(1)(B) must be ducted to a particulate matter control device meeting the applicable control efficiency requirements of subsection (c)(1)(A) by January 1, 2006.

   For modified or new thermal spraying operations, the exhaust gas stream from the air pollution control collection system required by subsection (c)(1)(B) must be ducted to a particulate matter control device meeting the applicable control efficiency requirements of subsection (c)(2)(A)2. or (c)(3)(A)1., respectively, upon initial startup.

2. *Operating Requirements for Ventilation Systems at Existing, New, and Modified Thermal Spraying Operations*
   a. The ventilation system and control device must be properly maintained and kept in good operating condition at all times. Any leak, as determined by a visual leak inspection conducted in accordance with Appendix 3, is a violation of this section.
   b. Material collected by a particulate matter control system must be discharged into closed containers or an enclosed system that is completely sealed to prevent dust emissions.
   c. Dust collectors for control devices must be maintained in a manner that prevents emissions of particulate matter into the ambient air.

(D) Permit Requirements for Existing Thermal Spraying Operations

All unpermitted existing thermal spraying operations must submit a permit application to the permitting agency no later than October 1, 2005. This permitting requirement applies only to existing thermal spraying operations that use materials containing chromium, chromium compounds, nickel, or nickel compounds.

(E) Standards for Remotely Located Existing Thermal Spraying Operations

1. The requirements of subsections (c)(1)(A), (c)(1)(B), and (c)(1)(C) do not apply to existing thermal spraying operations that meet all of the following criteria:
   a. The thermal spraying operation is located at least 1,640 feet from a sensitive receptor, as determined by the permitting agency; and
   b. Annual emissions of hexavalent chromium from all thermal spraying operations do not exceed 0.5 lb; and
   c. The thermal spraying operation uses an air pollution control system that achieves a minimum control efficiency of 90 percent; and

d. The thermal spraying operation complies with the permitting requirements of subsection (c)(1)(D); and
e. The owner or operator of the thermal spraying operation has submitted an annual report to the permitting agency by March 1st of each calendar year, that quantifies emissions of hexavalent chromium and nickel from all thermal spraying operations during the previous calendar year; and
f. The thermal spraying operation has undergone a site specific analysis from the permitting agency to ensure public health protection.

2. Thermal spraying operations that qualify for this standard must undergo an annual evaluation by the permitting agency to ensure that the thermal spraying operation still complies with the conditions of this standard. This standard shall cease to apply if the permitting agency determines that the thermal spraying operation no longer meets all of the criteria in subsection (c)(1)(E)1. If the permitting agency determines that the standard ceases to apply, the owner or operator of the thermal spraying operation must submit a permit application to the permitting agency within 3 months of receipt of the permitting agency's determination. The owner or operator must achieve compliance with the requirements of this section within 9 months of receipt of the permitting agency's determination.

(F) Exemption for Existing Thermal Spraying Operations with Low Emission Levels

1. The requirements in subsections (c)(1)(A), (c)(1)(B), and (c)(1)(C) shall not apply to existing thermal spraying operations that meet all of the following criteria:
   a. For point sources, annual emissions of hexavalent chromium are less than 0.004 lb and annual emissions of nickel are less than 2.1 lbs. For volume sources, annual emissions of hexavalent chromium are less than 0.001 lb and annual emissions of nickel are less than 0.3 lb; and
   b. For point sources, maximum hourly emissions of nickel from all thermal spraying operations at a stationary source do not exceed 0.1 lb. For volume sources, maximum hourly emissions of nickel from all thermal spraying operations at a stationary source do not exceed 0.01 lb; and
   c. The thermal spraying operation complies with the permitting requirements of subsection (c)(1)(D); and
   d. The owner or operator of the thermal spraying operation has submitted an annual report to the permitting agency by March 1st of each calendar year, that quantifies emissions of hexavalent chromium and nickel from all thermal spraying operations during the previous calendar year.

(2) *Standards for Modified Thermal Spraying Operations*

(A) Upon initial startup, each owner or operator of a modified thermal spraying operation must comply with all of the following requirements:

1. Modified thermal spraying operations must control hexavalent chromium and nickel emissions by complying with the control efficiency requirements specified in subsection (c)(2)(A)2.

2. All thermal spraying operations that undergo a modification on or after January 1, 2005, must use a control device that is certified by the manufacturer to achieve 99.97 percent control efficiency for particles that are 0.3 micron in diameter. These thermal spraying operations must also comply with the enclosure standards specified in subsection (c)(1)(B) and the ventilation standards specified in subsection (c)(1)(C).

3. For point sources, the maximum hourly emissions of nickel from all thermal spraying operations at a stationary source must not exceed 0.1 lb. For volume sources, the maximum hourly emissions of nickel from all thermal spraying operations at a stationary source must not exceed 0.01 lb. Maximum hourly nickel emissions must be determined in accordance with the emission calculation methods specified in Appendix 1 or may be based on the results of an emissions source test. The use of source test data must be approved by the permitting agency and the test must be conducted by an independent tester.

4. All thermal spraying operations that undergo a modification on or after January 1, 2005, must submit a permit modification application to the permitting agency, in accordance with permitting agency requirements. This permitting requirement only applies to thermal spraying operations that use materials containing chromium, chromium compounds, nickel, or nickel compounds.

(3) *Standards for New Thermal Spraying Operations*

(A) 1. No person may operate a new thermal spraying operation unless it is located outside of an area that is zoned for residential or mixed use and is located at least 500 feet from the boundary of any area that is zoned for residential or mixed use.

2. A new thermal spraying operation shall be deemed to meet the standard specified above in subsection (c)(3)(A)1. if one of the following criteria are met, even if the operation does not meet the standard at the time of initial startup (e.g., because of a zoning change that occurs after the authority to construct is issued):

a. A new thermal spraying operation shall be deemed to meet the standard specified above if it meets the standard at the time it is issued an authority to construct by the permitting agency, and substantial use of the authority to construct takes place within one year after it is issued, or

b. A new thermal spraying operation shall be deemed to meet the standard specified above if it meets the standard at the time it is issued an authority to construct by the permitting agency, and substantial use of the authority to construct takes place before any zoning change occurs that affects the operation's ability to meet the standard at the time of initial start-up.

3. Prior to initial startup of a new thermal spraying operation, the owner or operator must demonstrate to the permitting agency that the operation either meets the standard specified above in subsection (c)(3)(A)1., or meets one of the criteria specified above in subsection (c)(3)(A)2.

(B) On and after initial startup, the new thermal spraying operation must use a control device that is certified by the manufacturer to achieve 99.97 percent control efficiency for particles that are 0.3 micron in diameter. These operations must also comply with the enclosure standards specified in subsection (c)(1)(B) and the ventilation standards specified in subsection (c)(1)(C).

(C) The maximum hourly emissions of nickel from all thermal spraying operations at a stationary source must not exceed 0.1 lb. Maximum hourly nickel emissions must be determined in accordance with the emission calculation methods specified in Appendix 1 or may be based on the results of an emissions source test. The use of source test data must be approved by the permitting agency and the test must be conducted by an independent tester.

(D) Prior to initial startup, the thermal spraying operation must undergo a site specific analysis from the permitting agency to ensure public health protection.

(E) *Permit Requirements for New Thermal Spraying Operations*
All new thermal spraying operations must submit a permit application to the permitting agency prior to initial startup, in accordance with permitting agency requirements. This permitting requirement only applies to new thermal spraying operations that use materials containing chromium, chromium compounds, nickel, or nickel compounds.

(d) ***Test Requirements and Test Methods***

(1) Testing to Demonstrate Compliance with Enclosure and Ventilation Standards

(A) The owner or operator of an existing thermal spraying operation subject to the control efficiency requirements in subsection (c)(1)(A), must conduct a test to demonstrate compliance with the enclosure and ventilation standards specified in subsections (c)(1)(B) and (c)(1)(C). The test must include

measurement of the inward face velocity (in accordance with Appendix 2) and a visual leak inspection (in accordance with Appendix 3.) This test must be conducted within 60 days of the operative date of this section. The owner or operator must notify the permitting agency at least 30 days prior to conducting a test. Although 60 days are allowed to conduct the test, all thermal spraying operations must comply with specified control efficiency requirements, enclosure standards, and ventilation standards by January 1, 2006, as specified in subsection (c)(1).

(B) The owner or operator of a modified or new thermal spraying operation subject to the control efficiency requirements in subsections (c)(2)(A)2. or (c)(3)(A)1., respectively, must conduct a test to demonstrate compliance with the enclosure and ventilation standards in subsections (c)(1)(B) and (c)(1)(C). The test must include measurement of the inward face velocity (in accordance with Appendix 2) and a visual leak inspection (in accordance with Appendix 3.) This test must be conducted within 60 days after initial startup. The owner or operator must notify the permitting agency at least 30 days prior to conducting a test. Although 60 days are allowed to conduct the test, all thermal spraying operations must comply with specified control efficiency requirements, enclosure standards, and ventilation standards upon initial startup.

(C) Before beginning operations pursuant to subsection (c)(1)(B)5., the owner or operator must verify that negative pressure is maintained while the enclosure door is open, using one of the following procedures:

1. Measuring with an anemometer at the door opening to demonstrate flow into the enclosure door, or
2. Measuring the static pressure across the enclosure door, or
3. Using smoke tubes to demonstrate flow into the enclosure door.

As specified in subsection (e)(5), this negative pressure verification must have been performed at least once during the12-month period immediately before operations begin, and at least once after the enclosure is changed in any way that may impact air flow.

(2) *Verification of Control Efficiency*

Existing thermal spraying operations that are subject to Tier 2 or Tier 3 control efficiency requirements specified in subsection(c)(1)(A), modified thermal spraying operations that are subject to the requirements of subsection (c)(2)(A)2., and new thermal spraying operations that are subject to the requirements of subsection (c)(3)(A)1., must use control devices with a control efficiency verified by the manufacturer. This verification must be provided to the permitting agency upon request. The control device manufacturer must verify the control efficiency using one of the following test methods, which are incorporated by reference herein:

(A) ASHRAE Standard 52.2-1999, “Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size”, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 1791 Tullie Circle NE, Atlanta, GA 30329. 1999.

(B) MIL-PRF-51526A(EA), “Filter, Particulate, 340 CMH (200 CFM), 13 March 2000, U.S. Army.

(C) ASME AG-1-2003, “Code on Nuclear Air and Gas Treatment”, American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017. 2003.

(D) IEST-RP-CC001.3, ”HEPA and ULPA Filters”, Institute of Environmental Sciences and Technology, 5005 Newport Drive, Suite 506, Rolling Meadows, IL 60008-3841. 1993.

(3) *Source Tests to Determine Emissions of Hexavalent Chromium and Nickel*
Owners or operators of thermal spraying operations may choose to quantify hexavalent chromium and/or nickel emissions using data from a source test rather than using the calculation methods specified in Appendix 1. In addition, a permitting agency may require that a source test be performed to quantify hexavalent chromium and/or nickel emissions from thermal spraying operations. The use of source test data must comply with the requirements specified in this subsection (d)(3).

(A) *Use of Existing Source Tests*
A source test conducted prior to January 1, 2006, may be used to quantify emissions or demonstrate compliance with the standards in subsection (c)(1)(A), if the permitting agency approves the use of that test. The test must be conducted by an independent tester, in accordance with a test protocol that was reviewed and approved by the permitting agency.

(B) *Test Methods*
If the owner or operator of a thermal spraying operation conducts a source test to quantify emissions of hexavalent chromium and/or nickel, the testing must be conducted in accordance with the following listed test methods, which are incorporated by reference herein, or in accordance with alternative test methods approved by the permitting agency.

1. Testing to determine emissions of hexavalent chromium must be conducted in accordance with one of the following test methods, which are incorporated by reference herein:

   ARB Test Method 425, “Determination of Total Chromium and Hexavalent Chromium Emissions from Stationary Sources”, last amended July 28, 1997, section 94135, title 17, California Code of Regulations (CCR).

   EPA Test Method 306, “Determination of Chromium Emissions From Decorative and Hard Chromium Electroplating and Chromium Anodizing

Operations – Isokinetic Method", 40 CFR 63, Appendix A, as promulgated on January 25, 1995.

South Coast Air Quality Management District (SCAQMD) Test Method 205.1, "Determination of Hexavalent and Total Chromium from Plating", August 1991.

2. Testing to determine emissions of nickel must be conducted in accordance with one of the following test methods, which are incorporated by reference herein:

   ARB Test Method 433, "Determination of Total Nickel Emissions from Stationary Sources", last amended September 12, 1989, section 94145, title 17, California Code of Regulations (CCR).

   ARB Test Method 436, "Determination of Multiple Metals Emissions from Stationary Sources" (for nickel only), adopted July 28, 1997, section 94161, title 17, California Code of Regulations (CCR).

(C) The owner or operator of a thermal spraying operation that is conducting a source test must submit a pre-test protocol to the permitting agency, in accordance with permitting agency procedures, at least 60 days prior to conducting a source test. The pre-test protocol must include source test methods, planned sampling parameters, preliminary pollutant analytical data, calculated targets for testing the pollutant, and any proposed modifications to standardized methods. In addition, the pre-test protocol must include information on equipment, logistics, personnel, and any other information required by the permitting agency.

(e) *Monitoring, Inspection, and Maintenance Requirements*

(1) *Monitoring Requirements*

All thermal spraying operations with air pollution control systems must comply with the applicable monitoring requirements listed in Table 3 of this subsection (e)(1). In addition, any other operating parameters designated by the permitting agency must be monitored while conducting thermal spraying to ensure compliance with the requirements set forth in subsection (c).

Table 3 – Summary of Monitoring Requirements for Thermal Spraying Operations Using Add-on Air Pollution Control Devices

	Control Equipment	Monitoring Requirements
(A)	Dry particulate filter system (e.g., dry filter cartridge, HEPA filter)	1. Ensure that the pressure differential gauge continuously monitors pressure drop across the control device while conducting thermal spraying. 2. Record pressure drop once per week while conducting thermal spraying.
(B)	Conventional Water Curtain	1. Ensure that the flow meter continuously monitors the water flow rate while conducting thermal spraying. 2. Monitor the water curtain continuity by visual observation to ensure that there are no gaps while conducting thermal spraying. 3. Record water flow rate and water curtain continuity once per week while conducting thermal spraying.
(C)	Pumpless Water Curtain	1. Monitor parameters that indicate booth performance, per manufacturer's recommendations, while conducting thermal spraying. 2. Visually inspect the water curtain for continuity to ensure that there are no gaps while conducting thermal spraying. 3. Record recommended parameters and water curtain continuity once per week while conducting thermal spraying.

(2) *Pressure Drop Monitoring Requirements*

All dry particulate control devices (e.g., dry filter cartridges or HEPA filters) must have gauges that continuously monitor the pressure drop across each control device when thermal spraying is occurring. The gauge must have a high and low setting for the pressure drop and must trigger an alarm system when the high or low set points are exceeded. The gauge must be designed to accurately measure pressure drops within the expected range and have an accuracy of at least ± 5% of full scale. The gauge must be located so that it can be easily visible and in clear sight of the operation or maintenance personnel. The pressure drop must be maintained per manufacturer's specifications. If the pressure drop is outside of the acceptable limits, the owner or operator must shut down the thermal spraying operation immediately and take corrective action. The thermal spraying operation must not be resumed until the pressure drop is within the specified limit(s).

(3) *Water Curtain Monitoring Requirements*

For thermal spraying operations that are conducted in water curtain booths, the owner or operator must monitor booth operating parameters during thermal spraying to ensure compliance with the requirements specified in subsection (c). Water curtain booths must provide a continuous sheet of water down the rear wall of the booth. For all water curtain booths, the owner or operator must visually monitor the water curtain during thermal spraying to ensure that the sheet is continuous without any gaps or dry spots. The owner or operator of a

conventional water curtain booth must continuously monitor the water flow rate with a flow meter during thermal spraying to ensure the water flow meets or exceeds the minimum flow rate recommended by the manufacturer. The owner or operator of a pumpless water curtain booth must monitor the parameters recommended by the booth manufacturer to ensure that these parameters meet or exceed the manufacturer's recommendations. If the water curtain fails the continuity and/or flow requirements, the owner or operator must shut down the thermal spraying operation immediately to take corrective action. The thermal spraying operation must not be resumed until the monitored parameters meet or exceed the manufacturer's recommendations.

(4) *Inspection and Maintenance Requirements*

All thermal spraying operations with air pollution control systems must comply with the applicable inspection and maintenance requirements listed in Table 4.

Table 4 - Summary of Inspection and Maintenance Requirements for Thermal Spraying Operations Using Add-on Air Pollution Control Devices

	Control Equipment	**Inspection & Maintenance Requirements**	**Frequency**
(A)	Dry particulate filter system (e.g., dry filter cartridge, HEPA filter)	1. Conduct a visual inspection to ensure there are no leaks in accordance with Appendix 3.	At least once every 90 days.
		2. Visually inspect ductwork from work area to the control device to ensure there are no leaks in accordance with Appendix 3.	At least once every 90 days.
		3. Replace filter.	Per manufacturer's specifications or permitting agency's requirement.
(B)	Water Curtain	1. Visually inspect ductwork from booth to the exhaust stack to ensure there are no leaks in accordance with Appendix 3.	At least once every 90 days.
(C)	All	1. Measure inward face velocity at each opening in accordance with Appendix 2. This requirement does not apply to existing thermal spraying operations that are remotely located and comply with the standards in section (c)(1)(E).	At least once per calendar year and whenever the air pollution control system is changed in any way that may impact air flow.

(5) *Negative Pressure Measurements*

Thermal spraying operations that are operating pursuant to subsection (c)(1)(B)5. (i.e., operating with the enclosure door open), must demonstrate negative pressure at least once every 12 months and whenever the enclosure is changed in any way that may impact air flow.

(f) ***Recordkeeping Requirements***

(1) *Monitoring Data Records*
The owner or operator must maintain records of monitoring data required by subsection (e), including the date and time the data are collected. Recordkeeping logs must include the applicable acceptable limit(s) for: pressure drop (dry particulate control); water flow rate (conventional water curtain); or manufacturer's recommended parameter limits (pumpless water curtain).

(2) *Inspection Records*
The owner or operator must maintain inspection records that clearly document all inspections and maintenance activities to enable the permitting agency to determine whether the requirements of subsection (e)(4) have been met. The records may take the form of a checklist and must identify:

(A) the name of the device inspected;
(B) the date and time of inspection;
(C) a brief description of the working condition of the device during the inspection;
(D) all maintenance activities performed on the components of the air pollution control system (e.g., duct work replacement, filter replacement, fan replacement, leak repairs, etc.);
(E) the actions taken to correct deficiencies found during the inspection; and
(F) the person that conducted the inspection.

(3) *Material Usage Records*
For thermal spraying materials that contain chromium, chromium compounds, nickel, or nickel compounds, the owner or operator must record the name and quantity of material used during each month of the annual reporting period, and the total usage to date for that calendar year.

(4) *Source Test Records*
The owner or operator must maintain test reports documenting the conditions and results of all source tests.

(5) *Equipment Malfunctions and Failures*
The owner or operator must maintain records of the occurrence, duration, cause (if known), and action taken for each equipment malfunction and/or failure. This recordkeeping requirement applies only to equipment malfunctions or failures that cause or may cause uncontrolled emissions to be released.

(6) *Records Maintenance and Retention*
All records required by this subsection (f) must be readily accessible for inspection and review at the thermal spraying operation for at least five years. If so requested by the permitting agency, the owner or operator must provide copies of the records to the permitting agency.

(g) ***Reporting Requirements***

(1) *Initial Emission Inventory for Existing Thermal Spraying Operations*
All existing thermal spraying operations must submit an emission inventory for hexavalent chromium and nickel to the permitting agency no later than October 1, 2005. This inventory must quantify the emissions from thermal spraying operations conducted during the 12-month period between July 1, 2004 and July 1, 2005. The emission inventory must be prepared in accordance with Appendix 1 or must be based on an emissions source test approved by the permitting agency.

(2) *Annual Emission Inventory for Existing Thermal Spraying Operations Qualifying for the Standards for Remotely Located Operations or the Exemption for Operations with Low Emission Levels*
Existing thermal spraying operations that qualify for the standards specified in subsection (c)(1)(E) or the exemption specified in subsection (c)(1)(F) must submit an annual report to the permitting agency by March 1st of each calendar year that quantifies emissions of hexavalent chromium and nickel from thermal spraying operations during the previous calendar year.

(3) *Initial Notification*
Existing thermal spraying operations that intend to begin using materials containing chromium, chromium compounds, nickel, or nickel compounds on or after January 1, 2005, must notify the permitting agency at least 45 days prior to using any of these materials. If the use of these materials begins before the operative date of this section, this notification may be delayed until the operative date of this section.

(4) Reports of Breakdowns, Equipment Malfunctions, and Failures
The owner or operator of a thermal spraying operation must report breakdowns, equipment malfunctions, and failures as required by the permitting agency. This reporting requirement only applies to equipment malfunctions or failures that cause or may cause uncontrolled emissions to be released.

(5) *Source Test Documentation*

(A) *Notification of Source Test*
The owner or operator of a thermal spraying operation must notify the permitting agency of his or her intention to conduct a source test to measure emissions of hexavalent chromium and/or nickel. The owner or operator must provide this notification to the permitting agency at least 60 days before the source test is scheduled. The notification must include a pre-test protocol and any other documentation required by the permitting agency.

(B) *Reports of Source Test Results*
The owner or operator of a thermal spraying operation must provide the source test results to the permitting agency no later than 60 days following completion of the testing.

(6) *Adjustments to the Timeline for Submittal and Format of Reports*
A permitting agency may change the timeline for submittal of periodic reports, allow consolidation of multiple reports into a single report, establish a common schedule for submittal of reports, or accept reports prepared to comply with other State or local requirements. Prior to allowing any of these changes, the permitting agency must determine that the change will provide the same information and will not reduce the overall frequency of reporting.

(h) *Severability*

Each part of this section is deemed severable, and in the event that any part of this section is held to be invalid, the remainder of this section shall continue in full force and effect.

Appendix 1 – Emission Calculation Method

Emissions of hexavalent chromium (Cr^{+6}) and nickel (Ni) from thermal spraying operations must be calculated in accordance with the procedures specified in this Appendix 1.

Step 1: Identify all thermal spraying materials that contain chromium (Cr) or nickel (Ni) at a concentration of at least 0.1% by weight (or less than 0.1%, if listed on the Material Safety Data Sheet.) Include materials that contain chromium or nickel in the form of a metallic compound or alloy. Examples of compounds and alloys include, but are not limited to, stainless steel; chromium carbide (Cr_3C_2); nichrome alloys (NiCr); and chromium oxide (Cr_2O_3).

Step 2: Determine the total percentage of chromium and/or nickel contained in each thermal spraying material. These data can be obtained from the material safety data sheet (MSDS) or by contacting the manufacturer. If the MSDS contains a range of percentages, use the upper value of the range. If the material contains a compound (e.g., Cr_3C_2), include only the portion that is chromium or nickel.

Step 3: For each thermal spraying operation, compile the annual usage for each thermal spraying material that contains chromium or nickel. For thermal spraying operations that have air permits, the annual usage is the maximum allowable under the permit.

Step 4: For each thermal spraying operation, calculate the annual usage quantities for chromium and nickel using the following equations:

Eqn. 1: [Annual Usage, lbs Cr/yr] = [Material Usage, lbs material used/yr][weight % Cr in Material]*

Eqn. 2: [Annual Usage, lbs Ni/yr] = [Material Usage, lbs material used/yr][weight % Ni in Material]*

Step 5. Identify the applicable emission factor(s) for each thermal spraying operation, based on the applicable control efficiency level. If a material is used for multiple thermal spraying operations and material usage records document the quantity of material used for each operation, use the applicable emission factors for each operation. If material usage records do not document the quantity of material used for each operation, use the highest emission factor.

Table 1-1 specifies the applicable emission factors for thermal spraying operations using materials that contain chromium, chromium compounds, or chromium alloys.

Table 1-2 specifies the applicable emission factors for thermal spraying operations using materials that contain nickel, nickel compounds, or nickel alloys.

Table 1-1: Thermal Spraying Emission Factors for Hexavalent Chromium

Operation	Emission Factors (lbs Cr^{+6}/lb Cr sprayed)*			
	0% Control Efficiency (Uncontrolled)	90% Control Efficiency (e.g. Water Curtain)	99% Control Efficiency (e.g. Dry Filter)	99.97% Control Efficiency (e.g., HEPA Filter)
Single-Wire Flame Spray	4.68E-03	4.68E-04	4.68E-05	1.40E-06
Twin-Wire Electric Arc Spray	6.96E-03	6.96E-04	6.96E-05	2.09E-06
Flame Spray	6.20E-03	1.17E-03	6.20E-05	1.86E-06
HVOF	6.20E-03	1.17E-03	6.20E-05	1.86E-06
Plasma Spray	1.18E-02	6.73E-03	2.61E-03	2.86E-06
Other Thermal Spraying	7.17E-03	2.05E-03	5.70E-04	2.01E-06

*Some emission factors are based directly on stack test results while others are calculated values, derived from stack test results and control efficiencies.

Table 1-2: Thermal Spraying Emission Factors for Nickel

Operation	Emission Factors (lbs Ni/lb Ni sprayed)*			
	0% Control Efficiency (Uncontrolled)	90% Control Efficiency (e.g. Water Curtain)	99% Control Efficiency (e.g. Dry Filter)	99.97% Control Efficiency (e.g., HEPA Filter)
Twin-Wire Electric Arc Spray	6.0E-03	6.0E-04	6.0E-05	1.8E-06
Flame Spray	1.10E-01	4.64E-02	1.10E-03	3.30E-05
HVOF	1.10E-01	4.64E-02	1.10E-03	3.30E-05
Plasma Spray	1.5E-01	3.67E-02	1.5E-03	1.72E-05
Other Thermal Spraying	9.4E-02	3.25E-02	9.4E-04	2.13E-05

*Some emission factors are based directly on stack test results while others are calculated values, derived from stack test results and control efficiencies.

Step 6 – Annual Emissions. For each thermal spraying operation, calculate the annual emissions by multiplying the applicable emission factors by the annual usage rates, using the following equations:

Eqn. 3: [Annual Emissions, lbs Cr^{+6}/yr] = [Emission Factor, lbs Cr^{+6}/lb Cr sprayed][Annual Usage, lbs Cr sprayed/yr]]*

Eqn. 4: [Annual Emissions, lbs Ni/yr] = [Emission Factor, lbs Ni/lb Ni sprayed][Annual Usage, lbs Ni sprayed/yr]*

Step 7 – Maximum Hourly Nickel Emissions: For each thermal spraying operation that uses nickel, calculate the maximum hourly emissions by multiplying the applicable emission factors by the maximum hourly usage rates, using the following equations:

Eqn. 5:
[Max. Hourly Emissions, lbs Ni/hr] = [Emission Factor, lbs Ni/lb Ni sprayed][Max. Hourly Usage, lbs Ni sprayed/hr]*

Eqn. 6:
[Max. Hourly Usage, lbs Ni sprayed/hr] = [Max. Gun Spray Rate, lbs material sprayed/hr][Max. wt.% Ni in material]*

where

"Maximum Gun Spray Rate" is the highest material throughput rate that a thermal spraying gun can achieve, based on manufacturer specifications or actual user experience, whichever is greater. If multiple guns have the potential to be operated at the same time (e.g., in two separate booths), the maximum gun spray rate must include the total throughput from all guns.

"Maximum Weight % Nickel in Material" is the highest weight percentage of nickel for all of the thermal spraying materials that are used in thermal spraying operations at a facility.

Point Source Example:

Thermal Spraying Inc. operates two thermal spraying booths. One booth is used for plasma spraying and the other booth is used for flame spraying and twin-wire electric arc spraying. Listed below is information on the facility's operations:

Booth	Control Device	Operation	Materials Used	Quantity Used	% Total Chromium	% Nickel
Booth #1	HEPA Filter	Plasma Spray	Powder ABC	25 lbs/yr	25%	0%
			Powder XYZ	50 lbs/yr	20%	75%
Booth #2	Dry Filter (99% effic.)	Flame Spray	Powder 123	10 lbs/yr	0%	95%
			Powder XYZ	75 lbs/yr	20%	75%
		Twin-Wire	Wire #1	80 lbs/yr	20%	5%

An example calculation is provided below for Thermal Spraying Inc.:

Step 1: Identify all thermal spraying materials that contain at least 0.1% by weight of chromium (Cr), chromium compounds, nickel (Ni), or nickel compounds.

The following four products contain chromium or nickel: Powder 123; Powder ABC; Powder XYZ; Wire #1.

Step 2: Determine the total percentage of chromium and/or nickel.

Materials Used	% Total Chromium	% Nickel
Powder 123	0%	95%
Powder ABC	25%	0%
Powder XYZ	20%	75%
Wire #1	20%	5%

If a thermal spraying material contains a compound, include only the portion that is chromium or nickel. For example, if the material contains 95% chromium oxide (Cr_2O_3), the weight percent of chromium would be calculated as follows:

$$[\text{Chromium Weight \%}] = [\text{Weight \% } Cr_2O_3] * \frac{[\text{Molecular Weight of Chromium } (Cr_2)]}{[\text{Molecular Weight of Chromium Oxide } (Cr_2O_3)]}$$

Molecular Weight of Chromium (Cr_2) = (52 g/g-mol)*(2) = 104 g/g-mol
Molecular Weight of Chromium Oxide (Cr_2O_3) = (52 g/g-mol)*(2)+(16)*(3) = 152 g/g-mol

$$[\text{Chromium Weight \%}] = [95 \text{ \% } Cr_2O_3] * \frac{[104 \text{ g/g-mol}]}{[152 \text{ g/g-mol}]} = 65\%$$

Step 3: Compile the annual material usage.

Operation	Materials Used	Quantity Used
Plasma Spray	Powder ABC	25 lbs/yr
	Powder XYZ	50 lbs/yr
Flame Spray	Powder 123	10 lbs/yr
	Powder XYZ	75 lbs/yr
Twin-Wire	Wire #1	80 lbs/yr

Step 4: Calculate the annual usage quantities for chromium and nickel.

Materials Used	Quantity Used	% Total Chromium	% Nickel	Qty. of Total Chromium Used	Qty. of Nickel Used
Powder ABC	25 lbs/yr	25%	0%	[25 lbs/yr]x[25% Cr] = **6.25** lbs Cr/yr	[25 lbs/yr]x[0% Ni] = **0** lbs Ni/yr
Powder XYZ	50 lbs/yr	20%	75%	[50 lbs/yr]x[20% Cr] = **10.0** lbs Cr/yr	[50 lbs/yr]x[75% Ni] = **37.5** lbs Ni/yr
Powder 123	10 lbs/yr	0%	95%	[10 lbs/yr]x[0% Cr] = **0** lbs Cr/yr	[10 lbs/yr]x[95% Ni] = **9.5** lbs Ni/yr
Powder XYZ	75 lbs/yr	20%	75%	[75 lbs/yr]x[20% Cr] = **15.0** lbs Cr/yr	[75 lbs/yr]x[75% Ni] = **56.25** lbs Ni/yr
Wire #1	80 lbs/yr	20%	5%	[80 lbs/yr]x[20% Cr] = **16.0** lbs Cr/yr	[80 lbs/yr]x[5% Ni] = **4.0** lbs Ni/yr

Step 5: Identify the applicable emission factors.

Control Device	Operation	Emission Factor - Hexavalent Chromium (lb Cr^{+6}/lb Cr sprayed)	Emission Factor – Nickel (lb Ni/lb Ni sprayed)
HEPA Filter	Plasma Spray	2.86E-06	1.72E-05
Dry Filter (99% effic.)	Flame Spray	6.20E-05	1.10E-03
	Twin-Wire	6.96E-05	6.0E-05

Step 6: Calculate annual emissions (*[Annual Emissions] = [Emission Factor]*[Annual Usage].*)

For hexavalent chromium, the annual emissions are –

Booth	Control Device	Operation	Materials Used	Qty. of Total Chromium Used (lbs Cr sprayed/yr)	Emission Factor (lb Cr^{+6}/lb Cr sprayed)	Annual Emissions (lb Cr^{+6}/yr)
#1	HEPA Filter	Plasma Spray	Powder ABC	6.25	2.86E-06	[6.25]x[2.86E-06] = **1.79E-05**
			Powder XYZ	10.0	2.86E-06	[10.0]x[2.86E-06] = **2.86E-05**
#2	Dry Filter (99% effic.)	Flame Spray	Powder 123	0	6.20E-05	[0]x[6.20E-05] = **0**
			Powder XYZ	15.0	6.20E-05	[15.0]x[6.20E-05] = **9.30E-04**
		Twin-Wire	Wire #1	16.0	6.96E-05	[16.0]x[6.96E-05] = **1.11E-03**
					Total =	**0.002**

Based on this emission level, Thermal Spraying Inc. is below the Tier 1 threshold for hexavalent chromium. Therefore, no new control efficiency requirements would be imposed by this ATCM because of hexavalent chromium emissions. However, Thermal Spraying Inc. will still need to comply with the permitting, monitoring, and recordkeeping requirements of the ATCM. In addition, if the workload increased and emissions exceeded Tier 1 thresholds, it would be necessary to upgrade the dry filter system or limit the usage of all chromium materials to the booth that has the HEPA filter.

For nickel, the annual emissions are –

Booth	Control Device	Operation	Materials Used	Qty. of Nickel Used (lbs Ni sprayed/yr)	Emission Factor (lb Ni/lb Ni sprayed)	Annual Emissions (lb Ni/yr)
#1	HEPA Filter	Plasma Spray	Powder ABC	0	1.72E-05	[0]x[1.72E-05] = **0**
			Powder XYZ	37.5	1.72E-05	[37.5]x[1.72E-05] = **6.45E-04**
#2	Dry Filter (99% effic.)	Flame Spray	Powder 123	9.5	1.10E-03	[9.5]x[1.10E-03] = **1.05E-02**
			Powder XYZ	56.25	1.10E-03	[56.25]x[1.10E-03] = **6.19E-02**
		Twin-Wire	Wire #1	4.0	6.0E-05	[4.0]x[6.0E-05] = **2.40E-04**
					Total =	**0.073**

Based on this emission level, Thermal Spraying Inc. is below the Tier 1 threshold for nickel. Therefore, no new control efficiency requirements would be imposed by this ATCM because of nickel emissions. However, Thermal Spraying Inc. will still need to comply with the permitting, monitoring, and recordkeeping requirements of the ATCM. In addition, if the workload increased and emissions exceeded Tier 1 thresholds, it would be necessary to upgrade the dry filter system or limit the usage of all nickel materials to the booth that has the HEPA filter.

Step 7: Calculate the maximum hourly emissions for nickel.

Powder 123 is the material that has the highest weight percentage of nickel (95%).
The maximum spray rate for the flame spraying gun is 10 lbs/hr.
The emission factor for flame spraying is 1.10E-03 lb Ni/lb Ni sprayed.

[Maximum Hourly Usage] = [Maximum Gun Spray Rate]*[Maximum Wt.% Nickel]
[Maximum Hourly Usage] = [10 lbs/hr]*[95% Ni] = 9.5 lbs Ni sprayed/hr

[Maximum Hourly Emissions] = [Emission Factor]*[Maximum Hourly Usage]
Maximum Hourly Emissions = [1.10E-03 lb Ni/lb Ni sprayed]*[9.5 lbs Ni sprayed/hr] = 0.01 lb Ni/hr

The maximum hourly emissions for nickel are 0.01 lbs Ni/hr, which is well below the compliance limit of 0.1 lb Ni/hr for point sources. Therefore, this thermal spraying operation complies with the maximum hourly limit for nickel.

Volume Source Example:

Machine Shop Inc. conducts flame spraying with powder on small parts. The parts are turned on a lathe while spraying is being performed. Since the lathe is not located in a booth, the shop uses a portable local exhaust fan to remove fumes from the worker's breathing area. This type of operation would be considered a volume source with 0% control efficiency. Listed below is information on the facility's operations:

Booth	Control Device	Operation	Materials Used	Quantity Used	% Total Chromium	% Nickel
None	None (uncontrolled)	Flame Spray	Powder 123	20 lbs/yr	0%	95%
			Powder XYZ	5 lbs/yr	20%	75%

An example calculation is provided below for Machine Shop Inc.:

Step 1: Identify all thermal spraying materials that contain at least 0.1% by weight of chromium (Cr), chromium compounds, nickel (Ni), or nickel compounds.

The following two products contain chromium or nickel: Powder 123 and Powder XYZ.

Step 2: Determine the total percentage of chromium and/or nickel.

Materials Used	% Total Chromium	% Nickel
Powder 123	0%	95%
Powder XYZ	20%	75%

Step 3: Compile the annual material usage.

Operation	Materials Used	Quantity Used
Flame Spray	Powder 123	20 lbs/yr
	Powder XYZ	5 lbs/yr

Step 4: Calculate the annual usage quantities for chromium and nickel.

Materials Used	Quantity Used	% Total Chromium	% Nickel	Qty. of Total Chromium Used	Qty. of Nickel Used
Powder 123	20 lbs/yr	0%	95%	[20 lbs/yr]x[0% Cr] = **0** lbs Cr/yr	[20 lbs/yr]x[95% Ni] = **19.0** lbs Ni/yr
Powder XYZ	5 lbs/yr	20%	75%	[5 lbs/yr]x[20% Cr] = **1.0** lbs Cr/yr	[5 lbs/yr]x[75% Ni] = **3.75** lbs Ni/yr

Step 5: Identify the applicable emission factors.

Control Device	Operation	Emission Factor - Hexavalent Chromium (lb Cr^{+6}/lb Cr sprayed)	Emission Factor – Nickel (lb Ni/lb Ni sprayed)
Uncontrolled	Flame Spray	6.20E-03	1.10E-01

Step 6: Calculate annual emissions (*[Annual Emissions] = [Emission Factor]*[Annual Usage].*)

For hexavalent chromium, the annual emissions are –

Booth	Control Device	Operation	Materials Used	Qty. of Total Chromium Used (lbs Cr sprayed/yr)	Emission Factor (lb Cr^{+6}/lb Cr sprayed)	Annual Emissions (lb Cr^{+6}/yr)
None	None	Flame Spray	Powder 123	0	6.20E-03	[0]x[6.20E-03] **= 0**
			Powder XYZ	1.0	6.20E-03	[1.0]x[6.20E-03] **= 6.20E-03**
					Total =	**0.006**

Based on this emission level, Machine Shop Inc. is classified as Tier 1 for hexavalent chromium. Therefore, the thermal spraying operation would need to install a new booth with a control device that met the Tier 1 minimum efficiency requirement of 99%. In addition, Machine Shop Inc. would need to comply with the permitting, monitoring, and recordkeeping requirements of the ATCM. Machine Shop Inc. could avoid having to install a new booth and control device, if they eliminated the use of chromium-containing materials.

For nickel, the annual emissions are –

Booth	Control Device	Operation	Materials Used	Qty. of Nickel Used (lbs Ni sprayed/yr)	Emission Factor (lb Ni/lb Ni sprayed)	Annual Emissions (lb Ni/yr)
None	None	Flame Spray	Powder 123	19.0	1.10E-01	[19.0]x[1.10E-01] **= 2.09**
			Powder XYZ	3.75	1.10E-01	[3.75]x[1.10E-01] **= 4.13E-01**
					Total =	**2.50**

Based on this emission level, Machine Shop Inc. is below the Tier 1 threshold for nickel. Therefore, no new control efficiency requirements would be imposed by this ATCM because of nickel emissions. However, this ATCM requires thermal spraying operations to comply with the most stringent control efficiency. Since the control efficiency requirement based on hexavalent chromium is the most stringent, they must comply with the 99% control efficiency.

Step 7: Calculate the maximum hourly emissions for nickel.

Powder 123 is the material that has the highest weight percentage of nickel (95%).
The maximum spray rate for the flame spraying gun is 10 lbs/hr.
The emission factor for flame spraying is 1.10E-01 lb Ni/lb Ni sprayed.

[Maximum Hourly Usage] = [Maximum Gun Spray Rate]*[Maximum Wt.% Nickel]
[Maximum Hourly Usage] = [10 lbs/hr]*[95 % Ni] = 9.5 lbs Ni sprayed/hr

[Maximum Hourly Emissions] = [Emission Factor]*[Maximum Hourly Usage]
Maximum Hourly Emissions = [1.10E-01 lb Ni/lb Ni sprayed]*[9.5 lbs Ni sprayed/hr] = 1.1 lb Ni/hr

The maximum hourly emissions for nickel are 1.1 lbs Ni/hr, which exceeds the compliance limit of 0.01 lb Ni/hr for volume sources. Therefore, this thermal spraying operation does not comply with the maximum hourly limit for nickel and it would be necessary to reduce emissions (e.g., install a control device, limit usage, etc.)

Appendix 2 –Method for Measuring Inward Face Velocity

Inward face velocity must be measured at least once every calendar year and whenever the air pollution control system is changed in any way that may impact air flow to ensure that the ventilation system is working properly. Measurements must be conducted in accordance with the procedures specified in this Appendix 2 or an alternative method approved by the permitting agency.

1. Hood Measurement:

Divide the face of the hood, the slot area, or the normal plane, at the capture velocity measurement point into equal area rectangles (see Figure 1). The side of each rectangular area should be no longer than 12 inches. Measure the air velocity (fpm) at the center of each rectangle using a calibrated anemometer or other measuring device approved by the permitting agency. The velocity measuring device must have an accuracy of at least ±10% of full scale. The measuring device must be in good condition, of proper velocity range, and operated according to the manufacturer's instructions. The measuring device must be calibrated in accordance with the manufacturer's recommendations. Do not block or disturb the airflow while taking the readings.

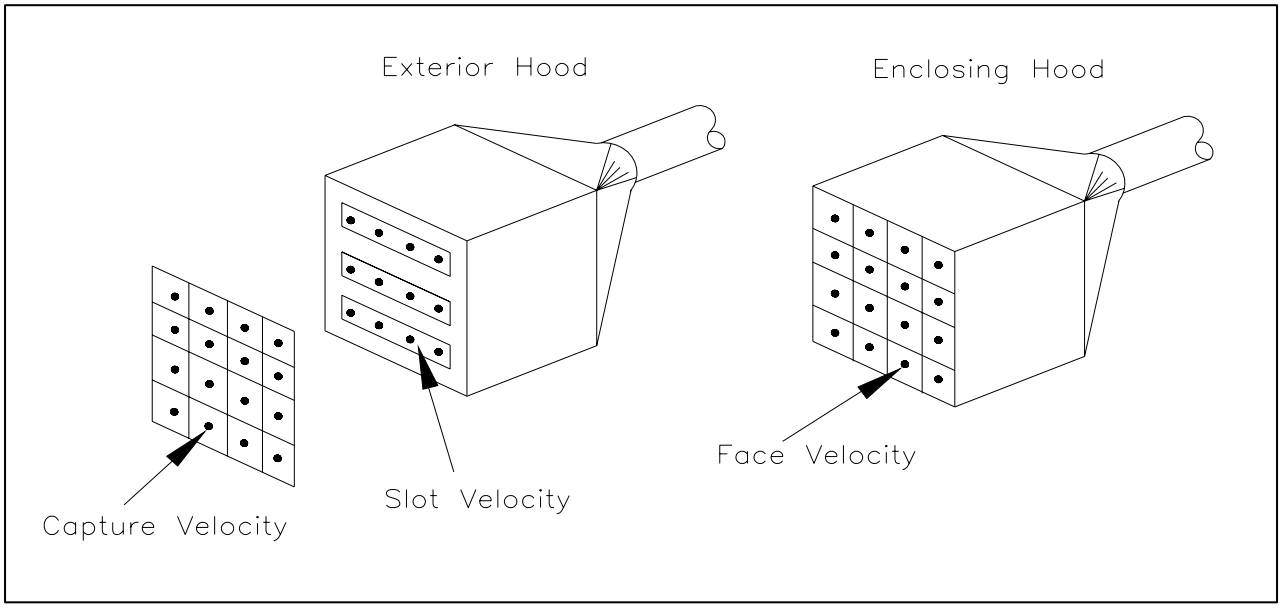

Figure 1: Airflow distribution measurement for an exterior hood and an enclosing hood

Measure the volumetric airflow rate through the hood by measuring the velocity at the center of each equal-sized rectangular area (i.e., by performing pitot traverses.) If no suitable location exists for performing complete pitot traverses, measure the slot velocity and use this data to estimate the volumetric airflow rate through a hood.

2. Walk-in Booth Measurement:

For a cross-draft walk-in booth (i.e., air enters through filters in the front of the booth and leaves through filters in the back of the booth):

Divide the **length** of the booth into at least three cross-sectional areas to obtain the velocity profile in the booth. One cross-sectional area must be located near the exhaust plenum, one close to the supply plenum, and the other in the middle of the booth. Figure 2 illustrates the location of cross-sectional areas. Record the distance between each cross-sectional area and the exhaust or supply plenums. The distance between each cross-sectional area must not exceed ten feet.

Lay out imaginary grid lines through each cross sectional area. Use the intersections of the grid lines as locations to measure velocities inside the booth. The intersection points must be no more than six feet apart. Record the location of each point on the grid. Measure the air velocity (fpm) at each intersection point on the grid using a calibrated anemometer or other measuring device approved by the permitting agency. The velocity measuring device must have an accuracy of at least ±10% of full scale. The measuring device must be in good condition, of proper velocity range, and operated according to the manufacturer's instructions. The measuring device must be calibrated in accordance with the manufacturer's recommendations.

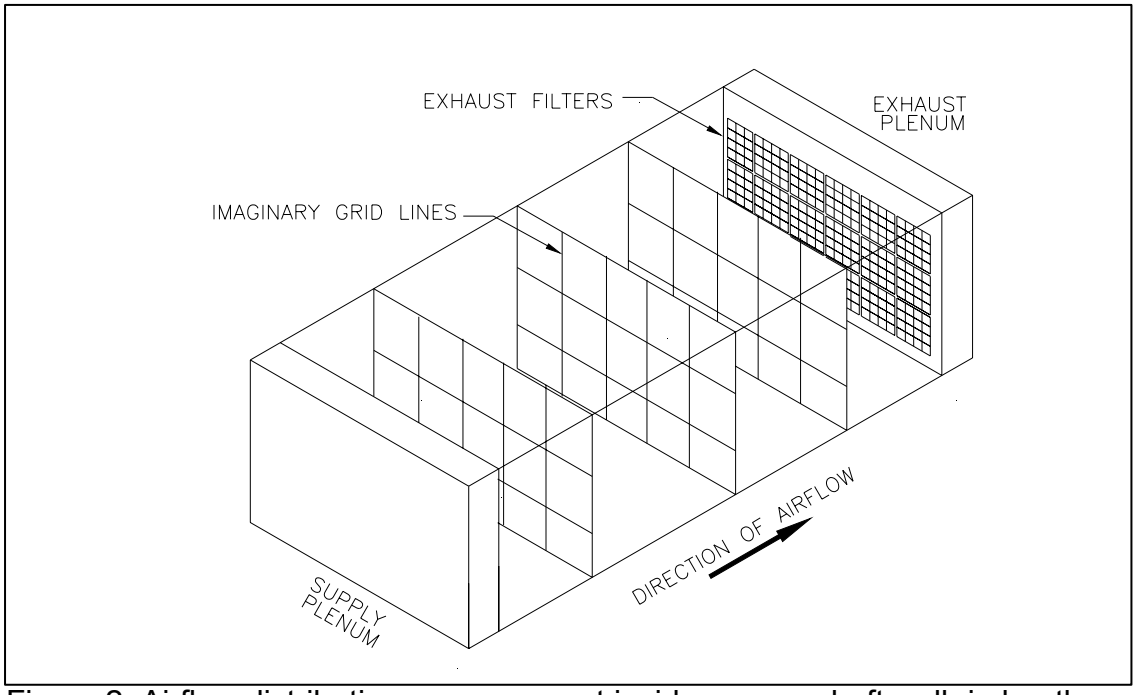

Figure 2: Airflow distribution measurement inside a cross-draft walk-in booth

For a down-draft walk-in booth (i.e., air enters through filters in the ceiling of the booth and leaves through filters that cover trenches under a metal grate floor):

> Divide the **height** of the booth into at least three cross-sectional areas to obtain the velocity profile in the booth. One cross-sectional area must be located near the exhaust plenum, one close to the supply plenum, and the other in the middle of the booth. Record the distance between each cross-sectional area and the exhaust or supply plenums. The distance between each cross-sectional area must not exceed ten feet.
>
> Lay out imaginary grid lines through each cross sectional area. Use the intersections of the grid lines as locations to measure velocities inside the booth. The intersection points must be no more than six feet apart. Record the location of each point on the grid. Measure the air velocity (fpm) at each intersection point on the grid using a calibrated anemometer or other measuring device approved by the permitting agency. The velocity measuring device must have an accuracy of at least ±10% of full scale. The measuring device must be in good condition, of proper velocity range, and operated according to the manufacturer's instructions. The measuring device must be calibrated in accordance with the manufacturer's recommendations.

3. Average Value of Readings

Calculate the average value for all velocity readings, if all individual readings are within ± 20% of the average value. Do not include turbulent readings when calculating the average (turbulent airflow may be indicated by negative or zero velocity readings.) Record and make available for inspection by the permitting agency the entire velocity profile to show the airflow distribution.

Examples:

Hood A – Velocity Readings (fpm)		
100	90	110
85	115	100
105	95	100
Average Velocity = 900 fpm / 9 = 100 fpm		

Hood B – Velocity Readings (fpm)		
200	200	0
200	50	0
100	-5 *	-45 *
Average velocity = 750 fpm / 7 = 107 fpm **		

* Negative values indicate airflow in reverse direction and are not included in the average.
** This is not a valid average, because individual readings are not within ±20% of the average. The booth airflow needs to be adjusted and balanced before the velocity is measured again.

Appendix 3 – Leak Check Visual Inspection Checklist

Visual inspections must be conducted at least once every 90 days to ensure that no leaks are present in the control device or ventilation system. At a minimum, the inspection must include the items listed in the following checklist that are applicable. In addition to the items on this checklist, thermal spraying operations must inspect items in accordance with manufacturers' recommendations.

✔ Acceptable
✕ Unacceptable

Item to be Inspected	Look For -	Dates of Inspection:			
1. Hoods	Dents, holes, corrosion				
2. Ductwork	Dents, holes, corrosion				
	Blockages, plugging				
3. Dampers	Deterioration of seals/gaskets				
	Settings				
4. Access doors	Deterioration of seals/gaskets				
	Gaps when door is closed				
5. Fan housing	Deterioration of seals/gaskets				
	Gaps in connection to ductwork				
6. Dry filter media	Holes, gaps, abrasions				
	Does filter need to be changed?				
	Dust on clean side of filter?				
7. Dry filter mounting frame	Deterioration of seals/gaskets				
8. Other items inspected (provide descriptions):					
9. Corrective actions (provide descriptions & dates):					
10. Initials of person doing inspection:					

NOTE: Authority Cited: Sections 39600, 39601, 39650, 39658, 39659, 39666, and 41511, Health and Safety Code. Reference: Sections 39650, 39658, 39659, 39666, and 41511, Health and Safety Code