



CONTRACT NO. 95-328  
FINAL REPORT  
JUNE 1999

# Characterization of Emissions from Nickel Plating

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Volume II:  
Appendices

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY



AIR RESOURCES BOARD  
Research Division



For more information about the ARB's Research Division,  
its research and activities, please visit our Web site:

<http://www.arb.ca.gov/rd/rd.htm>



# **Characterization of Emissions from Nickel Plating**

## **Volume II - Appendices**

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## **Appendix A**

### **Phone Calls to and Surveys of Nickel Industry and Suppliers**



## Appendix A

### Telephone Contacts with Nickel Industry Representatives and Suppliers

Air Chem System, Inc.  
15222 Connector Lane  
Huntington Beach, CA 92649-1118  
(714) 897-1017

American Electroplaters and Surface Finishers  
Orlando, FL  
(407) 281-6441

American Society of Metals, International  
Materials Park, OH  
(800) 336-5152

ATOTECH USA, Inc.  
Dennis Masarik, Director  
(216) 749-8165

Calfran International  
PO Box 269  
Springfield, MA 01101-0269  
(413) 732-3616  
Frank Hoffman

CALifornia TECHNical PLATING, INC.  
11533 Bradley Ave.  
San Fernando, CA 91340  
(818) 365-8205  
David Anzures, VP  
\*Sam Patel

CAI Engineering  
Oakton, VA  
George Cushnie  
(703) 264-0039

Chrometech  
Cleveland, OH  
Larry Zitko  
(216) 968-9820

Conserve Engineering

Long Beach, CA  
(714) 494-6440  
Tom Miles

Excel  
241 N. Roosevelt Ave.  
Chandler, AZ 85226-2623  
(602) 940-1805  
Bob Taylor

Finishing Technology  
14 Fiddler's Elbow  
Kinnelon, NJ 07405  
(201) 838-1346  
Ted Mooney

Foss Plating Company, Inc.  
Segura Way  
Santa Fe Springs, CA 9067  
(310) 945-3451  
\*Carol Foss McCracken

GP Gene's  
Plating Works  
3498 East 14th Street  
Los Angeles, CA 90023  
(213) 269-8748  
(213) 269-5390  
Harry Levy  
\*Randy Solganik

GP Systems  
Compton Lakes, NJ  
(201) 835-6368  
Mark Halliday

Harrington Industrial Plastics  
11501 Rojas Dr.  
El Paso, TX 79936-6900  
(915) 599-1102

Harrington Industrial Plastics Co.  
1034 Kiel Ct.  
Sunnyvale, CA 94089-2104  
(510) 490-8620  
Jim Logan

International Nickel Company - INCO LIMITED

P.O. Box 44  
Royal Trust Tower  
Toronto-Dominion Centre  
Toronto, Canada M5K 1N4  
J.Stuart Warner  
VP - Occupational and Environmental Health  
(416) 361-7511  
Jane Marquardsen

International Nickel, Inc.  
Park 80 West-Plaza Two  
Saddle Brook, NJ 07663  
(201) 368-4808  
George DiBari (Director Nickel Plating Products)

KCH Services  
Forest City, NC  
(704) 245-9836  
Maxie Jolly

Metal Finishers Supply Association  
(708) 887-0797  
Dick Crane

Metal Finishing  
660 White Plains Road  
Tarrytown, NY 10591-5153  
(914) 333-2578  
FAX (914) 333-2570

Midwest Air Products  
Traverse City, MI  
(616) 941-5865

Midwest Research Institute  
401 Harrison Oaks Boulevard, Suite 350  
Cary, NC 27513-2412

Modern Plating Company  
5400 West 104th Street  
Los Angeles, CA 90045-0007  
(213) 776-2440  
(213) 649-3957  
John Bohacik  
\*George

Nickel Development Institute  
Ron Parkinson

214 King Street West, Suite 510  
Toronto, Canada M5H 3S6  
(416) 591-7999  
(Fax) (416) 591-7987

Nickel Development Institute  
European Technical Information Centre  
The Holloway, Alvechurch  
Birmingham, England B48 7QB  
052-758-4777  
(fax) 052-758-5562

Nickel Producers Environmental Research Association  
Alston Technical Park  
100 Capitola Drive, Suite 104  
Durham, NC 27713  
(919) 544-7722  
Dr. Larry Curcio  
Director

REMCO  
San Luis Obispo  
(805) 594-0161

S&K Products Intl.  
1450 Koll Circle  
San Jose, CA 95112  
(408) 441-6600  
Tom Fugate

SESCO  
500E Carson Plaza Dr.  
Carson, CA  
(310) 329-3883  
Bill Chuh

# Results of Telephone Survey of Nickel Industry Representatives

**Coastal Valley Plating Co.  
Robert Di Acri  
223 South Laurel  
Ventura, CA 93001  
805/643-5356**

Do you conduct nickel plating?

Yes

What type?

Decorate Plating on Bumpers

Type of electrolyte(s) (e.g.; nickel chloride, nickel sulfate, nickel sulfamate) (Forgot to ask this question)

Number of Plating Tanks

Two tanks

Frequency of operation (e.g.; every 2 hours, 5 hours, or seasonally)

Surface Area 1) 400 gals operates 6 hours/day  
1) 1100 gallons operates 2 hours/day

Depth

Temp range -

Temperature must be less than 150 degrees , otherwise the core seal will melt.  
These tanks are kept at 145 degrees.

Are they mechanically agitated?

Air agitated

Current density or amperage

4-5 volts/900 amps

Operating pH

4.54

Has any source testing (emission tests) been conducted?

No

Do you use plastic balls on the surface of your nickel plating tank?

No, because bumpers would displace the plastic balls.

Are emissions from the operation vented to a scrubber or directly out?

No scrubber

Is any other type of control device used (e.g.; mist suppressant)?

Chrome uses mist suppressant. Nickel wetting additives contain suppressant in the additive.

If known, the emissions control efficiency.

No control devices.

What are the capital and operating costs associated with your control equipment?

NA

Do you conduct, or have you conducted, monitoring or workplace air for nickel compounds? Outside your facility?

Several years ago, CalOSHA monitored the work place and said that levels were not significant.

To what substrate do you apply the nickel?

Steel (In general, nickel can also be applied to copper or brass, but they use steel for the bumpers.)

What is the end product you produce?

Decorative plating on bumpers

Do you also conduct chromium plating at your facility?

Yes. Mist Suppressants are used on the chrome tanks.

Comments:

Mr. Di Acri believes that nickel emissions are "0" at his facility.



**General Mafnaplate  
Martin Chadwick  
805/642-6262**

**2707 Palma Drive  
Ventura, CA 93003**

Responses to Questions:

Operating Data

Do you conduct nickel plating?

Yes

What type?

Electroless and Electro. The electro is based on nickel chloride and requires an anode, cathode and an electric current

Number of Plating Tanks

Four.

Surface \*

Depth \*

Temp range

180-185

Mechanical agitation

Yes

current density or amperage \*

pH \*

Type of electrolyte(s) (nickel chloride, nickel sulfate, nickel sulfamate)

Nickel chloride

Emissions Data

Any source testing?

No.

Do you use plastic balls on the surface of your nickel plating tank?

Yes.

Are emissions from the operation vented to a scrubber?

No, vented directly out.

Is any other type of control device used (e.g.; mist suppressant)?

No.

What are the capital and operating costs associated with your control equipment?

\*

Do you conduct, or have you conducted, monitoring or workplace air for nickel compounds? Outside your facility?

Insurance Company periodically monitors compliance with CalOSHA requirements inside the facility.

General Data

To what substrate do you apply the nickel?

Metal.

What is the end product you produce?

Metal job shop.

Do you also conduct chromium plating at your facility?

No.

\*Asterisks indicate that the individual did not know offhand, but would research data if we need it.

**Cal-Tron Plating Inc.**  
**Carl Troncale**  
**310-945-1183**

Do you conduct nickel plating?

Yes.

What type?

Nickel chloride and nickel sulfate, not nickel sulfamate.

Type of electrolyte(s) (e.g.; nickel chloride, nickel sulfate, nickel sulfamate)

Number of Plating Tanks

Six.

Frequency of operation (e.g.; every 2 hours, 5 hours, or seasonally)

24 hours a day, 5 days a week.

Tank Sizes

900,800, 600, 350, 2300, and (1) 800 tin/nickel tank.

Temp range

140 degrees.

Are they mechanically agitated?

Air.

Current density or amperage

Current constantly varies because of different size of parts.

Operating pH

4.2

Has any source testing (emission tests) been conducted?

CalOSHA

Do you use plastic balls on the surface of your nickel plating tank?

No.

Are emissions from the operation vented to a scrubber or directly out?

There is a vent.

Is any other type of control device used (e.g.; mist suppressant)?

Wetting agent.

If known, the emissions control efficiency

What are the capital and operating costs associated with your control equipment?

Do you conduct, or have you conducted, monitoring or workplace air for nickel compounds? Outside your facility?

No.

To what substrate do you apply the nickel?

Steel, brass, aluminum.

What is the end product you produce?

Automotive parts, scuba gear parts, musical instrument parts, motorcycle parts.

**Bumper Shop  
Danny  
213-585-3865  
828 East Florance Ave  
Los Angeles**

Do you conduct nickel plating?

Yes.

What type?

Nickel chloride and nickel sulfate, no nickel sulfamate.

Type of electrolyte(s) (e.g.; nickel chloride, nickel sulfate, nickel sulfamate)

Number of Plating Tanks

Three.

Frequency of operation (e.g.; every 2 hours, 5 hours, or seasonally)

Operates 10 hours a day, 4 days a week.

Tank Size

1500, 2800, 300 gals.

Temp range

140-160 degrees.

Are they mechanically agitated?

They are air agitated.

Current density or amperage

Reostats - up to 2,000 amps.

Operating pH

3.4 - 4.6

Has any source testing (emission tests) been conducted?

No.

Do you use plastic balls on the surface of your nickel plating tank?

No.

Are emissions from the operation vented to a scrubber or directly out?

There is a ventilation system.

Is any other type of control device used (e.g.; mist suppressant)?

Fume suppressant is used in bath. It creates a foam, thereby reducing vapors.

If known, the emissions control efficiency.

What are the capital and operating costs associated with your control equipment?

Do you conduct, or have you conducted, monitoring or workplace air for nickel compounds? Outside your facility?

No. CalOSHA has conducted tests

To what substrate do you apply the nickel?

Copper, brass, metal, steel, and aluminum bathed in zinc.

What is the end product you produce?

Automobile bumpers.

Do you also conduct chromium plating at your facility?

Yes.

**Escondido Plating  
Johnny Prestage  
860 Metcalf  
Escondido, CA 92025  
619-743-4148**

Do you conduct nickel plating?

Yes.

What type?

Decorative.

Type of electrolyte(s) (e.g.; nickel chloride, nickel sulfate, nickel sulfamate)

Nickel chloride and nickel sulfate.

Number of Plating Tanks

One.

Frequency of operation (e.g.; every 2 hours, 5 hours, or seasonally)

Size

1000 gals.

Temp range

110-120 degrees.

Are they mechanically agitated?

Air.

Current density or amperage

Designed to handle 1500 amps.

Operating pH

3-4

Has any source testing (emission tests) been conducted?

CalOSHA and Workman's comp.

Do you use plastic balls on the surface of your nickel plating tank?

No.

Are emissions from the operation vented to a scrubber or directly out?

No vent.

Is any other type of control device used (e.g.; mist suppressant)?

No suppressants.

If known, the emissions control efficiency

What are the capital and operating costs associated with your control equipment?

Do you conduct, or have you conducted, monitoring or workplace air for nickel compounds? Outside your facility?

CalOSHA and Workman's comp.

To what substrate do you apply the nickel?

Metal.

What is the end product you produce?

Car parts/ bumpers/ other small job shop parts.

Do you also conduct chromium plating at your facility?

Yes.

**Air Industries Corporation  
Tom Boyd  
12570 Knott Street  
Garden Grove, CA 92841**

Do you conduct nickel plating?

Yes.

What type?

Type of electrolyte(s) (e.g.; nickel chloride, nickel sulfate, nickel sulfamate)

Nickel sulfamate and nodes are solid nickel.

Number of Plating Tanks

Four.

Frequency of operation (e.g.; every 2 hours, 5 hours, or seasonally)

2 hours, twice a week

Surface Area (Inches - surface area x surface area x depth)

18 x 24 x 24      30 x 40 x 30      (2 tanks) 30 x 40 x 30

Temp range

130 degrees.

Are they mechanically agitated?

Two are mechanically agitated as the filtering barrel rates slowly. The others are air agitated.

Current density or amperage

Mr. Boyd did not know off the top of his head.

Operating pH

3-4 range

Has any source testing (emission tests) been conducted?

Just CalOSHA

Do you use plastic balls on the surface of your nickel plating tank?

No - the plastic balls came up with the parts.

Are emissions from the operation vented to a scrubber or directly out?

No vent.

Is any other type of control device used (e.g.; mist suppressant)?

No - Steam is emitted from the tank. The solution is replenished with water.

If known, the emissions control efficiency.

What are the capital and operating costs associated with your control equipment?

Do you conduct, or have you conducted, monitoring or workplace air for nickel compounds? Outside your facility?

CalOSHA came out and took samples.

To what substrate do you apply the nickel?

Steel.

What is the end product you produce?

Bolts and screws for aerospace industry.

Do you also conduct chromium plating at your facility?

No.

**SPS Technologies**  
**714/545-9311**  
**2701 South Harbor Blvd**  
**Santa Ana, CA 92704**  
**George Drayton**

Do you conduct nickel plating?

Yes, as an undercoating for plating on silver and stainless steel.

What type?

Nickel chloride and nickel sulfamate.

Type of electrolyte(s) (e.g.; nickel chloride, nickel sulfate, nickel sulfamate)

Number of Plating Tanks

Two tanks, one 250 gal chloride tank and one 250 gal sulfamate tank.

Temp range

Not sure if they are heated.

Are they mechanically agitated?

Just with existing barrel rotation.

Current density or amperage

Unknown.

Operating pH

Unknown.

Has any source testing (emission tests) been conducted?

CalOSHA had them place containers on cadmium tanks only.

Do you use plastic balls on the surface of your nickel plating tank?

No, although in the past they did.

Are emissions from the operation vented to a scrubber or directly out?

There is a vent and a scrubber. The scrubber is cleaned every 18 months; otherwise, it gets very clogged.

Is any other type of control device used (e.g.; mist suppressant)?

No

If known, the emissions control efficiency.

Did not know efficiency.

What are the capital and operating costs associated with your control equipment?

The system was installed 15 years ago and cost between \$200,000 and \$300,000. The main trunk is 6 feet in diameter. It handles 50,000 cu feet a minute - more than is needed at the facility. Fiberglass duct work.

Do you conduct, or have you conducted, monitoring or workplace air for nickel compounds? Outside your facility?

No.

To what substrate do you apply the nickel?

Stainless steel/ metal / steel alloy #4130 or 1050.

What is the end product you produce?

Nuts and bolts for aerospace industry. Cadplated, coated with lubrication.

Do you also conduct chromium plating at your facility?

No.

Mr. Drayton expressed the concern that with all the enforcement conducted by the SCAQMD, they never investigate whether the scrubbers have been cleaned out. Nor do they conduct any source testing on the scrubber. Mr. Drayton is not encouraging more inspections at his facility; however, he concerned that other facilities that have scrubbers are not routinely cleaning them.



## **Appendix B**

### **Calls to Agencies and Universities**



## Appendix B

### Calls to Agencies and Universities

#### Agencies

Agency for Toxic Substances and Disease Registry  
Atlanta, GA  
(404) 639-0501

Amador County APCD  
500 Argonaut lane  
Jackson, CA 95642-2310  
(209) 223-6406  
Jim Harris

American Conference of Governmental Industrial Hygienists  
Cincinnati, OH  
(513) 742-2020

American Industrial Hygiene Association  
Washington, D.C.  
(703) 849-8888  
John Meger  
(415) 565-1725  
(415) 565-1647  
Yvette Brittain  
Vice-Chair, Engineering Committee

American National Standards Institute  
New York, NY  
(212) 642-4900

Bay Area Air Quality Management District  
Brian Bateman, Randy Frasier, Scott Lutz  
(415) 771-6000

Butte County AQMD  
Chico, CA  
(916) 891-2882  
Richard Perrelli

Calaveras County APCD  
891 Mountain Ranch Rd.  
San Andreas, CA 95249  
(209) 754-6521  
Al Grewal

California Dept. of Health Services  
Toxic Substances Control Division  
Sacramento, CA  
(916) 324-3614

California Dept of Health Services  
(510) 540-2973  
Eric Vallard

California Environmental Protection Agency  
Toxic Substances Control  
(916) 324-1826

California State Compensation Insurance Fund  
Safety and Health Services  
1275 Market Street, Room 630  
San Francisco, CA 94103  
(415) 565-3831  
Heather Borman

Center for Disease Control  
(404) 639-3311

Colusa County APCD  
100 Sunrise Blvd., Suite F  
Colusa, CA 95932  
(916) 458-5891  
Bonnie McCullough

El Dorado County APCD  
Placerville, CA 95667  
(916) 621-6662  
Reba Cloud

Feather River AQMD  
Marysville, CA  
(916) 634-7659  
Ken Corbin

Kern County APCD  
2700 M Street, Suite 302  
Bakersfield, CA 93301  
(805) 862-5251  
Mary Flynn

Lawrence Livermore National Laboratory  
Livermore, CA  
(510) 422-1100  
FAX: (510) 422-9115

Massachusetts Dept. of Environmental Management  
Boston, MA  
(617) 292-5574

Minnesota Pollution Control Agency  
Hutchinson, MN  
(617) 297-8512  
(617) 296-8585  
Cathy Latham

Mojave Desert Air Quality Management District  
Richard Wales, 11/95/96  
(619) 245-1661

Monterey Bay Unified Air Pollution Control District  
Amy Taketomo, 3/6/97  
(408) 647-9411

National Center for Environmental Publications and Information  
Cincinnati, OH  
(513) 489-8190

National Institute for Occupational Safety and Health  
Robert A. Taft Laboratories  
4676 Columbia Parkway  
Cincinnati, OH 45226-1998  
(800) 356-4674

North Coast Unified AQMD  
2389 Myrtle Ave.  
Eureka, CA 95501  
(707) 443-3093  
Tammy Pullington

Northern Sonoma County Air Pollution Control District  
Barbara Lee, 2/12/97  
(707) 433-5911

Sacramento Metropolitan Air Quality Management District  
Jorge DeGuzman, 2/19/97  
(916) 386-7027

San Diego County Air Pollution Control District  
Tom Weeks, 3/7/97  
(619) 694-3894

San Joaquin Unified Air Pollution Control District  
Steve Bonnacker, 12/11/96  
(209) 497-1053

Santa Barbara County Air Pollution Control District  
Richard Steadman, Joe Patrini  
(805) 961-8800

South Coast Air Quality Management District  
Mohan Balagopalan, 2/13/97  
(909) 396-2100, ext. 2704

U.S. Environmental Protection Agency  
Office of Air Quality Planning and Standards  
Emission Factor and Inventory Group  
Research Triangle, NC  
(919) 541-5407  
Ron Meyers  
(919) 541-5371  
Dallas Safriet

U.S. EPA  
Bulletin Board  
(919) 541-5742  
Technical Guidance

U.S. EPA Library  
Boston, MA  
(617) 565-3298  
and  
Washington, DC  
(202) 260-7751  
FAX: (202) 260-6257

U.S. Dept. of Commerce

Technology Administration  
National Technical Information Service  
5285 Port Royal Road  
Springfield, VA 22161  
(800) 553-6847

Ventura County Air Pollution Control District  
Mike Villegas, Terri Thomas, 11/19/96  
(805) 645-1400

## Universities

University of California Engineering Department  
Santa Barbara  
Los Angeles  
Berkeley  
Davis  
San Diego



## **Appendix C**

### **Databases Searched**



## Appendix C

### Databases Searched

Applied Science and Technology Index

Engineering Index

Melvyl (The University of California Library System)

Compendex

Government Publications Office

Chemical Abstracts

Environment Abstracts

Environmental Periodicals Bibliography

Environmental and Pollution Management

Metadex

NTIS

Agricola

Internet Search

Info Seek

WorldCat Database

Toxline



## **Appendix D**

### **Telephone Surveys**



## Appendix D

### Telephone Surveys

**Santa Barbara  
Richard Steadman  
Joe Patrini (805-961-8894)**

#### Permitting

1. Are there any facilities engaged in nickel plating operations within your air pollution control district jurisdiction?

There is one chrome plater and one cadmium plater.

2. Do you permit nickel plating operators or their abatement device control equipment?

Yes. These are permitted for chrome and are subject to the MACT requirements.

2.a. If not, are they specifically exempt?

2.b. If #2 is no, are these sources treated as area sources for emission inventory purposes?

3. If #2 is yes, has any source testing been conducted?
4. If yes, can you tell me anything about the types of nickel plating conducted at these sources, types of control equipment, control efficiency (or emissions rate)

See below.

5. Does the agency have a nickel plating regulation?

No. Only hexavalent chromium.

#### AB2588

6. Is there an AB2588 Risk Assessment for this source?
  - 6.a. If yes, has any source testing been conducted?
  - 6.b. Has any in-house modeling been conducted on these types of sources?
7. How were the nickel plating facilities assessed?

8. Do you conduct any health risk analyses or risk screening assessments (beyond AB2588 requirements)? (e.g. public nuisance)

No

9. Is there a specific methodology you use to estimate the deposition rate and distance from the source?

Santa Barbara APCD uses the deposition velocity in the ISC 3 model, which models controlled and uncontrolled emissions.

10. Is there any additional information the District can provide?

We reviewed one of their permits, which is for a relatively small source.

The source is a “mom and pop” operation. There are several tanks, one for nickel, brass, copper, water rinsing, and sulfuric acid. Each tank is 36 inches deep.

According to the plot plan, there are no hoods, covers, or vents--just doors and windows.

There are no emission limits on the permit.

The permit is renewed every three years.

Requirements include:

anti misting additives

45 dines per centimeter (the 45 dines/centimeter (MACT standard) is currently being revised by EPA and the State is considering an equivalency provision.

annual reporting and record keeping requirements

surface tension testing will be required once the permit is revised this year - this test costs about \$100 and is initially conducted every 4 hours. The frequency is gradually reduced to every 40 hours if the source is in compliance.

**Ventura County  
Mike Villegas, Rules Manager  
November 19**

Permitting

1. Are there any facilities engaged in nickel plating operations within your air pollution control district jurisdiction?

Yes. Talk to Terri Thomas in Toxics.

2. Do you permit nickel plating operators or their abatement device control equipment?

No. Not permitted.

- 2.a. If not, Are they specifically exempt?

Yes. According to Rule.

- 2.b. If #2 is no, are these sources treated as area sources for emission inventory purposes?

Don't know.

3. If #2 is yes, has any source testing been conducted?
4. If yes, can you tell me anything about the types of nickel plating conducted at these sources, types of control equipment, control efficiency (or emissions rate)

Talk to Terri Thomas.

5. Does the agency have a nickel plating regulation?

No. If ARB does develop an ATCM for nickel plating operations, the APCD would most probably develop a rule or the equivalent ATCM.

AB2588

**Terri Thomas**

6. Is there an AB2588 Risk Assessment for this source?

There are approximately five known sources in Ventura County. The APCD has information only on facilities on permit pursuant to Rule 231.9. Therefore, they have information only on facilities that happened to require a permit for other processes at the facility.

These sources have submitted AB2588 reports and have been permitted.

6.a. If yes, has any source testing been conducted?

Unknown

6.b. Has any in-house modeling been conducted on these types of sources?

Unknown

7. How were the nickel plating facilities assessed?

Nickel emissions were generally estimated using emission factors developed for chrome plating. Using these factors, the facilities reported between  $10^{-3}$  and 1 lb/year of nickel emissions. Somtech reported negligible emissions based on a source test that was performed on similar equipment by NEESA at the Long Beach Naval Shipyard.

8. Do you conduct any health risk analyses or risk screening assessments (beyond AB2588 requirements)? (E.g. public nuisance)

Unknown

9. Is there a specific methodology you use to estimate the deposition rate and distance from the source?

Unknown

10. Is there any additional information District can provide?

Permit #	Facility Name	Location
0339	General Magnaplate	2707 Palma Drive, Ventura
0441	Coastal Valley Plating	223 South Laurel St. Ventura
0506	Semtech	652 Mitchell Rod., Newbury Park
1169	Coastal Multichrome	1100 Mercantile St., Oxnard
1321	G&H Technology	750 W. Ventura bl., Camarillo

Mike Villegas suggested we contact Randy Solganik, Metal Finishing Association, at 213-269-8748. Mike believes that the Association may have conducted a study on nickel plating operators demonstrating that emissions are not sufficient to warrant an ATCM.

**Mojave District  
Richard Wales  
11/25**

Permitting

1. Are there any facilities engaged in nickel plating operations within your air pollution control district jurisdiction?  
  
No platers within District jurisdiction.
2. Do you permit nickel plating operators or their abatement device control equipment?
  - 2.a. If not, are they specifically exempt?
  - 2.b. If #2 is no, are these sources treated as area sources for emission inventory purposes?
3. If #2 is yes, has any source testing been conducted?
4. If yes, can you tell me anything about the types of nickel plating conducted at these sources, types of control equipment, control efficiency (or emissions rate)?
5. Does the agency have a nickel plating regulation?

AB2588

6. Is there an AB2588 Risk Assessment for this source?
  - 6.a. If yes, has any source testing been conducted?
  - 6.b. Has any in-house modeling been conducted on these types of sources?
7. How were the nickel plating facilities assessed?
8. Do you conduct any health risk analyses or risk screening assessments (beyond AB2588 requirements)? (E.g. public nuisance)
9. Is there a specific methodology you use to estimate the deposition rate and distance from the source??
10. Is there any additional information the District can provide?

When any plating activities are undertaken, the material is taken to the Los Angeles area. Richard indicated that there is (or was) a huge nickel, chrome, copper plating facility in Woodstock, Illinois, and that they might have information, if we need it.



**San Joaquin**  
**Steve Bonnacker (209-497-1053)**  
**12/11/96**

Permitting

1. Are there any facilities engaged in nickel plating operations within your air pollution control district jurisdiction?

There are seven chrome and nickel platers in the District.

2. Do you permit nickel plating operators or their abatement device control equipment?

Yes.

2.a. If not, are they specifically exempt?

2.b. If #2 is no, are these sources treated as area sources for emission inventory purposes?

3. If #2 is yes, has any source testing been conducted?

No.

4. If yes, can you tell me anything about the types of nickel plating conducted at these sources, types of control equipment, control efficiency (or emissions rate)

See Attachment

5. Does the agency have a nickel plating regulation?

No. Only hexavalent chromium.

AB2588 Call Leland Villavilazo, Technical Services

6. Is there an AB2588 Risk Assessment for this source?

Yes.

6.a. If yes, has any source testing been conducted?

6.b. Has any in-house modeling been conducted on these types of sources?

7. How were the nickel plating facilities assessed?

8. Do you conduct any health risk analyses or risk screening assessments (beyond AB2588 requirements)? (E.g. public nuisance)

9. Is there a specific methodology you use to estimate the deposition rate and distance from the source?
10. Is there any additional information District can provide?

Permit requirements are as follows:

de-mister/mist suppressor

throughput of 260 amp hours per year

0 - 45 dines/centimeter

Emission limit of 0.014 pounds per year hexavalent chromium

Steve did not know how compliance was determined

Another source, a hard plating operation, has a scrubber.

Requirements: Amperage shall not exceed 32,000 per day or  
9,984,000 per year.

There is a dedicated meter to monitor compliance.

Estimated emissions are 300 grams/year.

(My notation: This seems awfully high)

Another Source:

Surfactant on bubble shield.

Zero mist must be maintained.

Monthly record keeping requirement

½ inch foam blanket

35-45 dines per centimeter

Temperature controls (he wasn't sure what temp).

Overall control efficiency is 95%.

Emission Calculations - They use AP42 emission factor to estimate emissions from sources.

BACT is a surfactant on the bubble shield on the chrome solution. This keeps the chrome and nickel from aerating.

**Bay Area AQMD**  
**Brian Bateman, Randy Frasier, Scott Lutz**

Permitting

1. Are there any facilities engaged in nickel plating operations within your air pollution control district jurisdiction?

Yes. About 35 chrome (½ are decorative) and 20 nickel plating facilities, small to medium size).

2. Do you permit nickel plating operators or their abatement device control equipment?

No.

- 2.a. If not, are they specifically exempt?

Yes

- 2.b. If #2 is no, are these sources treated as area sources for emission inventory purposes?

No

3. If #2 is yes, has any source testing been conducted?
4. If yes, can you tell me anything about the types of nickel plating conducted at these sources, types of control equipment, control efficiency (or emissions rate)
5. Does the agency have a nickel plating regulation?

AB2588

6. Is there an AB2588 Risk Assessment for this source?
  - 6.a. If yes, has any source testing been conducted?
  - 6.b. Has any in-house modeling been conducted on these types of sources?
7. How were the nickel plating facilities assessed?
8. Do you conduct any health risk analyses or risk screening assessments (beyond AB2588 requirements)? (E.g. public nuisance)

9. Is there a specific methodology you use to estimate the deposition rate and distance from the source?
10. Is there any additional information District can provide?

Chrome Plating operators require a permit but not nickel plating operators.

In general, sources are uncontrolled and some are not ventilated to the outside. (This statement sounds questionable.)

They do not estimate emissions from these types of facilities. They follow the AB2588 Criteria Document guidelines. They use the emissions that were developed for the AB2588 toxic inventory.

They do not conduct source testing.

**San Diego County APCD  
Tom Weeks  
(619-694-3307)**

The District estimates emissions from nickel plating operations with EPA's *Toxic Air Pollutant Emission Factors Manual A Compilation For Selected Air Toxic Compounds and Sources*, 2nd Edition.

The District does not have any source test results for testing conducted at nickel plating operation.

**San Luis Obispo County APCD  
Dean Carlson  
(805-781-5912)**

There are two nickel platers in the District:

- 1) Joslyn Sunbank Corporation plates small metal electrical parts and is controlled by a fume scrubber. No testing has been performed.
- 2) California Fine Wire coats and plates very fine wire. One source test was performed to prove the assumption that emissions from this source are negligible. Wire plated during the source test had a diameter of 0.005 inches. The District will mail Sierra Research the source test report. In the interim, a summary of the source test results were faxed to Sierra.

**Sacramento Metropolitan AQMD**  
**Jorge DeGuzman**  
**(916-386-7027)**

There are two nickel platers in the District:

- 1) Gold River Metal Finishing; and
- 2) Alta Plating.

To determine emissions of nickel compounds for AB2588, the following methodology was used.

-the EPA emission factor for open nickel tanks (rate from an uncontrolled source) is 0.225 milligrams/Amp Hr.

-to determine air it is necessary to arrive at an estimate or calculation of amp hours of plating for a year and use the following calculation for total releases:

$(x \text{ amp hours/yr}) \times (0.225 \text{ mg/Amp Hr}) \times (1 \text{ lb}/454,000 \text{ mg}) = \text{the lbs/yr of nickel emitted.}$

**South Coast AQMD  
Mohan Balagopalan  
(909-396-2704)**

A confidentiality agreement was signed by Sierra and SCAQMD, but SCAQMD only provided nickel emissions data based on theoretical correlations with chrome plating emissions factors. SCAQMD stated that no other nickel emissions data was available.

(Source test data was subsequently provided by the SCAQMD in January 1999 as a result of Public Records Act information requests.)

The following Districts indicated there were no nickel platers located within the District:

Amador County APCD  
Butte County APCD  
Colusa County APCD  
El Dorado County APCD  
Feather River AQMD  
Kern County APCD  
Monterey Bay Unified APCD  
Northern Sonoma County APCD

The following Districts indicated they did not know if there are any nickel platers located within the District:

Calaveras County APCD  
North Coast Unified AQMD (may have)



## **Appendix E**

### **PES Source Test Protocol and Response to Comments**





1801 J Street  
Sacramento, CA 95814  
(916) 444-6666  
Fax: (916) 444-8373

October 27, 1997

Mr. M. Dean High  
Pacific Environmental Services, Inc.  
13100 Brooks Drive, Suite 100  
Baldwin Park, CA 91706-2290

Dear Mr. High:

You are probably aware that Sandra Lopez has left Sierra Research. I have been designated to replace her as Principal Investigator for Sierra's contract with the California Air Resources Board (ARB) on emissions from nickel plating facilities.

I reviewed your source test plan, comments on the plan from ARB staff, and your September 22, 1997 letter to Sandra Lopez. I also discussed these items with Sandra. Based on this review I believe that you have addressed all the concerns\* and should proceed to schedule the source test at a time when all interested parties can attend. We agree that the US Environmental Protection Agency should be invited to attend if that is acceptable to the Metal Finishing Association and to Foss Plating.

Please give me a call if you have any questions.

Sincerely,

Larry Caretto

cc: Robert Grant, ARB  
Randy Solganick, Gene's Plating

---

\* I believe that there is a typographical error in the computation of the stack gas molecular weight,  $M_g$ , in Appendix A. The symbol Q in equation 4) should be replaced by  $B_{ws}$ .





RECEIVED SEP 26 1997



13100 Brooks Drive, Suite 100  
Baldwin Park, CA 91706-2290  
(818) 856-1400  
FAX (818) 814-0820

September 22, 1997

Ms. Sandra Lopez  
Sierra Research  
1801 J. Street  
Sacramento, CA 95814

Dear Sandra:

As discussed last Monday, September 15, 1997, we are providing a partial response to your verbal comments on our "Source Test Protocol For Nickel Measurements, Foss Plating Company, Santa Fe Springs, California". Because several reviewers provided overlapping questions or comments we have addressed the general questions without reference to the reviewer's question.

Attached is a 1995 summary of an industrial hygiene survey conducted of Foss Plating by the State Compensation Insurance Fund. Results showed nickel concentrations to be only about 1/100 of the Cal OSHA PEL for a plater. We conclude that the current natural ventilation is more than adequate to protect the workers. With an exhaust fan on the opening above the nickel tanks, we expect the added ventilation rate to capture all nickel emissions and reduce worker exposures even lower.

Attached is a sketch of the nickel plating line. The tank numbers have been changed. The semi-bright tank is No. 24 (not 28-29 as shown in the protocol) and the bright nickel tank is No. 2 (not 24-23). Ignore the numbers inside the tanks 40-41 and 31-30 on the attached sketch. Also attached is a floor plan of the entire plating shop which shows other possible pollution sources. Photographs are enclosed to clarify questions regarding the juxtaposition of the tanks, the roof vent, and other equipment in the plating shop.

Attached are three example analyses reports for both the semi-bright nickel tank and the bright nickel plating tank respectively. These plating solution analyses are conducted routinely and will be done at the time of the source tests. You will note that the baths do not vary significantly. Also note that surface tension is measured on the semi-bright nickel solution. At the time of the source tests we will measure surface tension in both tanks.

The air agitation pressure is only about 5-10 psi and the company does not measure flow rate or pressure.





Ms. Sandra Lopez - September 23, 1997

Page 2

At the time of the tests, we will keep process logs of the rate of plating by the automatic hoist line as well as amperage and voltage as listed in our protocol.

Regarding testing methodology, we considered using EPA Method 29. However, that method was developed for nickel in high temperature combustion exhausts. It calls for a heated probe and filter and a permanganate/peroxide solution in the impingers. We recommend keeping the ambient temperature nickel mist at ambient temperature until it is absorbed in a chemical solution.

The West Coast Analytical Service (WCAS) laboratory minimum level of detection for nickel using ICPMS is 1  $\mu\text{g}/\text{l}$ . The worker exposure samples in 1995 showed 13 or 14  $\mu\text{g}/\text{m}^3$  which would be 130 or 140  $\mu\text{g}/\text{l}$  of solution since the sampling period was 8 hours for 1 cubic meter of air and the sample was dissolved in about 100 ml of solution. We, therefore conclude that our analytical method will be able to detect nickel. We plan to take two-hour samples at 50 l/m (6000 l) and our impinger solutions plus clean up will be less than 500 ml so we expect to see concentrations of about 1 to 168  $\mu\text{g}/\text{l}$ . We could only improve the detection by extending the sampling time to 4, 6, or 8 hours but we do not recommend such long duration samples. It adds lots of cost for little value. The calculation is as follows:

$$6000 \text{ l} = 6 \text{ m}^3 \text{ sample size @ } 14 \mu\text{g}/\text{m}^3 = 84 \mu\text{g} \text{ collected in } 500 \text{ mls of solution} = 168 \mu\text{g}/\text{l}$$

The expected chromium concentrations are equal to or less than nickel. Analyses will be done for total chromium to check for interferences with nickel measurements. Table 4 of the protocol lists the quality assurance objectives for precision and accuracy. CARB needs to be more specific about any additional samples or analyses.

To help ensure good collection of the nickel emissions, we will drape plastic to partially enclose the nickel plating operation. This procedure also should help reduce contamination by other pollutants. We will operate four OSHA personal samplers at the perimeter of the draped area to determine if any nickel emissions can be found and thereby help confirm no fugitive loss of the nickel emissions. We will plan to run the fan for a few days after installation to help season the ductwork and blower before the source test. The 2000 cfm fan was sized to provide about 5 air changes per hour. The volume of the draped area is about 40'L x 25'W x 25'H = 25000  $\text{ft}^3$ . At a 2000 cfm exhaust rate the volume of the nickel area would be exhausted in 12.5 minutes which is 4.8 air changes per hour.



Ms. Sandra Lopez - September 23, 1997  
Page 3

We would like to suggest that the USEPA be invited to review the tests since we have a broader industry interest from members across the U.S.A.

If you have any further questions, please let us know.

Very truly yours,

A handwritten signature in cursive script that reads 'M. Dean High'.

M. Dean High  
Senior Vice President

MDH/jr

Enclosures

cc: Randy Solganik



**SOURCE TEST PROTOCOL  
FOR NICKEL EMISSION MEASUREMENTS  
FOSS PLATING COMPANY  
SANTA FE SPRINGS, CALIFORNIA**



**PACIFIC ENVIRONMENTAL SERVICES, INC.**

WASHINGTON, D.C. • RESEARCH TRIANGLE PARK, NC • LOS ANGELES, CA • CINCINNATI, OH



**SOURCE TEST PROTOCOL  
FOR NICKEL EMISSION MEASUREMENTS  
FOSS PLATING COMPANY  
SANTA FE SPRINGS, CALIFORNIA**

Prepared For

Sierra Research, Inc.  
1801 J Street  
Sacramento, California 95814

Prepared On

April 28, 1997

Prepared By

Pacific Environmental Services, Inc.  
13100 Brooks Drive, Suite 100  
Baldwin Park, California 91706

Telephone: 818-856-1400



**SOURCE TEST PROTOCOL  
FOR NICKEL EMISSION MEASUREMENTS  
FOSS PLATING COMPANY  
SANTA FE SPRINGS, CALIFORNIA**

**GENERAL INFORMATION**

**Facility:** Foss Plating Company, Inc.  
8140 Secura Way  
Santa Fe Spring, CA 90670

**Contact:** Mr. Randall Foss  
Telephone: 310-945-3451  
Fax: 213-698-2326

**Source Test Coordinators:** Sierra Research, Inc.  
1801 J Street  
Sacramento, CA 95814

Ms. Sandra Lopez  
Telephone: 916-444-6666  
Fax: 916-444-8373

Metal Finishing Association of Southern California  
5000 Van Nuys Boulevard, Suite 305  
Sherman Oaks, CA 91403

Mr. Randy Solganick (Gene's Plating)  
Telephone: 213-269-8748  
Fax: 213-269-5390

**Source Testing Contractor:** Pacific Environmental Services, Inc.  
13100 Brooks Drive, Suite 100  
Baldwin Park, CA 91706

**Contact:** Mr. Dean High  
Telephone: 818-856-1400  
Fax: 818-814-0820

**Schedule:** Two weeks after approval of test protocol

**SOURCE TEST PROTOCOL  
 FOR NICKEL EMISSION MEASUREMENTS  
 FOSS PLATING COMPANY  
 SANTA FE SPRINGS, CALIFORNIA**

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## APPENDICES

- APPENDIX A    FIELD DATA AND CALCULATION SHEETS
- APPENDIX B    EXAMPLE CHAIN OF CUSTODY FORM
- APPENDIX C    COPY OF PERMIT TO OPERATE





**SOURCE TEST PROTOCOL  
FOR NICKEL EMISSION MEASUREMENTS  
FOSS PLATING COMPANY  
SANTA FE SPRINGS, CALIFORNIA**

**1.0 INTRODUCTION**

Pacific Environmental Services (PES) is planning to conduct emissions testing to determine nickel emissions from plating tanks in operation at Foss Plating Company, 8140 Secura Way, Santa Fe Springs, California. The purpose of this testing program is to collect information for the California Air Resources Board and the Metal Finishing Association of Southern California by measuring nickel emissions from semi-bright or bright nickel plating tanks.

**2.0 EQUIPMENT AND PROCESS DESCRIPTION**

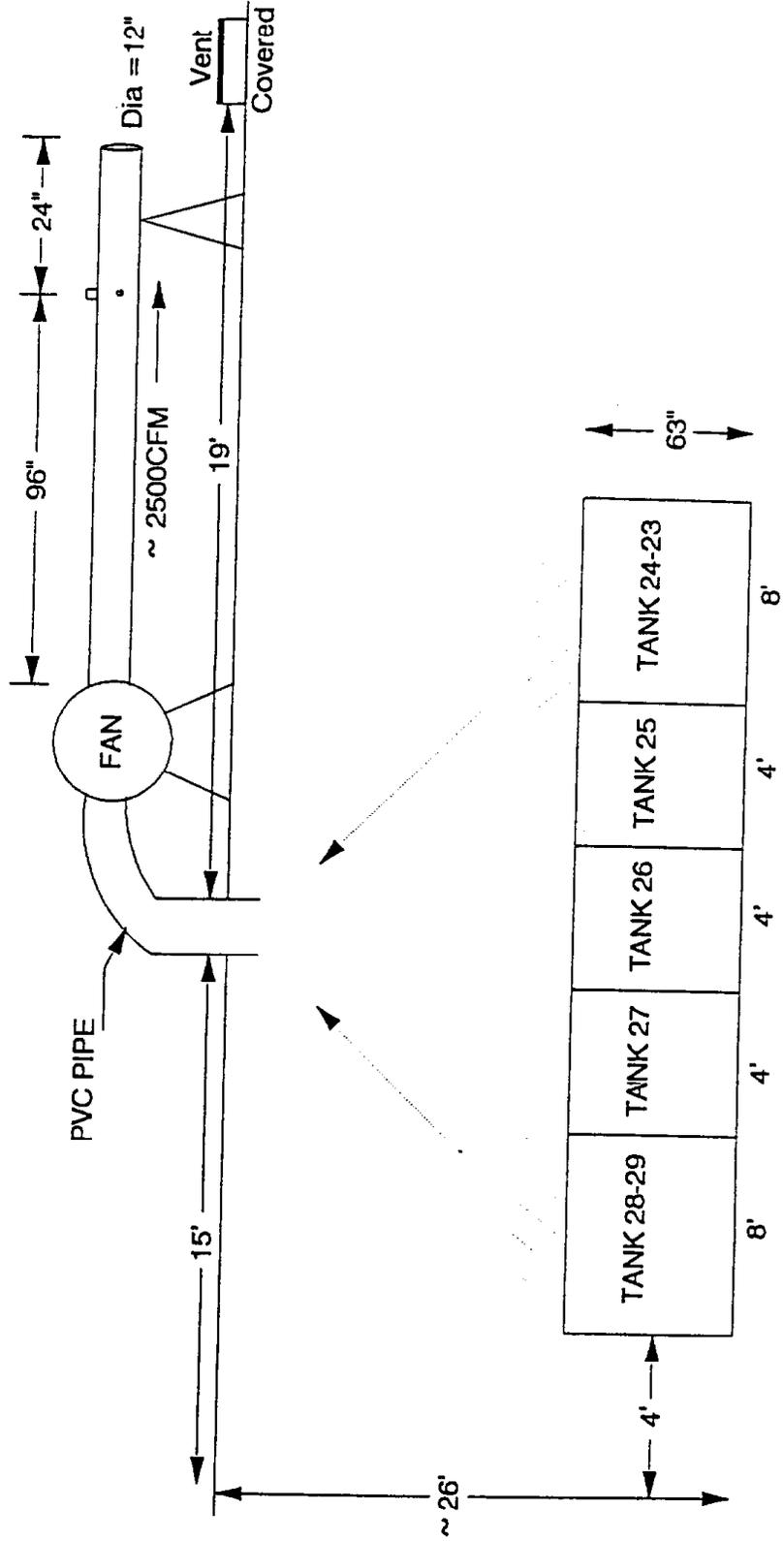
The decorative chrome plating facility operated by Foss Plating utilizes two tanks (each with two compartments) that are operated in accordance with Permits to Operate granted by the SCAQMD. The following is a summary of the tanks and the rectifiers in use:

Tank & Station No.	Operating Amperages	Dimensions (L W H)	Contents
29-28	2,000 amps (9VDC)	12' x 8' x 63"	Semi-bright Nickel
27		12' x 3' x 63"	drag out
26		12' x 3' x 63"	rinse
25		12' x 3' x 63"	rinse
24-23	2,000 amps (9 VDC)	12' x 8' x 63"	Bright Nickel

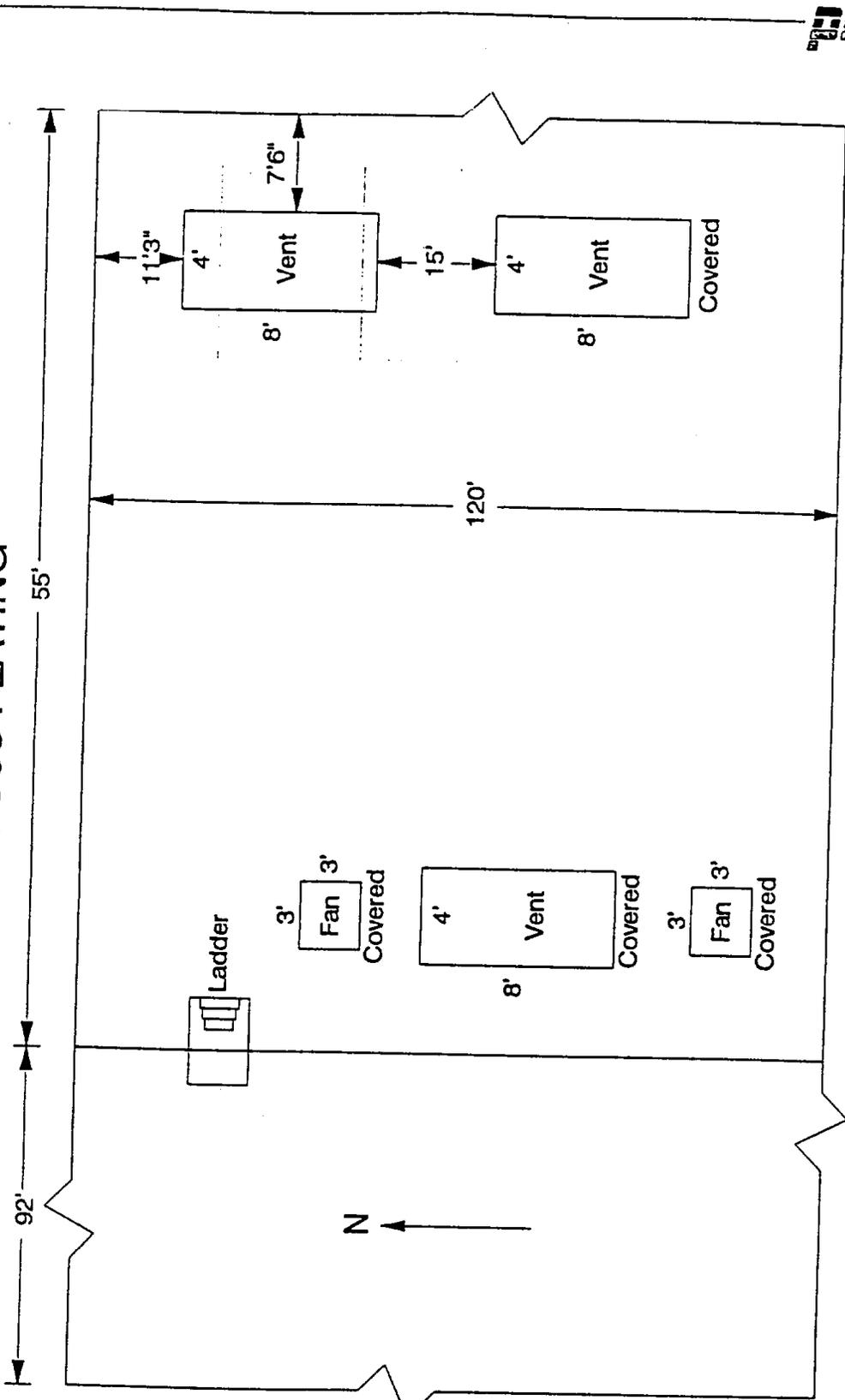
Tanks 29-28 and 24-23 are each equipped with rectifiers. The rectifiers are always operated at 2,000 amps and 9 VDC, however, the operating time is varied depending on the product being plated. A diagram showing the tanks and temporary fan is shown as Figure 1. A plan view of the plating area and roof vents is shown as Figure 2. These tanks are not equipped with lip exhausts or fume hoods. The plating area is ventilated by natural draft through the plating area and up through vents in the roof above the tanks. For this source test the roof vents will be temporarily sealed except for the vent directly above the nickel plating and rinse tanks. A 2,500 ACFM blower with a discharge stack will be temporarily installed in the roof vent above the tanks.

The tanks are equipped with air agitation. For this testing program three test runs will be conducted with air agitation, and a second series of three test runs will be conducted without air agitation.

FIGURE 1  
 DIAGRAM OF TEMPORARY EXHAUST SYSTEM  
 FOSS PLATING COMPANY  
 SANTA FE SPRINGS, CALIFORNIA



**FIGURE 2**  
**PLAN VIEW OF ROOF**  
**AT FOSS PLATING**



Note: Not to scale

This testing program will be conducted over a three day period. Equipment setup will occur on day one, normal operations will be tested by conducting three runs on day two. On the third and fourth day, testing without air agitation will be conducted between midnight and 0500 hours to avoid interfering with normal plant production.

### 3.0 TESTING METHODOLOGY

The location of the sampling ports for the stack is shown in Figure 1. The required number of traverse points for each will be 12 points on each of two diameters, 90° apart. The locations of traverse points will be based on EPA Method 1. The sampling will be conducted in triplicate on each system during periods of high production. In order to maintain a high level of continuous plating operations during the emissions testing without air agitation, the facility will plate scrap parts similar to those normally processed through the facility.

A smoke test will be conducted prior to the emissions testing program to verify that adequate ventilation over the tanks has been achieved with the temporary fan installed on the roof. A solution of liquid ammonia in hydrochloric acid will be used to generate a white smoke for this test.

Nickel will be measured using a modified CARB Method 433 sampling procedure. A diagram showing the configuration of the sampling train is shown in Figure 3. The samples will be extracted at ambient temperature with a sampling train configured with: a glass nozzle; Teflon union, a 60-inch glass-lined probe; a 10-foot Teflon tube from the probe to the first impinger, two Greenburg-Smith impingers; each containing 100 milliliters of 0.1 Normal solution of nitric acid; an empty impinger; an impinger filled with approximately 200 grams silica gel; a 30-foot umbilical line; a vacuum pump; a dry gas meter; and a calibrated orifice connected to an inclined oil manometer. A filter operated at ambient temperature will be located between the third and fourth impingers.

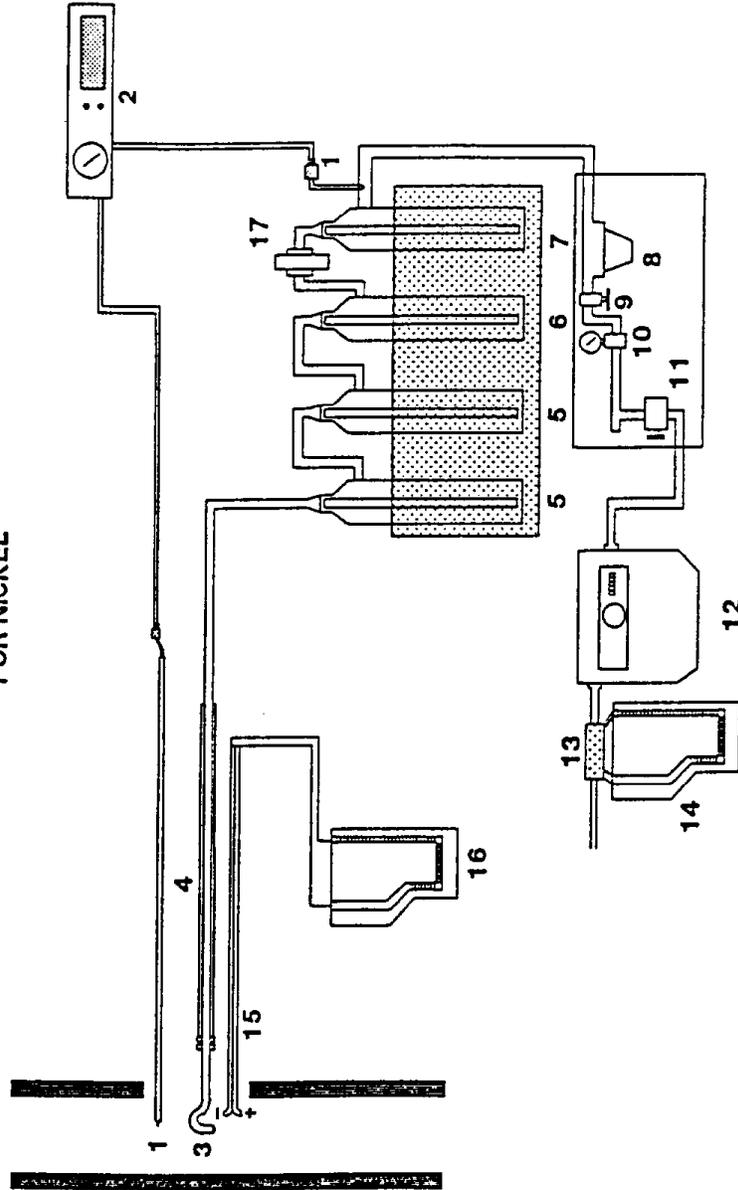
The weight of the impinger solution and the weight of the silica gel will be recorded before and after each test run in order to obtain the moisture content of the exhaust gases. All sample weights will be recorded on sample recovery sheets during charging and sample recovery. Leak checks will be performed immediately before and after each test.

Sampling will be conducted isokinetically two hours per test run (5 minutes per point) per sample (test run) generating a sample size of about 100 cubic feet through the sampling train. Field data will be recorded on data sheets shown in Appendix A.

Volumetric flow rates for the outlet will be calculated from the measured velocity head and the cross-sectional area of each stack. As each traverse point is sampled, the velocity head of the flue gas will be measured with an S-type Pitot tube connected to an inclined oil manometer, and the temperature of the flue gas will be measured with a chromel-alumel (type K) thermocouple connected to a digital readout (EPA Method 2).

Figure 3

CALIFORNIA AIR RESOURCES BOARD METHOD 433  
WET IMPINGEMENT SAMPLING TRAIN  
FOR NICKEL



- |                                |                            |
|--------------------------------|----------------------------|
| 1. Temperature Sensor          | 15. S-Type Pilot Tube      |
| 2. Digital Temperature Readout | 16. Inclined Oil Manometer |
| 3. Button Hook Nozzle          | 17. Teflon Coated Filter   |
| 4. Quartz Lined Probe          |                            |
| 5. Impinger w/ 0.1 N HNO3      |                            |
| 6. Empty Impinger              |                            |
| 7. Silica Gel Impinger         |                            |
| 8. Pump Filter                 |                            |
| 9. Coarse Adjustment Valve     |                            |
| 10. Vacuum Gauge               |                            |
| 11. Fine Adjustment Valve      |                            |
| 12. Dry Gas Meter              |                            |
| 13. Critical Orifice           |                            |
| 14. Inclined Oil Manometer     |                            |

After each test run, the contents of the impingers will be recovered and placed in a 1,000 milliliter polyethylene container. The remainder of the sampling train components will be rinsed from the nozzle through the third impinger with the charging solution and the rinse added to the sample. The filter will be placed in the same sample container and analyzed along with the solution. During sample collection, the impingers and solution will be immersed in an ice bath (chilled to 68 degrees Fahrenheit or less during the tests) and refrigerated prior to the analyses.

The laboratory analyses for nickel will be conducted by West Coast Analytical Services in Santa Fe Springs, California. The mass of nickel collected in each train will be determined by inductively coupled plasma/mass spectrometry. The detection level of the analytical procedure for nickel is expected to be 1 microgram/liter. An example of a chain of custody form to be used for tracking samples during this project is shown in Appendix B and will be maintained for each sample throughout the sample recovery and analytical process.

#### **4.0 RESULTS**

Calculations will be made from field data sheets to determine sample volume, molecular weight, velocities, flow rate, and isokinetic variation for the test. These calculations are shown on the emission test calculation sheets located in Appendix A. An example of a data summary for the source emissions is shown in Table 1. An example table showing the production data that will be collected during the testing is shown in Table 2.

#### **5.0 QUALITY ASSURANCE/QUALITY CONTROL**

Source tests are performed to determine the types and amounts of pollutants emitted by a source. Information from this source test program may be used for determining research needs, for obtaining permits, for preparing emission inventories, and for determining compliance with emission regulations. For these purposes, reliable data are required. Pacific Environmental Services, Inc. (PES) provides this reliability by using the following work practices:

##### **5.1 Use of Standard Test Procedures**

A procedure must be thoroughly studied under various conditions in order to be designated as a state or federal Reference Method. Results of many executions of the procedure are compared to demonstrate accuracy and repeatability before adoption of the procedure as a source testing method. EPA Methods 1 and 2 will be utilized to determine the sampling point locations and flow rate. CARB Method 433 will be used to determine the emission rates of nickel.

##### **5.2 Use of Trained Test Personnel**

Because of the complexity of typical source testing methods, the testers are trained and experienced with the test procedures in order to assure reliable results for this testing program. PES personnel have had professional training and routinely conduct this kind of source testing.



Table 1  
Example Data Summary for  
Nickel Emissions

Run Number	1	2	3	Average
Sample Collection Date				
Sample Time				
Load (amp-hrs/hr)				
Sample Number				
Stack Temperature (deg F)				
Outlet Velocity (ft/sec)				
Static Pressure, in. H <sub>2</sub> O				
Outlet Flow Rate (ACFM)				
Outlet Flow Rate (DSCFM)				
Moisture (% v/v)				
Sample Volume (DSCF)				
Sampling Time (min)				
Isokinetic Rate (%)				
Nickel				
Concentration (mg/m <sup>3</sup> )				
Emission Rate (mg/hr)				
Emission Factor (mg/amp-hr)				



Table 2

Example Data Summary of Process Data

Run No.	1	2	3	Average
Sample Collection Date				
Tank No. Volts Amperage Temperature Nickel solution				
Tank No. Volts Amperage Temperature Nickel solution				
Air agitation (on or off)				

### **5.3 Knowledge of Source's Operation**

The source testing team will have sufficient knowledge of the process to be tested in order to properly document the process parameters during the tests. Without documentation of the process parameters used, results are much less meaningful. PES has previously tested similar plating operations and is familiar with the processes and equipment involved.

### **5.4 Equipment Maintenance and Calibration**

Use of properly maintained and calibrated test equipment is essential for minimizing systematic errors in results. All sampling devices to be used for this project will be constructed, maintained, and calibrated as suggested in EPA documents APTD-0576, and APTD-0581 (These are commonly accepted construction and maintenance manuals for source testing equipment). The dry gas meters will be calibrated with a transfer gas meter with NIST traceability. These calibrations will be included in the Appendices to the final source test report along with those for the nozzles, thermocouples, digital potentiometers, and Pitot tubes. Calibration procedures and acceptance criteria for CARB Method 433 are summarized in Table 3.

### **5.5 Thorough Recordkeeping**

All data relating to the operation of the sampling train will be immediately recorded to ensure that it is not lost or misinterpreted. PES accomplishes this thorough recordkeeping by use of the field data sheets similar to those shown in Appendix A. The PES test team is familiar with these sheets and the information required to complete them. Any unusual occurrences in the process operations, unusual test instrument readings, or any other items that could affect the test results will be noted.

### **5.6 Proper Sample Handling Procedures**

Inaccurate source test results can be caused by delays in retrieving samples, contamination of the samples, insufficient sample identification, tampering, and mishandling of samples. The chances of these errors are greatly increased when too many people are permitted to handle the samples. For this reason, a chain of custody procedure will be used. The samples will be recovered in the PES lab and kept in secure areas until delivery to the analytical laboratory. The nickel samples will be kept refrigerated until analysis. A sample submittal/chain of custody form will be completed and submitted with the nickel samples to document that each sample analyzed was taken under the conditions reported.

### **5.7 Use of Thoroughly Cleaned Glassware**

All glassware and probe lines will be cleaned prior to the tests with hot tap water and then with 40% nitric acid solution. The trains will then be cleaned with 0.1 normal sodium hydroxide solution, laboratory grade distilled water, air dried, and sealed until the tests.

**TABLE 3**  
**CALIBRATION PROCEDURES AND CRITERIA FOR**  
**CARB METHOD 433 SAMPLING EQUIPMENT**

Parameter	Calibration Technique	Reference Standard	Acceptance Limit	Frequency
1. Probe nozzle	Measure Diameter to nearest 0.001"	Micrometer	Average of three measurements; difference between high and low <0.1 mm	Prior to test
2. Gas Meter Volume	Compare to Reference Meter	Dry Gas Meter Transfer Standard	Record calibration factor  ± 5% of pretest calibration factor	Prior to test
3. Gas Meter Temperature	Compare to Mercury-in-glass	ASTM Thermometer	± 5 deg F	Posttest
4. Stack Temperature Sensor	Heated block monitored with potentiometric thermocouple system	NIST Traceable potentiometric thermocouple system	± 1.5% of minimum absolute stack temperature	Prior to test
5. Final Impinger Temperature Sensor	Compare to Mercury-in-glass	ASTM thermometer	± 5 deg F	Prior to test and Posttest
6. Aneroid Barometer	Compare to Mercury Barometer	Mercury column barometer	± 2.5 mm	Prior to test and Posttest
7. S-Type Pitot Tube		Micrometer and Angle finder	No change from pretest conditions	Prior to test and Posttest



### 5.8 Use of Standardized Data Reduction Techniques

Data reduction will be accomplished by the use of step by step calculation sheets. The calculations will be systematic and easy to follow. All calculations for the source test will be included in the final source test report.

### 5.9 Analytical Quality Assurance Procedures

Filter and reagent samples from an unused but charged nickel sampling train carried to the field will be submitted to the laboratory and analyzed with the other samples to detect any possible contamination of sampling media or problems with lab analyses. No corrections will be made to the measured concentrations of the collected samples, but the blank train results will be reported on the calculation sheets. In addition, one sample in the group submitted will be spiked and re-analyzed to check for matrix effects, and duplicate analysis will be performed on one sample in the group. Acceptance criteria for the analytical QA procedures are summarized in Table 4.

**TABLE 4**  
**QUALITY ASSURANCE OBJECTIVES FOR**  
**PRECISION AND ACCURACY**

Data Quality Parameter	Method of Determination	Frequency	Precision	Accuracy
CARB Method 433 Nickel	Duplicate analysis	1 per test series	< 10% RPD	
	Spike	1 per test series		75 to 125 % recovery
	Field blanks	1 per test series	NA	NA
	Initial Calibration reference standard. Certified standard independent of working calibration standards.	Prior to sample analysis	NA	10%
	Check - standard midpoint standard verification	After every 10 samples and at end of analytical run	NA	10%



**APPENDIX A**

**EXAMPLE FIELD DATA AND CALCULATION SHEETS**

## FOSS PLATING

PES, Inc. CARB 433 Calculations

Plant \_\_\_\_\_

Project # \_\_\_\_\_

Operation \_\_\_\_\_

Run \_\_\_\_\_

Location \_\_\_\_\_

Date \_\_\_\_\_

## Outlet Test Data

Vlc =	cc	Vol. of H2O collected (impingers)
Vm =	cf	Dry gas meter reading
Pb =	in. Hg	Barometric pressure
Ps =	in. Hg	Stack pressure
dP =		Average sq.rt delta P
dH =	in. H2O	Average delta H reading
Tm =	R	Average meter temperature
Ts =	R	Average stack temperature
Dn =	in.	Nozzle diameter
Y =		Meter calibration factor
t =	min.	Duration of sampling time
A =	sq.ft.	Cross sectional area of stack
Cp =		Pitot tube coefficient
Kp =	0.84	Pitot tube constant
K1 =	17.64 R/in.Hg	constant
K2 =	0.04707 cu.ft/ml	constant
K3 =	0.002669 in.Hg-cf/ml-R	constant

Outlet - Page 2

## Orsat Data

$$[O_2] = 20.9 \%$$

$$[CO_2] = \%$$

1) Volume of gas sampled at standard conditions,  $V_{mstd}$ 

$$V_{mstd} = K_1 * Y * V_m * (P_b + dH/13.6)/T_m$$

$$V_{mstd} = \begin{array}{l} \text{cu.ft} \\ \text{cu.m} \end{array}$$

2) Volume of water vapor collected at standard conditions.

$$V_w(\text{std}) = K_2 * V_{lc}$$

$$V_w(\text{std}) = \text{scf}$$

3) Decimal fraction of moisture by volume in stack gas

$$B_{ws} = V_{wstd}/(V_{mstd} + V_{wstd})$$

$$B_{ws} =$$

4) Molecular weight of the stack gas on a wet basis  $M_s$ .

$$M_s = (1-Q) * ((44 * \%CO_2) + (32 * \%O_2) + (28 * \%N_2)) + (18 * Q)$$

$$M_s =$$

5) Average stack gas velocity.

$$v_s = K_p * C_p * (dP^{0.5}) * (T_s/P_s * M_d)^{0.5}$$

$$v_s = \text{ft/sec}$$

6) Average actual stack gas volumetric flowrate.

$$Q = 60 * v_s * A_s$$

$$Q = \begin{array}{l} \text{cfm} \\ \text{cmm} \end{array}$$

Outlet - Page 3

7) Average stack gas dry volumetric flowrate.

$$Q_{std} = Q * (T_{std}/T_s) * (P_s/P_{std})$$

$$Q_{std} = \begin{array}{l} \text{dscfm} \\ \text{dscmm} \end{array}$$

8) Analytical data

Metals Emissions

$$V(c) = \begin{array}{l} \text{mls of Volume of wash} \\ \text{Df = Dilution Factor} \end{array}$$

$$[\text{metal}] = \text{mass metal} / V_{mstd}$$

(9) Lab Data for Nickel

$$\begin{array}{l} \text{conc Ni} = \text{mg/l of Ni in wash} \\ \text{mass Ni} = \text{mg total Ni collected} \end{array}$$

(10) Stack Data for Nickel

$$\begin{array}{l} \text{conc Ni} = \text{mg/dscm} \\ E = \text{mg/hr} \\ E = \text{lbs/hr} \end{array}$$

(11) Blank Data for Nickel

$$\begin{array}{l} \text{conc Ni} = \text{mg/l Concentration of Ni in blank+C34+C20} \\ \text{vol of blank} = \text{mls of Blank} \\ \text{mass of Ni in blank} = \text{mg Total Ni in blank} \end{array}$$

Isokinetic Calculation

12) Isokineticity

$$A_n = \begin{array}{l} \text{ft}^2 \\ \text{Area of nozzle orifice} \end{array}$$

$$\% I = 100 * T_s * ((K_3 * V_{lc} + (V_m * Y / T_m) * (P_b + dH / 13.6)) / (60 * t * P_s * v_s * A_n))$$

$$\% I =$$

FOSS PLATING

Test Date  
 Barometer in.Hg  
 Run #  
 Static P in.H2O  
 Pitot Cp  
 Nozzle

Traverse Point	Delta-P (in. H2O)	Stack Temp. (Deg.F)	delta H (in. H2O)	Gas Meter Temp		(dP) <sup>.5</sup>
				IN	OUT	
N-1						
N-2						
N-3						
N-4						
N-5						
N-6						
N-7						
N-8						
N-9						
N-10						
N-11						
N-12						
E-1						
E-2						
E-3						
E-4						
E-5						
E-6						
E-7						
E-8						
E-9						
E-10						
E-11						
E-12						



**APPENDIX B**

**EXAMPLE CHAIN OF CUSTODY FORM**



**APPENDIX C**

**COPY OF THE PERMIT TO OPERATE**



SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT  
21865 East Copley Drive, Diamond Bar, CA 91765**PERMIT TO OPERATE**Permit No. D17181  
A/N 206424 Page 1

*This initial permit shall be renewed ANNUALLY unless the equipment is moved, or changes ownership.  
If the billing for annual renewal fee (Rule 301.f) is not received by the expiration date, contact the District.*

Legal Owner  
or Operator:POSS PLATING CO INC.  
8140 SECURA WAY  
SANTA FE SPRINGS, CA 90670  
ATTN: CAROL POSS

ID: 009202

Equipment  
located at:

8140 SECURA WAY, SANTA FE SPRINGS, CA 90670-2198

Equipment Description:

**NICKEL PLATING LINE CONSISTING OF:**

1. NICKEL PLATING, TANK No. 24, 12'-0" L X 6'-9" W X 5'-3" H, 2376000 BTU/HR GAS HEATED, WITH A 72 KVA RECTIFIER.
2. NICKEL PLATING, TANK No. 23, 12'-0" L X 4'-0" W X 5'-3" H, 2376000 BTU/HR GAS HEATED, WITH A 72 KVA RECTIFIER.
3. NICKEL PLATING, TANK No. 1, 12'-0" L X 4'-0" W X 5'-3" H, 2376000 BTU/HR GAS HEATED, WITH A 72 KVA RECTIFIER.
4. NICKEL PLATING, TANK No. 2, 12'-0" L X 8'-0" W X 5'-3" H, 2376000 BTU/HR GAS HEATED, WITH A 72 KVA RECTIFIER.
5. DE-SMUTTER, TANK No. 6, 12'-0" L X 3'-0" W X 5'-3" H, UNHEATED.
6. METAL SURFACE CLEANING, TANK No. 8, 12'-0" L X 3'-5" W X 5'-3" H, 2376000 BTU/HR GAS HEATED, WITH A 18 KVA RECTIFIER.
7. DE-SMUTTER, TANK No. 10, 12'-0" L X 3'-6" W X 5'-3" H, UNHEATED.
8. METAL SURFACE CLEANING, TANK No. 12, 12'-0" L X 3'-6" W X 5'-3" H, 2376000 BTU/HR GAS HEATED.
9. METAL SURFACE CLEANING, TANK No. 14, 12'-0" L X 3'-6" W X 5'-3" H, 2376000 BTU/HR GAS HEATED.
10. METAL SURFACE CLEANING, TANK No. 15, 12'-0" L X 3'-6" W X 5'-3" H, 2376000 BTU/HR GAS HEATED.
11. METAL SURFACE CLEANING, TANK No. 18, 12'-0" L X 3'-0" W X 5'-3" H, UNHEATED.
12. TRI-CHROME PLATING, TANK No. 22, 12'-0" L X 4'-0" W X 5'-3" H, 2376000 BTU/HR GAS HEATED, WITH A 96 KVA RECTIFIER.
13. ASSOCIATED RINSE TANKS.

**ORIGINAL**



SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT  
21965 East Copley Drive, Diamond Bar, CA 91765  
**PERMIT TO OPERATE**

Permit No. D57181  
A/N 206C4 Page

*CONTINUATION OF PERMIT TO OPERATE*

Conditions:

1. OPERATION OF THIS EQUIPMENT SHALL BE CONDUCTED IN COMPLIANCE WITH ALL DATA AND SPECIFICATIONS SUBMITTED WITH THE APPLICATION UNDER WHICH THIS PERMIT IS ISSUED UNLESS OTHERWISE NOTED BELOW.
2. THIS EQUIPMENT SHALL BE PROPERLY MAINTAINED AND KEPT IN GOOD OPERATING CONDITION AT ALL TIMES.
3. THE FOLLOWING TANK(S) SHALL NOT BE HEATED:

DE-SMUTTER TANK NO. 6.  
DE-SMUTTER TANK NO. 10.  
METAL SURFACE CLEANING TANK NO. 18.

NOTICE

IN ACCORDANCE WITH RULE 206, THIS PERMIT TO OPERATE OR COPY SHALL BE POSTED ON OR WITHIN 8 METERS OF THE EQUIPMENT.

THIS PERMIT DOES NOT AUTHORIZE THE EMISSION OF AIR CONTAMINANTS IN EXCESS OF THOSE ALLOWED BY DIVISION 26 OF THE HEALTH AND SAFETY CODE OF THE STATE OF CALIFORNIA OR THE RULES OF THE AIR QUALITY MANAGEMENT DISTRICT. THIS PERMIT CANNOT BE CONSIDERED AS PERMISSION TO VIOLATE EXISTING LAWS, ORDINANCES, REGULATIONS OR STATUTES OF OTHER GOVERNMENT AGENCIES.

EXECUTIVE OFFICER

*Dorris M. Bailey*

By Dorris M. Bailey  
October 27, 1992

**ORIGINAL**

**STATE**  
 COMPENSATION  
 INSURANCE  
**FUND**

**REPORT OF INDUSTRIAL HYGIENE CONSULTATION**

**SAFETY AND HEALTH SERVICES**

DATE OF REPORT

January 19, 1995

INSURED

POLICY NUMBER

75 -93 #55

Foss Plating  
 8140 Secura Way  
 Santa Fe Springs, Ca 90670

Attn: Carol Foss

Dear Carol,

This report contains the results of the industrial hygiene survey conducted on November 29, 1994, at your request. Personal exposure monitoring was conducted for chromium, nickel, formaldehyde, and hydrogen chloride in the plating area, and nuisance dust in the polishing area. Area samples for chromium and formaldehyde were also collected.

**Results:**

Laboratory results were received by State Fund on January 4, 1995. In the plating area, the results for chromium, nickel, hydrogen chloride, and formaldehyde were well below the Cal OSHA Permissible Exposure Limits (PEL's) for those contaminants. In the polishing area the results were approximately 22% to 48% of the PEL's for nuisance dust. The highest exposure (48%) was for the polisher located in the building across the street.

**Table 1**  
**Exposure Results for Airborne Contaminants**

Employee Name/Area	Contaminant	Exposure Results (mg/M <sup>3</sup> )	Cal OSHA Permissible Exposure Limit mg/M <sup>3</sup>
Manual Maldonado/Plater	Chromium	LT 0.007	0.50
	Nickel	0.013	1.00
Abel Sanchez/Wastewater treatment	Chromium	0.014	0.50
	Nickel	0.014	1.00
	Hydrogen Chloride	0.110	7.00
Fernando Campos/Free Plating	Hydrogen Chloride	0.110	7.00
Area Sample	Chromium	0.009	0.50

LT - indicates less than the limit of quantitation for the laboratory.

Results reported in actual time sampled.

Mg/M<sup>3</sup> - milligrams of contaminant per cubic meter of air.

Table 2  
Exposure Results for Formaldehyde

Name	Exposure Results (ppm)	Cal OSHA Permissible Exposure Limit (ppm)
Manual Maldonado	0.0088	0.75
Area Sample	0.0077	0.75

ppm - parts of formaldehyde per million parts of air.

Table 3  
Exposure Results for Nuisance Dust

Name/Area	Exposure Result (mg/M <sup>3</sup> )	% of Cal OSHA Permissible Exposure Limit (mg/M <sup>3</sup> )
Ricardo Montes/Polishing - Main Bldg.	2.21	22
Manuel Real/Polishing - Main Bldg.	2.16	21.6
Gabriel Alvarez/Polishing - Bldg. across the street.	4.76	48

Cal OSHA Permissible Exposure Limit - 10 mg/M<sup>3</sup>

Recommendations:

1. Conduct a job safety analysis to identify ways to reduce exposure to nuisance dust in the polishing area across the street.
2. Repair the loose floorboard and stair near the hydrochloric acid tank.
3. Prohibit smoking in the workplace.

A new California law on smoking in the workplace took effect January 1, 1995. The law AB 13, states that an employer cannot knowingly or intentionally allow people to smoke in enclosed areas at a workplace. I have attached a copy of AB 13 at the end of this report to provide you with further information.

Carol, if you have any further questions you can contact me at (714) 668-3413. For additional loss control services, contact Stefanie Nobriga your Loss Control Representative.

Sincerely,

*Evelyn M. Tovar*

Evelyn M. Tovar  
Industrial Hygiene Consultant

c. Stefanie Nobriga, Loss Control Representative, Arcadia District Office

The above evaluations and recommendations are based upon current occupational Safety and Health requirements, current reference sources, and accepted industrial hygiene principles and practices. They are based upon operating and working conditions observed on the particular day of the survey and relate only to those conditions specifically discussed herein. This report should in no way be considered as exhaustive or inclusive of all potential health hazards that may exist, and does not warrant, expressed or implied, that your workplace is safe or that it complies with all laws or standards. Current regulations require that employees be informed of any potential exposures to chemical or physical agents and that they have access to the records of workplace monitoring. It is suggested that this report be posted on your safety bulletin board to help fulfill these requirements, and that affected employees be fully informed of the survey results.

INSURED Foss Plating (75-93 #55)

INDUSTRIAL HYGIENIST Evelyn Tovar

DATE 1/19/95

WORKPLACE SAMPLING Trivalent Chromium, Nickel

INSTRUMENTS AND SAMPLE MEDIA

MSA Flo-Lite Pro Pumps #21 & 15 in line with MCE filter  
calibrated at 1.0 liters per minute.

SAMPLE AND CALIBRATION METHOD

Pre and Post calibration at SCIF laboratory - Buck calibrator.

Instruments were calibrated for sampling performance prior to and following the survey. Calibration was monitored during the survey.

SAMPLE DURATION:

Manuel Maldonado - 394 minutes

Abel Sanchez- 362 minutes

Area Sample - 405 minutes

ANALYTICAL PROCEDURES

NIOSH 7300 Inductively Coupled Argon Plasma Emission Spectroscopy  
Travelers Insurance Co., Analytical Laboratory  
248 Constitution Plaza

Hartford, CT 06103-1800

Analyses were performed by the State Fund Industrial Hygiene Laboratory, or a consulting lab Accredited by the American Industrial Hygiene Association. Where pertinent, NIOSH analytical methods were used. Analytical results were corrected for blank samples.

CALCULATIONS

Results are reported as Time-Weighted-Average (TWA) exposures calculated over a full typical workday according to the formula below; except where otherwise noted.

$TWA = C_1 T_1 + C_2 T_2 + \dots C_n T_n / 8 \text{ hr. day}$     C = Concentration of contaminant sampled during portion of workday = T.

Results reported in actual time sampled.

Workplace sampling, laboratory analysis, and calculation of exposure were all conducted in accordance with generally accepted industrial hygiene principles and practices. Further survey data and calculations are on file and available from the State Fund Industrial Hygiene Staff.

INSURED **Foss Plating (75-93 #55)**

INDUSTRIAL HYGIENIST **Evelyn Tovar**

DATE **1/19/95**

WORKPLACE SAMPLING **Nuisance Dust**

INSTRUMENTS AND SAMPLE MEDIA

**MSA Fixt Flo Pumps #4, 8, & 9 in line with tared PVC filter  
calibrated at 1.7 liters per minute.**

SAMPLE AND CALIBRATION METHOD

**Pre and Post calibration at SCIF laboratory - Buck calibrator.**

Instruments were calibrated for sampling performance prior to and following the survey. Calibration was monitored during the survey.

SAMPLE DURATION:

**Ricardo Montes - 307 minutes  
Manuel Real - 257 minutes  
Gabriel Alvarez - 297 minutes**

ANALYTICAL PROCEDURES

**NIOSH 0500-Gravimetric Analysis  
State Compensation Insurance Fund Industrial Hygiene Laboratory  
1275 Market Street  
San Francisco, Ca. 94103**

Analyses were performed by the State Fund Industrial Hygiene Laboratory, or a consulting lab Accredited by the American Industrial Hygiene Association. Where pertinent, NIOSH analytical methods were used. Analytical results were corrected for blank samples.

CALCULATIONS

Results are reported as Time-Weighted-Average (TWA) exposures calculated over a full typical workday according to the formula below; except where otherwise noted.

$TWA = C_1 T_1 + C_2 T_2 + \dots C_n T_n / 8 \text{ hr. day}$      $C = \text{Concentration of contaminant sampled during portion of workday} = T.$

**Results reported in actual time sampled**

Workplace sampling, laboratory analysis, and calculation of exposure were all conducted in accordance with generally accepted industrial hygiene principles and practices. Further survey data and calculations are on file and available from the State Fund Industrial Hygiene Staff.

INSURED **Foss Plating (75-93 #55)**

INDUSTRIAL HYGIENIST **Evelyn Tovar**

DATE **1/19/95**

WORKPLACE SAMPLING **Hydrogen Chloride**

INSTRUMENTS AND SAMPLE MEDIA

**MSA C-210 Pumps #S-6 & S-13 in line with silica gel tube  
calibrated at 0.10 liters per minute.**

SAMPLE AND CALIBRATION METHOD

**Pre and Post calibration at SCIF laboratory - Buck calibrator.**

Instruments were calibrated for sampling performance prior to and following the survey. Calibration was monitored during the survey.

SAMPLE DURATION: **Fernando Campos - 315 minutes  
Abel Sanchez- 362 minutes**

ANALYTICAL PROCEDURES

**NIOSH 7903 Ion Chromatography  
Travelers Insurance Co., Analytical Laboratory  
248 Constitution Plaza  
Hartford, CT 06103-1800**

Analyses were performed by the State Fund Industrial Hygiene Laboratory, or a consulting lab Accredited by the American Industrial Hygiene Association. Where pertinent, NIOSH analytical methods were used. Analytical results were corrected for blank samples.

CALCULATIONS

Results are reported as Time-Weighted-Average (TWA) exposures calculated over a full typical workday according to the formula below; except where otherwise noted.

$TWA = C_1 T_1 + C_2 T_2 + \dots C_n T_n / 8 \text{ hr. day}$      $C = \text{Concentration of contaminant sampled during portion of workday} = T.$

**Results reported in actual time sampled.**

Workplace sampling, laboratory analysis, and calculation of exposure were all conducted in accordance with generally accepted industrial hygiene principles and practices. Further survey data and calculations are on file and available from the State Fund Industrial Hygiene Staff.

INSURED Foss Plating (75-93 #55)

INDUSTRIAL HYGIENIST Evelyn Tovar

DATE 1/19/95

WORKPLACE SAMPLING Formaldehyde

INSTRUMENTS AND SAMPLE MEDIA

GMD Passive dosimeter for formaldehyde

SAMPLE AND CALIBRATION METHOD

Instruments were calibrated for sampling performance prior to and following the survey. Calibration was monitored during the survey.

SAMPLE DURATION: Manuel Maldonado - 405 minutes  
Area Sample- 370 minutes

ANALYTICAL PROCEDURES

Formaldehyde Analysis by Liquid Chromatography  
Travelers Insurance Co., Analytical Laboratory  
248 Constitution Plaza  
Hartford, CT 06103-1800

Analyses were performed by the State Fund Industrial Hygiene Laboratory, or a consulting lab Accredited by the American Industrial Hygiene Association. Where pertinent, NIOSH analytical methods were used. Analytical results were corrected for blank samples.

CALCULATIONS

Results are reported as Time-Weighted-Average (TWA) exposures calculated over a full typical workday according to the formula below; except where otherwise noted.

$TWA = C_1 T_1 + C_2 T_2 + \dots + C_n T_n / 8 \text{ hr. day}$  C = Concentration of contaminant sampled during portion of workday = T.

Results reported in actual time sampled.

Workplace sampling, laboratory analysis, and calculation of exposure were all conducted in accordance with generally accepted industrial hygiene principles and practices. Further survey data and calculations are on file and available from the State Fund Industrial Hygiene Staff.

# PLATING LINE

Permit Applied for

6/2/89

Nickel Cas 7440020

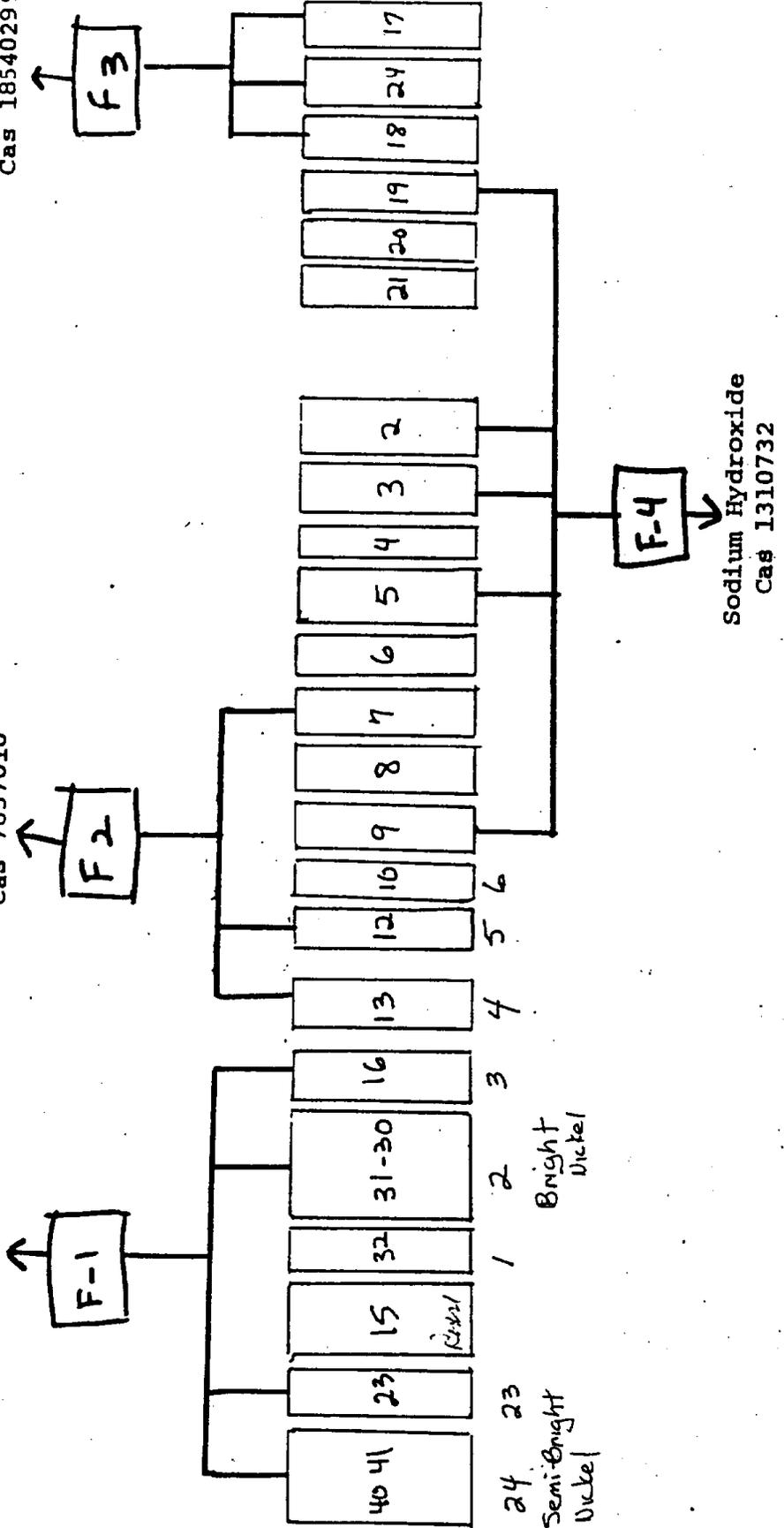
Formaldehyde Cas 50000

Saccharin CAS 81072

Nickel compounds Emis.#1145

Hydrochloric Acid  
Cas 7657010

(Jan-Mar, 1989)  
Chromium(Hexavalent)  
Cas 18540299



# Foss Plating Co.

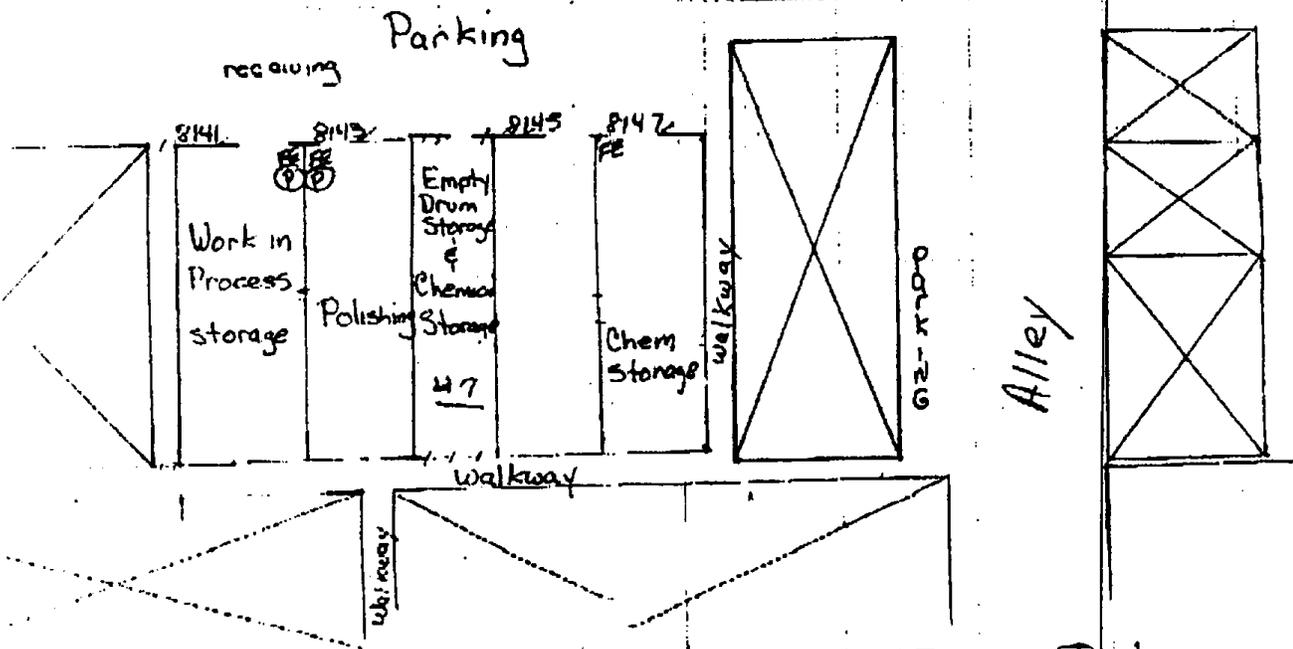
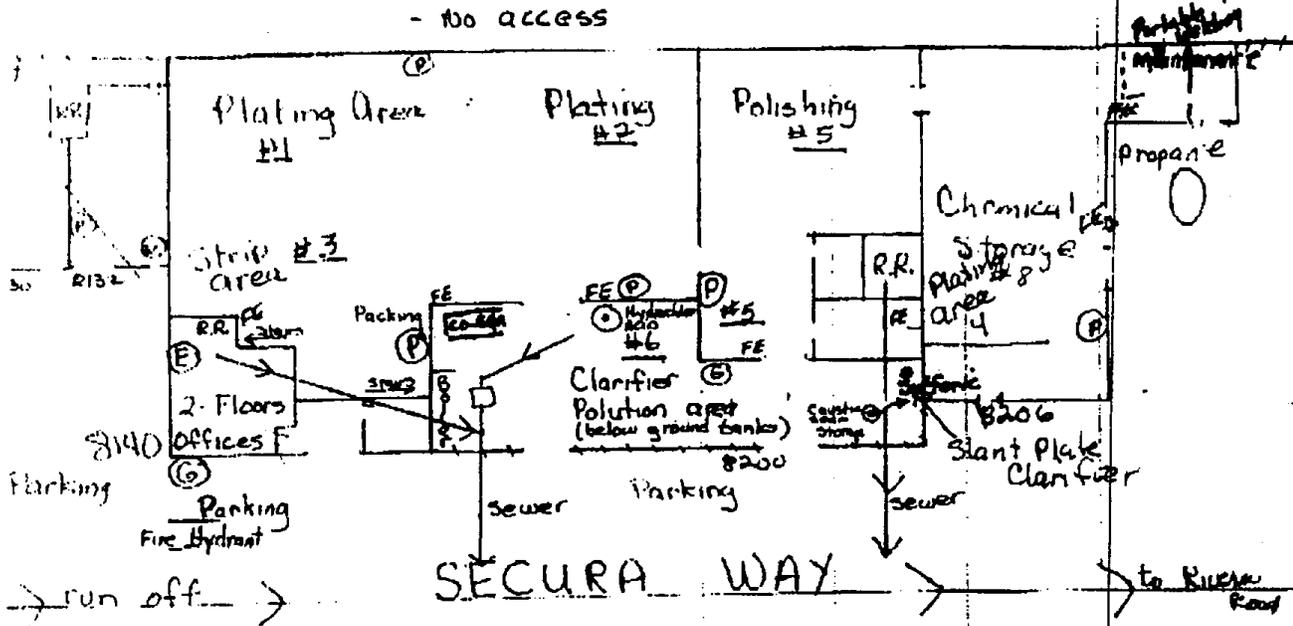
8140 Secura Way  
Santa Fe Springs, Calif.

revised

June 1988

2/89 2/90, 7/91, 2/94 8/94, 3/95 8/96

- no access





Atotech USA Inc.  
1713 South California Avenue  
Monrovia, CA 91016  
Tel: (818) 305-3014 -- Fax: (818) 305-4043

LABORATORY REPORT

Foss Plating  
8140 So. Secura  
Santa Fe Springs, CA 90670  
---  
Attn: Victor Foss

Report No. 1617  
Tank No. SBN  
Sampled 08/12/97  
Received 08/13/97  
Capacity 3600 GAL

ANALYSIS REPORT ON MARK 90 Semi-Bright Nickel

ANALYSIS RESULTS			CONTROL	SUGGESTED ADDITIONS	
7.9	oz/gal	Nickel metal	9.0 - 10.0	1400 lbs.	Nickel Sulfate *OR*
				280 gallons	Liquid Nickel Sulfate
9.4	oz/gal	Nickel Chloride	5.0 - 7.0		
29.0	oz/gal	Nickel Sulfate	30.0 - 40.0		
5.1	oz/gal	Boric Acid	5.0 - 6.5	90 lbs.	Boric Acid
4.30	gals/1000	M-901	5.00 - 6.0	4.3 gallons	M-901
35	dynes/Cm	Surface Tension	35 - 45		
3.82	pH	Value	3.60 - 4.00		

REMARKS

THIS ANALYSIS HAS BEEN CARRIED OUT UNDER CONTROLLED LABORATORY CONDITIONS AND ANY SUGGESTIONS ARE MADE SOLELY ON THAT BASIS.

Date: 08-15-1997

Analyst: WA

Iris L. Buchanan

cc: K. Waldron  
P. Cartwright



Atotech USA Inc.  
1713 South California Avenue  
Monrovia, CA 91016  
Tel: (818) 305-3014 — Fax: (818) 305-4043

LABORATORY REPORT

Foss Plating  
8140 So. Secura  
Santa Fe Springs, CA 90670  
---  
Attn: Victor Foss

Report No. 1514  
Tank No. SBN  
Sampled 07/29/97  
Received 07/30/97  
Capacity 3600 GAL

ANALYSIS REPORT ON MARK 90 Semi-Bright Nickel

ANALYSIS RESULTS			CONTROL		SUGGESTED ADDITIONS	
7.8	oz/gal	Nickel metal	9.0	- 10.0	1500 lbs.	Nickel Sulfate *OR*
					300 gallons	Liquid Nickel Sulfate
9.5	oz/gal	Nickel Chloride	5.0	- 7.0		
24.4	oz/gal	Nickel Sulfate	30.0	- 40.0		
5.0	oz/gal	Boric Acid	5.0	- 6.5	112 lbs.	Boric Acid
4.64	gals/1000	M-901	5.00	- 6.0	3.1 gallons	M-901
35	dynes/Cm	Surface Tension	35	- 45		
3.63	pH	Value	3.60	- 4.00		

REMARKS

**FAXED**

AUG 1 1997

By \_\_\_\_\_

THIS ANALYSIS HAS BEEN CARRIED OUT UNDER CONTROLLED LABORATORY CONDITIONS AND ANY SUGGESTIONS  
RE MADE SOLEY ON THAT BASIS.

ate: 08-01-1997

Analyst: WA

Iris L. Buchanan

c: K. Waldron  
P. Cartwright



Atotech USA Inc.  
1713 South California Avenue  
Monrovia, CA 91016  
Tel: (818) 305-3014 — Fax: (818) 305-4043

LABORATORY REPORT

Foss Plating  
8140 So. Secura  
Santa Fe Springs, CA 90670

Attn: Victor Foss

Report No. 1374  
Tank No. SBN  
Sampled 07/14/97  
Received 07/15/97  
Capacity 3600 GAL

ANALYSIS REPORT ON MARK 90 Semi-Bright Nickel

ANALYSIS RESULTS			CONTROL		SUGGESTED ADDITIONS	
8.5	oz/gal	Nickel metal	9.0	- 10.0	800 lbs.	Nickel Sulfate *OR*
					160 gallons	Liquid Nickel Sulfate
10.5	oz/gal	Nickel Chloride	5.0	- 7.0		
26.5	oz/gal	Nickel Sulfate	30.0	- 40.0		
5.1	oz/gal	Boric Acid	5.0	- 6.5	90 lbs.	Boric Acid
5.25	gals/1000	M-901	5.00	- 6.0	.9 gallons	M-901
29	dynes/Cm	Surface Tension	35	- 45		
3.81	pH	Value	3.60	- 4.00		

REMARKS

THIS ANALYSIS HAS BEEN CARRIED OUT UNDER CONTROLLED LABORATORY CONDITIONS AND ANY SUGGESTIONS ARE MADE SOLEY ON THAT BASIS.

Date: 07-17-1997

Analyst: WA

Iris L. Buchanan

cc: K. Waldron  
P. Cartwright

16961 Knott Avenue  
La Mirada, California 90638-6015



SERVICE THROUGH SOLUTIONS

NICKEL PLATING SOLUTION

TANK NO.: 1  
TANK VOLUME: 3500  
PROCESS: Nickel AP  
SAMPLE DATE: 5/28/97

CUSTOMER SERVICE ANALYSIS

<u>BATH COMPOSITION</u>	<u>ANALYSIS</u>	<u>OPTIMUM CONCENTRATION</u>	<u>RECOMMENDED ADDITIONS</u>
Nickel Metal oz/gal	<u>8.97</u>	_____	<u>10W.</u>
Nickel Sulfate oz/gal	<u>27.29</u>	_____	<u>200LB/1000 Gal</u>
Nickel Chloride oz/gal	<u>11.65</u>	_____	_____
Boric Acid oz/gal	<u>5.6</u>	<u>6.5 - 7.0</u>	<u>60LB/1000 Gal</u>
pH	<u>4.02</u>	_____	<u>OK.</u>
<u>ADDITIVES</u>			
<u>Carrier</u>	<u>2.30%</u>	<u>2.5-3.0%</u>	<u>5/Gal/1000 Gal tank</u>
<u>Lever</u>	<u>0.17%</u>	<u>0.25-0.35%</u>	<u>1 QT/1000 Gal } shown</u>
_____	_____	_____	_____
_____	_____	_____	_____

REMARKS & SPECIAL INSTRUCTIONS

Need to bring up Carrier + Lever (see shown)  
Add Carrier 1/2 gallon at a time.  
need to Add about 1 gallon of Lever.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Brent America, Inc.  
 16961 Knott Avenue  
 La Mirada, California 90638-6015



SERVICE THROUGH SOLUTIONS

NICKEL PLATING SOLUTION

TANK NO.: Foss BK  
 TANK VOLUME: \_\_\_\_\_  
 PROCESS: \_\_\_\_\_  
 SAMPLE DATE: 5/13/97

CUSTOMER SERVICE ANALYSIS

<u>BATH COMPOSITION</u>	<u>ANALYSIS</u>	<u>OPTIMUM CONCENTRATION</u>	<u>RECOMMENDED ADDITIONS</u>
Nickel Metal oz/gal	<u>9.01</u>	_____	<u>Low</u>
Nickel Sulfate oz/gal	<u>27.19</u>	_____	<u>200-LB / 1,000-GAL</u>
Nickel Chloride oz/gal	<u>11.94</u>	_____	<u>"HIGH"</u>
Boric Acid oz/gal	<u>6.42</u>	_____	<u>60-LB / 1,000-GAL</u>
pH	<u>4.06</u>	_____	<u>a.k.</u>
<u>ADDITIVES</u>	<u>NOTE: USE SULFURIC ACID FOR PH-CONTROL.</u>		
<u>CARRIER</u>	<u>2.48%</u>	<u>2.5 - 3.5%</u>	<u>(SEE SHAWN)</u>
<u>LEVELER</u>	<u>0.16%</u>	<u>0.25 - 0.35%</u>	<u>5-GAL / 1,000-GAL</u> <u>SEE SHAWN</u>

REMARKS & SPECIAL INSTRUCTIONS

ADD THE CARRIER 1/2 - GAL  
AT A TIME. / see SHAWN  
Regarding - Adding MAX AP  
Brightner instead of Additin

need to add 1/2 gal. Maxima AP

all added 1/2 gal @ 4:00 Thursday



SERVICE THROUGH SOLUTIONS

NICKEL PLATING SOLUTION

TANK NO.: Foss BN  
TANK VOLUME: \_\_\_\_\_  
PROCESS: \_\_\_\_\_  
SAMPLE DATE: 4/14/97

CUSTOMER SERVICE ANALYSIS

<u>BATH COMPOSITION</u>	<u>ANALYSIS</u>	<u>OPTIMUM CONCENTRATION</u>	<u>RECOMMENDED ADDITIONS</u>
Nickel Metal oz/gal	<u>9.01</u>	_____	<u>Low</u>
Nickel Sulfate oz/gal	<u>26.83</u>	_____	<u>200-60 / 1,000-GAL</u>
Nickel Chloride oz/gal	<u>12.25</u>	_____	<u>"HIGH"</u>
Boric Acid oz/gal	<u>6.42</u>	_____	<u>60-60 / 1,000 GAL</u>
pH	<u>3.85</u>	_____	<u>O.K.</u>
<b>ADDITIVES</b>			
<u>CARRIER</u>	<u>2.49%</u>	<u>2.5-3.5%</u>	<u>Y BOTH Low</u>
<u>LEVELER</u>	<u>0.17%</u>	<u>0.25-0.35%</u>	

REMARKS & SPECIAL INSTRUCTIONS

*NOTE: LARRY GLASER CALLED YESTERDAY FOR THE ADDITIONS AND INSTRUCTIONS.*

Hull-Cell PANEL AS-15:  
BRIGHT AND DUCTILE BUT "FLAT". ADDITION OF LEVELER HELPED.

**Appendix F**

**PES Source Test Report  
Foss Plating, Santa Fe Springs, California**



**SOURCE TEST REPORT  
FOR NICKEL EMISSION MEASUREMENTS FROM NON-VENTILATED TANKS AT  
FOSS PLATING COMPANY -  
SANTA FE SPRINGS, CALIFORNIA**

Prepared For:

Metal Finishing Association of Southern California  
5000 Van Nuys Blvd., Suite 300  
Sherman Oaks, CA 91403

Prepared By

Pacific Environmental Services, Inc.  
13100 Brooks Drive, Suite 100  
Baldwin Park, California 91706  
Telephone: 626-856-1400

December 14, 1998



**PACIFIC ENVIRONMENTAL SERVICES, INC.**

WASHINGTON, D.C. • RESEARCH TRIANGLE PARK, NC • LOS ANGELES, CA • CINCINNATI, OH



**SOURCE TEST REPORT  
FOR NICKEL EMISSION MEASUREMENTS FROM NON-VENTILATED TANKS AT  
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**SOURCE TEST REPORT  
FOR NICKEL EMISSION MEASUREMENTS FROM NON VENTILATED TANKS AT  
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SANTA FE SPRINGS, CALIFORNIA**

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## ACKNOWLEDGEMENT

Pacific Environmental Services, Inc. (PES) acknowledges the financial support for the activities described in this report from the Government Affairs Committee of the Surface Finishing Industry Council (SFIC). The SFIC is supported jointly by the National Association of Metal Finishers (NAMF), the American Electroplaters and Surface Finishers (AESF) and the Metal Finishing Suppliers Association (MFSA).

PES acknowledges the technical review and constructive comments on the source test protocol by Mr. Jeff Adkins of Sierra Research, Inc. and Messers. David Todd and Alex Santos of the California Air Resource Board (CARB).

The field testing was observed by Mr. Jeff Adkins of Sierra Research Inc., Messers. David Todd and Alex Santos of CARB, Mr. Marco Polo of the South Coast Air Quality Management District (SCAQMD), Mr. Randy Solganik of Gene's Plating on behalf of the Metal Finishing Association of Southern California (MFASC), and Mr. Daniel A. Cunningham, Executive Director of the MFASC. These same individuals provided comments on the draft report. In addition, Mr. Michael Garibay, SCAQMD provided comments on the report and later conducted source tests for SCAQMD at Foss Plating, Inc.

Our host for the tests was Foss Plating, Inc. We acknowledge the arrangements and scheduling that was provided by Mr. Randall Foss and Ms. Carol Foss McCracken. They assisted with arrangements for installation of a temporary enclosure of the nickel plating line and a temporary exhaust fan and ductwork so that source testing could be completed for the non-ventilated nickel tanks.



**SOURCE TEST REPORT  
FOR NICKEL EMISSION MEASUREMENTS FROM NON-VENTILATED TANKS AT  
FOSS PLATING COMPANY -  
SANTA FE SPRINGS, CALIFORNIA**

**GENERAL INFORMATION**

**Facility:** Foss Plating Company, Inc.  
8140 Secura Way  
Santa Fe Springs, CA 90670

**Contact:** Mr. Randall Foss  
Telephone: 562-945-3451  
Fax: 562-698-2326

**Source Test Coordinators:** Sierra Research, Inc.  
1801 J Street  
Sacramento, CA 95814

Mr. Jeff Adkins  
Telephone: 916-444-6666  
Fax: 916-444-8373

Metal Finishing Association of Southern California  
5000 Van Nuys Boulevard, Suite 305  
Sherman Oaks, CA 91403

Mr. Randy Solganik (Gene's Plating)  
Telephone: 213-269-8748  
Fax: 213-269-5390

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**Contact:** Mr. M. Dean High  
Telephone: 626-856-1400  
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**SOURCE TEST REPORT  
FOR NICKEL EMISSION MEASUREMENTS FROM NON-VENTILATED TANKS AT  
FOSS PLATING COMPANY -  
SANTA FE SPRINGS, CALIFORNIA**

**1.0 INTRODUCTION**

**1.1 Background**

The Metal Finishing Association of Southern California (MFASC) has long held the position that a large portion of the emissions from air agitated nickel plating tanks would settle back into the tank or onto the nearby surrounding surfaces within the plating shop. The MFASC had been concerned that ventilation systems installed on nickel plating tanks captured large droplets of nickel plating solution due to the high capture velocity of the air drawn into the slot hoods. Since most nickel electroplating tanks in the industry are air agitated and most tanks are not hooded and exhausted to control equipment, data were needed to identify an emission factor appropriate for these tanks.

The only available emissions data were based on either a 1977 Navy research project (not a source test) or a 1991 source test on a ventilated tank in which many results were very questionable and not all laboratory results were appended. These 1991 source test results, referenced by the USEPA in AP-42, showed an emission rate of 40.8 mg/A-H. This factor appeared to be excessive compared to 5.2 mg/A-H for chromium electroplating. Because of the higher plating efficiency of nickel electroplating, one would expect the emissions from nickel plating to be much less than chromium plating, not eight times higher.

Because the South Coast Air Quality Management District (SCAQMD) and other agencies were proposing to permit and regulate nickel plating tanks using the available emissions data, the MFASC urged the control agencies to develop nickel plating emission factors that would better represent non-ventilated nickel plating tanks. Discussions were held with the California Air Resources Board (CARB) in 1994 about the need for such data. CARB funded a project in 1996 with Sierra Research, Inc. to evaluate emissions and control technology for nickel electroplating. However, the project did not include field testing. Therefore, the MFASC agreed to undertake the necessary source test in collaboration with the California Air Resources Board.

On April 30, May 2, and May 29, 1998, Pacific Environmental Services (PES) conducted emissions testing to determine nickel emissions from electroplating operations at Foss Plating Company, 8140 Secura Way, Santa Fe Springs, California. The purpose of this testing program was to collect information for the California Air Resources Board (CARB) and the Metal Finishing Association of Southern California, for the development of an updated emission factor for nickel emissions from semi-bright and bright nickel electroplating tanks. Three test series, each comprised of three test runs, were conducted for this project: The first test series was conducted during normal operations with air agitation; the second test series was conducted without air agitation for the tanks;

and the third test series, a background test, was conducted during a period when no production operations were occurring within the facility.

## 2.0 EQUIPMENT AND PROCESS DESCRIPTION

The Foss Plating Company conducts nickel electroplating of a variety of metal parts including: truck and automobile grills; engine manifolds and exhaust pipes; chair and table supports; food service and processing equipment; weight lifting and exercise equipment; paper towel dispensers; and a large variety of tubular steel of various lengths. Nickel electroplating is conducted in two tanks containing solutions for bright and semi-bright nickel finishes. The tanks are operated in accordance with a Permit to Operate granted by the South Coast Air Quality Management District (SCAQMD). The following is a summary of the two tanks and the rectifiers in use:

Tank & Station No.	Operating Amperages	Dimensions (L W H)	Contents
2	2,000 amps (9 VDC)	12' x 8' x 63"	Bright Nickel
24	2,000 amps (9 VDC)	12' x 8' x 63"	Semi-bright Nickel

Tanks 2 and 24 are each equipped with a rectifier. During the source testing, the rectifiers were operated at approximately 2,000 amps and 9 VDC. However, the operating time varied depending on the type of product being plated. The nickel electroplating tanks were not equipped with lip exhausts or fume collection hoods, but were ventilated by natural draft which passes through the building, over the tops of the tanks, and up through vents in the roof above the tanks. For this source test, the roof vents were temporarily sealed except for the vent above the nickel plating tanks. A temporary plastic barrier was installed along the tanks from about one foot above the floor to the roof along the open side of the plating area. The partially enclosed area was approximately 13 feet high, 21 feet wide and 35 feet long. A 6,500 ACFM blower was temporarily installed to create a current of air that flowed directly up around and over the nickel tanks and then out the roof vent, through the exhaust duct, fan and temporary exhaust duct. The temporary ventilation system had sufficient capacity to exchange the air in the enclosed area every two minutes. A side view of the temporary ducting, fan and rectangular exhaust duct is shown as Figure 1. A diagram showing the tanks, location of the plastic barrier, and the temporary ventilation system is shown as Figure 2.

The two nickel electroplating tanks were each equipped with air agitation of approximately 40 cubic feet per minute per tank. For this testing program, three test runs were conducted with air agitation during a period of normal production; a second series of three test runs was conducted without air agitation. During the second series, 4' x 8' metal sheets were used to simulate plating

operations since the facility does not electroplate without air agitation. The metal sheets were lifted from the plating baths and reimmersed six times per test run to simulate disturbance of the surface associated with production operations. A third series of three test runs was conducted with no production in the shop to confirm background nickel levels in the shop.

A sample of the plating solutions from each of the nickel tanks was collected during each test run. The analysis of the semi-bright solution was conducted by Western Analytical Laboratories in Chino, California; and the analysis of the bright solution was conducted by Brent Laboratory in La Mirada, California. Copies of these laboratory reports are located in Appendices F and G.

The rectifiers were each equipped with a totalizing amp-hour meter. Both amp-hour meters were calibrated by Atlas Laboratories, Los Angeles, California, at the conclusion of the field testing program. The results of the calibration are included in the Appendices. The results showed that rectifier #1 was reading about 3% high, and rectifier #2 was reading about 9.7 % high. Since the error in the totalizers was less than 10% no corrections were made on the totalizer readings recorded during this testing program.

The plating line included twenty-seven tanks (Figure 2) comprised of caustic and acid baths for cleaning and surface preparation of the metal parts; each process bath was followed by one or more rinse tanks. A summary of the various tanks and their contents is shown in Figure 3. Also, the metal parts were placed in a trivalent chrome electroplating bath to develop additional lustre and adhesion characteristics for the finished product. Parts that are used in outdoor service, such as automobile parts, are typically passed through both the bright and semi-bright nickel tanks. Parts that are used for indoor purposes are typically passed through only the bright nickel.

Photographs of the two nickel tanks in operation are shown in Figure 4.

Figure 1

Diagram of Temporary Ventilation System and Location of Sampling Ports  
Foss Plating Company  
Santa Fe Springs, California

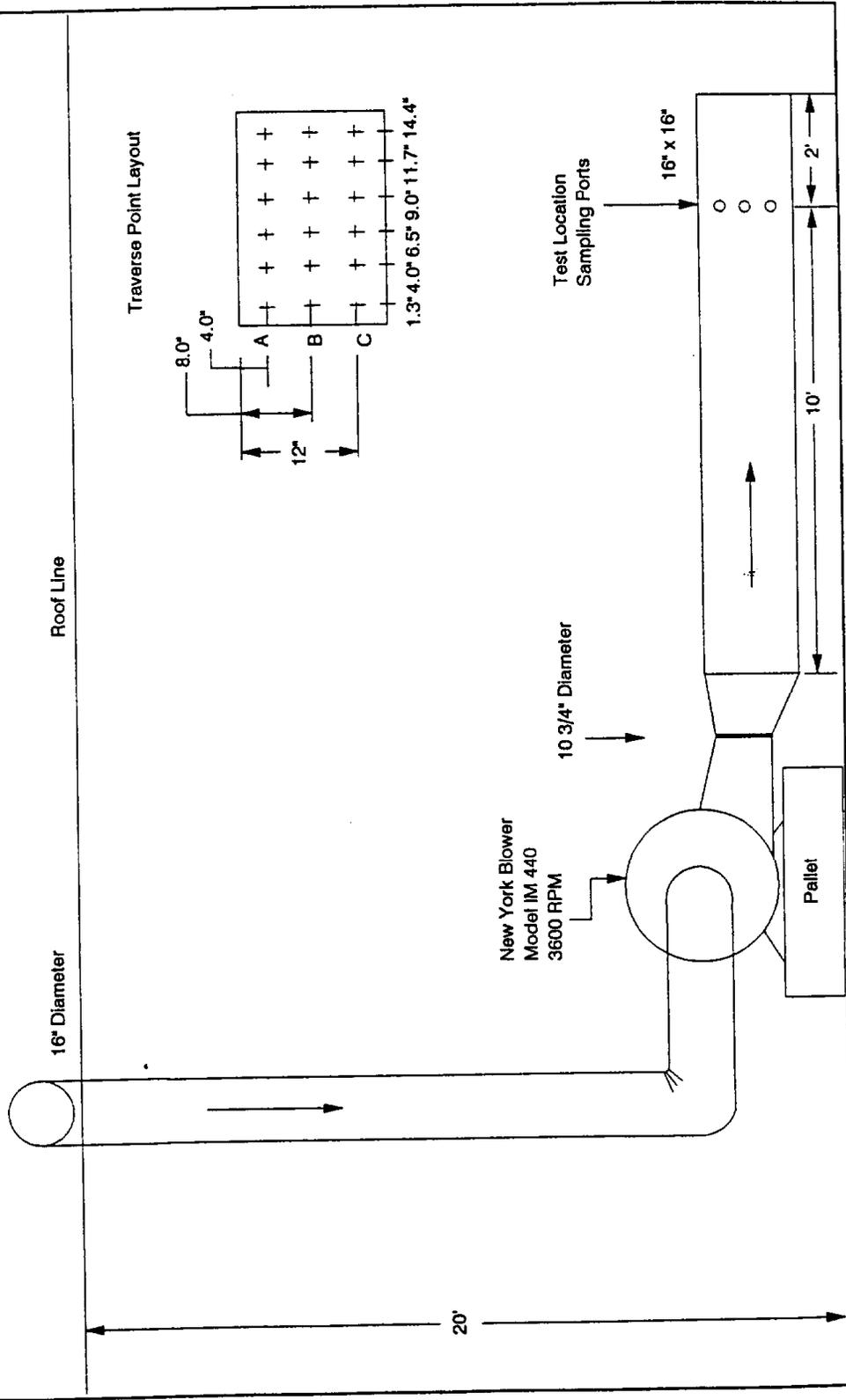


Figure 2

Plan View of Building Layout as of June 19, 1998  
Foss Plating Company  
Santa Fe Springs, California

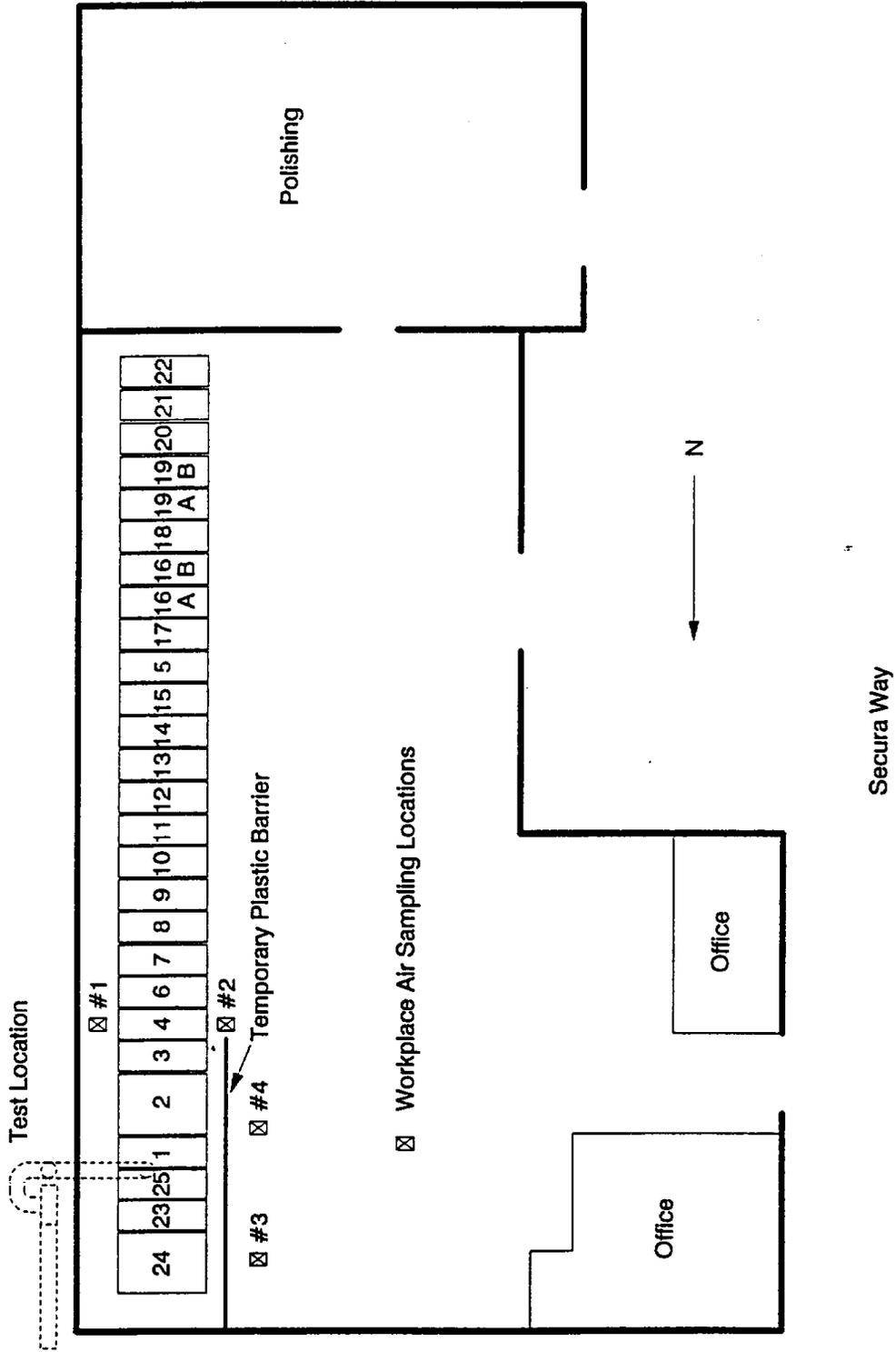


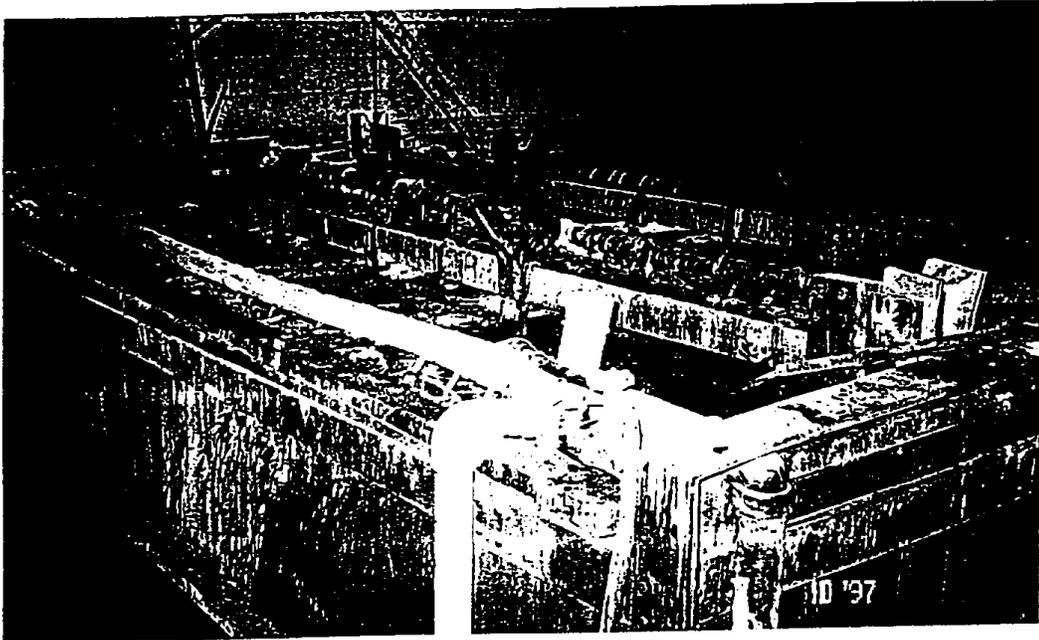
Figure 3

Summary of Tank Information  
Foss Plating Company  
Santa Fe Springs, California

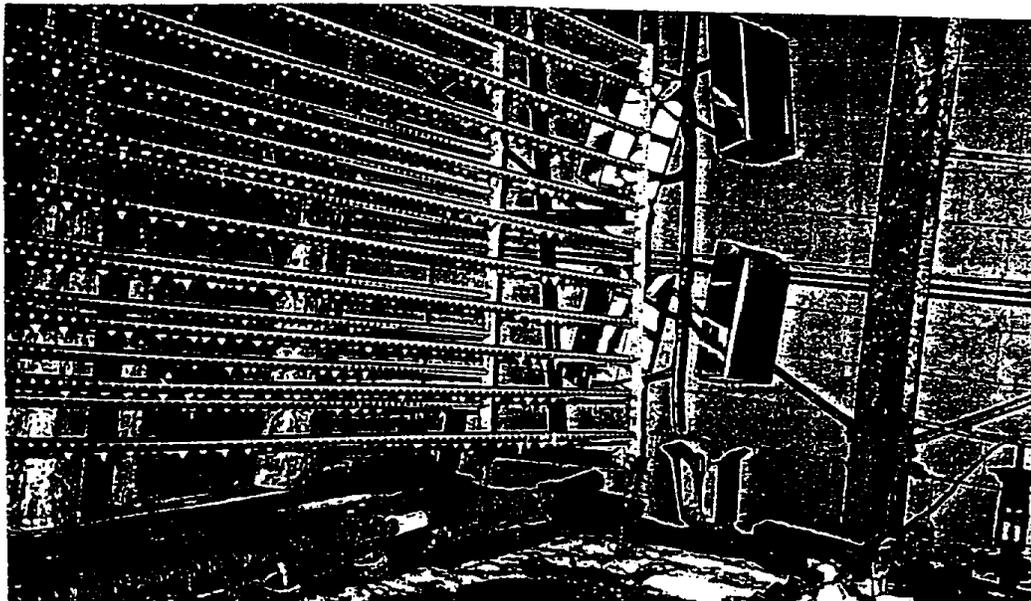
Tank No.	Contents
1	Temporarily Out of Service
2	Bright Nickel
3	Rinse
4	Rinse (with air)
5	Temporarily Out of Service
6	Hydrochloric Acid
7	Rinse
8	Sodium Hydroxide
9	Rinse
10	Hydrochloric Acid
11	Rinse (air)
12	Sodium Hydroxide
13	Rinse (air)
14	Sodium Hydroxide
15	Sodium Hydroxide
16A	Temporarily Out of Service
16B	Drag out rinse
17	Out of Service
18	Post dip
19A	Hot water spray rinse
19B	Rinse (air)
20	Rinse (air)
21	Drag out (trivalent chromium)
22	Trivalent Chrome
23	Temporarily Out of Service
24	Semi-bright Nickel
25	Rinse

Figure 4

Foss Plating Company  
Santa Fe Springs, California



(Above) Tank No. 24 Semi-bright nickel electroplating tank with parts immersed



(Above) Tank No. 2 Bright nickel electroplating tank showing a rack of parts being removed from the tank

The following process data were collected during the test runs conducted during normal nickel electroplating operations:

- Rectifier Amperage
- Rectifier Voltage
- Plating solution temperature
- Air agitation pressure
- Air agitation flow rate
- Quantity and description of parts plated
- Tank Freeboard
- Nickel Plating Solutions
  - Nickel Concentration
  - pH
  - Nickel Sulfate Concentration
  - Nickel Chloride Concentration
  - Boric Acid Concentration
  - Surface Tension

### **3.0 TESTING METHODOLOGY**

The location of the sampling ports for the exhaust duct is shown in Figure 1. The required number of traverse points was 6 points per each of three sample ports on the 16" x 16" discharge duct. The locations of traverse points were based on EPA Method 1. The sampling was conducted in triplicate on each system during periods of high production. In order to maintain a high level of continuous plating operations during the emissions testing without air agitation, the facility plated scrap parts similar to parts processed at the facility.

A smoke test was conducted prior to the emissions testing program to verify that adequate ventilation around and over the tanks had been achieved with the temporary fan installed outside on the ground. The smoke test was observed by Mr. David Todd of CARB. Smoke was generated with 30 second smoke generator tubes (Model #1A) purchased from Superior Signal Company, Spotswood, New Jersey. The smoke was generated in the area of the open end of the enclosure and showed that the air migrated into the enclosure and toward the opposite closed end of the enclosure where the nickel plating tanks were located, and upward toward the exhaust opening above the nickel tanks.

In order to assess the background levels of nickel in the rest of the plating shop and to assure the effectiveness of the temporary ventilation system, workplace background air sampling was conducted following NIOSH Method 7300 to determine if significant amounts of nickel were present in the workplace air outside of the temporary ventilation enclosure. The sampling was conducted at four locations concurrently with the source testing. Figure 2 shows the location of the four air samplers. At each workplace location, the workplace air was sampled for 8 hours through a

37-mm mixed cellulose ester filter (0.8 microns) with a Mine Safety Appliances (MSA) Escort Elf portable sampling pump operated at 2 liters/minute.

Nickel emissions from the enclosure exhaust were measured using a modified CARB Method 433 sampling procedure. A diagram showing the configuration of the sampling train is shown in Figure 5. The samples were extracted at ambient temperature with a sampling train configured with: a glass nozzle; Teflon union; a 48-inch glass-lined probe; a 5-foot Teflon tube from the probe to the first impinger; two Greenburg-Smith impingers, each containing 100 milliliters of 0.1 Normal solution of nitric acid; an empty impinger; an impinger filled with approximately 200 grams silica gel; a 30-foot umbilical line; a vacuum pump; a dry gas meter; and a calibrated orifice connected to an inclined oil manometer. A filter operated at ambient temperature was located between the third and fourth impingers.

The weight of the impinger solution and the weight of the silica gel were recorded before and after each test run in order to obtain the moisture content of the exhaust gases. All sample weights were recorded on sample recovery sheets during charging and sample recovery. Leak checks were performed immediately before and after each test.

Sampling was conducted isokinetically for 126 minutes per test run (7 minutes per traverse point), per sample (test run), generating a sample size of about 100 cubic feet through the sampling train. Field data were recorded on data sheets shown in Appendix A.

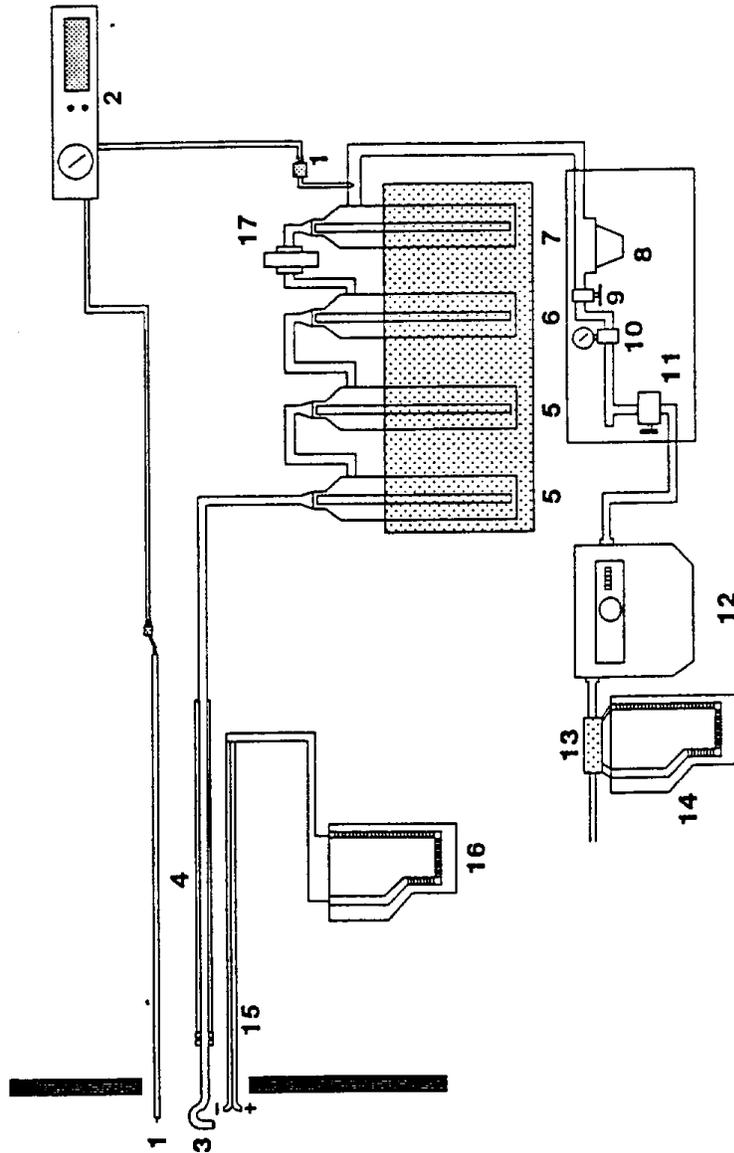
Volumetric flow rates for the exhaust were calculated from the measured velocity head and the cross-sectional area of the stack. As each traverse point was sampled, the velocity head of the exhaust gas was measured with an S-type Pitot tube connected to an inclined oil manometer, and the temperature of the exhaust gas was measured with a chromel-alumel (type K) thermocouple connected to a digital readout (EPA Method 2).

After each test run, the contents of the impingers was recovered and placed in a 1,000 milliliter polyethylene container. The remainder of the sampling train components were rinsed from the nozzle through the third impinger with the charging solution and the rinse added to the sample. The probe and nozzle were washed and brushed with a Teflon brush three times. The filter was placed in the same sample container and analyzed along with the solution. During sample collection the impingers and solution were immersed in an ice bath (chilled to 68 degrees Fahrenheit or less during the tests) and refrigerated prior to the analyses.

The laboratory analyses for nickel were conducted by West Coast Analytical Service, Inc., (WCAS) in Santa Fe Springs, California. The mass of nickel collected in each train and on the workplace sample filters was determined by inductively coupled plasma/mass spectrometry. Since chromium was considered a potential interference in the analysis of nickel, the samples were also analyzed for total chromium content. The detection level of the analytical procedure for nickel was

**Figure 5**

**California Air Resources Board Modified Method 433  
Wet Impingement Sampling Train  
For Nickel**



- |                                |                            |                            |
|--------------------------------|----------------------------|----------------------------|
| 1. Temperature Sensor          | 8. Pump Filter             | 15. S-Type Pitot Tube      |
| 2. Digital Temperature Readout | 9. Coarse Adjustment Valve | 16. Inclined Oil Manometer |
| 3. Button Hook Nozzle          | 10. Vacuum Gauge           | 17. Teflon Coated Filter   |
| 4. Quartz Lined Probe          | 11. Fine Adjustment Valve  |                            |
| 5. Impinger w/ 0.1 N HNO3      | 12. Dry Gas Meter          |                            |
| 6. Empty Impinger              | 13. Critical Orifice       |                            |
| 7. Silica Gel Impinger         | 14. Inclined Oil Manometer |                            |



approximately 1 microgram/liter. A chain of custody was maintained for each sample throughout the sample recovery and analytical process.

#### 4.0 RESULTS

The source test data with and without air agitation are summarized in Tables 1 and 2. The production data have been summarized in Tables 3 and 4. Additional supporting data are located in the Appendices.

For normal plating operations with air agitation the results showed nickel emissions from the two nickel tanks while plating with air agitation to average 0.05 mg/amp-hr. The concentration in the exhaust was 0.02 mg/m<sup>3</sup> and the mass emission rate was 207 mg/hr. These results were much less than USEPA, CARB, and SCAQMD had been using as emission factors for nickel plating. Emission rates are also expressed in terms of lb/(hr-ft<sup>2</sup> tank surface) and lb/ (hr-scfm air). The air agitation rate was observed to be very important to emission rates.

Results showed nickel emissions from the two nickel tanks while plating without air agitation, and a slightly higher amperage, to be reduced by about fifty percent. The process emission rate was 0.024 mg/amp-hr. The concentration in the exhaust was 0.01 mg/m<sup>3</sup> and the mass emission rate was 106 mg/hr.

Table 5 shows the results of the NIOSH Method 7300 workplace air samplers outside of the curtained- off nickel plating area. Four samplers collected 8-hour samples of nickel in the general room air. The concentrations ranged from a low of 0.0019 mg/m<sup>3</sup> to a high of 0.0076 mg/m<sup>3</sup>; the average was 0.0045 mg/m<sup>3</sup> and was essentially the same during all three source test sampling periods. The OSHA PEL is 0.1 mg/m<sup>3</sup> so the worker exposure would have been less than 1/20 th of the PEL.

The initial workplace air sampling indicated significant amounts of background nickel outside the enclosure even though smoke tests of the enclosure indicated no leakage was evident. In order to determine if the nickel present in the workplace air was typical due to the activities in the shop, additional source testing and workplace monitoring were repeated at night with the shop completely shut down and the nickel tanks idle (no plating, no agitation).

The results (Table 6) showed nickel in the exhaust from the plating shop without any plating, no air agitation, and no other operations, to still be very significant. However, the first test run was conducted from 0054 to 0302 hours; this test started about thirty minutes after the second shift shut down at midnight, and the shop area obviously contained heavy residual nickel aerosols. The fan was turned on for only thirty minutes before the test started. Test run 7 showed higher concentration than even tests 1, 2, 3 due presumably to the build up over the sixteen hour production period. Test runs 8 and 9 showed much lower nickel concentrations, about 0.005 mg/m<sup>3</sup>, and a mass emission rate of 50 mg/hr. This was typical of background workplace air concentrations during test runs 1-6. It is suggested that much of the nickel in the exhaust during these last two test runs was re-entrained from the building and equipment surfaces by the air velocity created by the

exhaust fan. Still, test runs 1 through 6 also would have included similar background loading in addition to the nickel loading from the operating nickel tanks.

The NIOSH sampling results were consistent with the source test results of test runs 8 and 9 which averaged  $0.0049 \text{ mg/m}^3$  versus the  $0.0045 \text{ mg/m}^3$  of the NIOSH Method. The 5/29/98 NIOSH sampling results were consistent with results from 4/30/98 and 5/2/98.

It is recommended that the results of test runs 1-3 be used as the nickel emission factor for non-ventilated semi-bright and bright nickel electroplating tanks operating with air agitation. It is recommended that the results of test runs 4-6 be used as the nickel emission factor for non-ventilated semi bright and bright nickel electroplating tanks operating without air agitation.

Table 1

**Data Summary for Nickel Emissions  
With Air Agitation  
Foss Plating Company  
Santa Fe Springs, California**

Run Number	1	2	3	Average
Sample Collection Date	4/30/98	4/30/98	4/30/98	
Sample Time	0920-1128	1200-1408	1420-1635	
Load (amp-hrs/hr)	4499	4171	4021	4230
Stack Temperature (deg F)	106	86	102	98
Outlet Velocity (ft/sec)	60.91	60.38	61.27	60.85
Outlet Flow Rate (ACFM)	6505	6449	6544	6499
Outlet Flow Rate (DSCFM)	5889	6058	5970	5972
Moisture (% v/v)	2.55	2.46	2.46	2.49
Sample Volume (DSCF)	75.986	74.977	76.428	75.797
Sampling Time (min)	126	126	126	126
Isokinetic Rate (%)	95.6	91.7	94.8	94.0
Nickel				
Concentration (mg/m <sup>3</sup> )	0.0121	0.0249	0.0240	0.0203
Emission Rate (mg/hr)	120.9	256.9	243.7	207.2
Emission Factor				
mg/amp-hr	0.0268	0.0616	0.0606	0.0496
lb/(hr-ft <sup>2</sup> tank surface)	1.4 x 10 <sup>-6</sup>	2.9 x 10 <sup>-6</sup>	2.8 x 10 <sup>-6</sup>	2.4 x 10 <sup>-6</sup>
lb/(hr-scfm air) <sup>1</sup>	3.3 x 10 <sup>-6</sup>	7.2 x 10 <sup>-6</sup>	6.8 x 10 <sup>-6</sup>	5.8 x 10 <sup>-6</sup>

<sup>1</sup> Based on air flow measurements conducted by the SCAQMD using a bucket technique on October 25, 1998. PES measurements were conducted with a hot wire anemometer in the air supply line through small openings and at locations considered less than ideal.

Table 2

**Data Summary for Nickel Emissions  
Without Air Agitation  
Foss Plating Company  
Santa Fe Springs, California**

Run Number	4	5	6	Average
Sample Collection Date	5/2/98	5/2/98	5/2/98	
Sample Time	0105-0312	0330-0538	0551-0758	
Load (amp-hrs/hr)	4360	4477	4618	4485
Stack Temperature (deg F)	109	111	110	110
Outlet Velocity (ft/sec)	58.31	58.72	58.71	58.58
Outlet Flow Rate (ACFM)	6228	6271	6270	6256
Outlet Flow Rate (DSCFM)	5652	5667	5652	5657
Moisture (% v/v)	1.96	2.02	2.45	2.14
Sample Volume (DSCF)	73.293	75.136	76.046	74.825
Sampling Time (min)	126	126	126	126
Isokinetic Rate (%)	95.5	97.7	99.1	97.4
Nickel				
Concentration (mg/m <sup>3</sup> )	0.0164	0.0103	0.0065	0.0111
Emission Rate (mg/hr)	157.3	99.6	62.43	106.4
Emission Factor (mg/amp-hr)	0.0361	0.0222	0.0135	0.0239

**Table 3**

**Summary of Process Data  
With Air Agitation  
Foss Plating Company  
Santa Fe Springs, California**

Run No.	1	2	3	Average
Sample Collection Date	4/30/98	4/30/98	4/30/98	
Bright Nickel Tank				
Volts	8.0	7.0	7.0	7.3
Amperage	2699	2278	2250	2409
Temperature	140	140	140	140
Nickel solution (oz/gal)	11.8	11.8	12.2	11.93
Surface Tension (dynes/cm)	31.3	31.2	31.1	31.2
Semi-Bright Nickel Tank				
Volts	7.0	7.0	7.0	7.0
Amperage	1800	1893	1771	1821
Temperature	136	130	130	132
Nickel solution (oz/gal)	8.19	8.28	8.09	8.19
Surface Tension (dynes/cm)	34.9	35.9	34.6	35.1
Air agitation (on or off)	on	on	on	
Bright nickel (ACFM) <sup>1</sup>	39.4	39.4	39.4	
Semi-bright (ACFM) <sup>1</sup>	39.4	39.4	39.4	

<sup>1</sup> Air flow data are based on measurements conducted by the SCAQMD during source tests on October 25, 1998. PES measurements showed about 80 ACFM on each tank. However, PES measurements were conducted with a hot wire anemometer in the air supply line through small openings and at locations considered less than ideal.

**Table 4**

**Summary of Process Data  
Without Air Agitation  
Foss Plating Company  
Santa Fe Springs, California**

<b>Run No.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Average</b>
Sample Collection Date	5/2/98	5/2/98	5/2/98	
Bright Nickel Tank				
Volts	10.2	10.2	10.2	10.2
Amperage	2505	2561	2659	2575
Temperature	137	143	145	142
Nickel solution (oz/gal)	11.83	11.83	12.23	
Surface Tension (dynes/cm)	32.0	31.3	33.5	32.3
Semi-Bright Nickel Tank				
Volts	9.6	9.6	9.6	9.6
Amperage	1855	1916	1959	1910
Temperature	130	130	130	130
Nickel solution (oz/gal)	8.25	8.07	8.44	8.25
Surface Tension (dynes/cm)	34.2	34.5	35.4	34.7
Air agitation (on or off)	off	off	off	

Table 5

Summary of NIOSH Method 7300 Air Sampling  
 Foss Plating Company  
 Santa Fe Springs, California

Sample ID	Date	Nickel (ug/filter)	Time (mins)	Volume (Liters/min)	Nickel (mg/m <sup>3</sup> )
Workplace #1	4/30/98	4.9	480	2.09	0.0047
Workplace #2	4/30/98	0.02	NA	NA	Pump Failure
Workplace #3	4/30/98	3.4	480	1.93	0.0037
Workplace #4	4/30/98	4.1	480	1.95	0.0044
Workplace #1	5/2/98	4.3	480	2.09	0.0043
Workplace #2	5/2/98	5.6	480	2.08	0.0056
Workplace #3	5/2/98	3.4	480	1.93	0.0037
Workplace #4	5/2/98	7.1	480	1.95	0.0076
Workplace #1	5/29/98	5.5	453	2.2	0.0055
Workplace #2	5/29/98	1.5	453	1.7	0.0019
Workplace #3	5/29/98	4.5	453	2.2	0.0045
Workplace #4	5/29/98	3.3	453	2.0	0.0036

Note: The OSHA PEL for soluble nickel is 0.1 mg/M<sup>3</sup>

Table 6

**Data Summary for Nickel Emissions  
With No Production in the Facility  
Foss Plating Company  
Santa Fe Springs, California**

Run Number	7	8	9	Average (runs 8 & 9)
Sample Collection Date	5/29/98	5/29/98	5/29/98	
Sample Time	0054-0302	0310-0518	0525-0732	
Load (amp-hrs/hr)	0	0	0	
Stack Temperature (deg F)	100	98	97	97.5
Outlet Velocity (ft/sec)	57.48	60.96	60.73	60.85
Outlet Flow Rate (ACFM)	6139	6511	6486	6499
Outlet Flow Rate (DSCFM)	5674	5984	6066	6025
Moisture (% v/v)	2.0	2.4	1.1	1.8
Sample Volume (DSCF)	78.478	80.523	76.392	78.458
Sampling Time (min)	126	126	126	126
Isokinetic Rate (%)	102.4	99.7	93.3	96.5
Nickel				
Concentration (mg/m <sup>3</sup> )	0.0324	0.0032	0.0065	0.0049
Emission Rate (mg/hr)	312.3	32.9	66.7	49.8

## **5.0 QUALITY ASSURANCE/QUALITY CONTROL**

Source tests are performed to determine the types and amounts of pollutants emitted by a source. Information from this source test program may be used for obtaining permits, evaluating control equipment performance, updating emission inventories, and determining compliance with present emission regulations. For these purposes, reliable data are required. Pacific Environmental Services, Inc. (PES) provides this reliability by using the following work practices:

### **5.1 Use of Standard Test Procedures**

A procedure must be thoroughly studied under various conditions in order to be designated as a state or federal Reference Method. Results of many executions of the procedure are compared to demonstrate accuracy and repeatability before adoption of the procedure as a source testing method. EPA Methods 1 and 2 were used to determine the sampling point locations and flow rate. CARB Method 433 was used to determine the emission rates of nickel. As required by the method, the concentration of chromium as a potential interferent in each sample was determined.

Samples of the plating solutions from each of the nickel tanks were collected during the source testing program and submitted to analytical laboratories having expertise in analyzing semi-bright and bright nickel plating solutions.

### **5.2 Use of Trained Test Personnel**

Because of the complexity of typical source testing methods, the testers are trained and experienced with the test procedures in order to assure reliable results were collected for this testing program. PES personnel have had professional training and routinely conduct this kind of source testing.

### **5.3 Equipment Maintenance and Calibration**

Use of properly maintained and calibrated test equipment is essential for minimizing systematic errors in results. All sampling devices used for this project were constructed, maintained, and calibrated as suggested in EPA documents APTD-0576, and APTD-0581 (These are commonly accepted construction and maintenance manuals for source testing equipment). The dry gas meters were calibrated with a dry gas meter transfer standard calibrated against a reference meter with NIST traceability. Copies of these calibrations are included in the Appendices. Calibration procedures and acceptance criteria for CARB Method 433 are summarized in Table 7. Also, the accuracy of the amp-hour totalizers on each of the rectifiers were calibrated by an independent laboratory at the conclusion of the testing program.

### **5.4 Thorough Recordkeeping**

All data relating to the operation of the sampling train was recorded to ensure that it was not lost or misinterpreted. PES accomplished this recordkeeping by use of standardized field data

Table 7

**Calibration Procedures and Criteria for  
CARB Method 433 Sampling Equipment**

Parameter	Calibration Technique	Reference Standard	Acceptance Limit	Frequency
<b>CARB Method 433 Measurements</b>				
1. Probe nozzle	Measure Diameter to nearest 0.001"	Micrometer	Average of three measurements; difference between high and low <0.1 mm	Prior to test
2. Gas Meter Volume	Compare to Reference Meter	Dry Gas Meter Transfer Standard	Record calibration factor  ± 5% of pretest calibration factor	Prior to test
3. Gas Meter Temperature	Compare to Mercury-in-glass	ASTM Thermometer	± 5 deg F	Posttest
4. Stack Temperature Sensor	Heated block monitored with potentiometric thermocouple system	NIST Traceable potentiometric thermocouple system	± 1.5% of minimum absolute stack temperature	Prior to test
5. Final Impinger Temperature Sensor	Compare to Mercury-in-glass	ASTM thermometer	± 5 deg F	Prior to test and Posttest
6. Aneroid Barometer	Compare to Mercury Barometer	Mercury column barometer	± 2.5 mm	Prior to test and Posttest
7. S-Type Pitot Tube		Micrometer and Angle finder	No change from pretest conditions	Prior to test and Posttest

sheets. Any unusual occurrences in the process operations, unusual test instrument readings, or any other items that could affect the test results were noted.

### **5.5 Proper Sample Handling Procedures**

Inaccurate source test results can be caused by delays in retrieving samples, contamination of the samples, insufficient sample identification, tampering, and mishandling of samples. The chances of these errors are greatly increased when too many people are permitted to handle the samples. For this reason, a chain of custody procedure was used. The samples were recovered at the PES laboratory in Baldwin Park and kept in a secure area until delivery by PES to the analytical laboratory. The nickel samples were kept refrigerated until analysis. A sample submittal/chain of custody form was completed and submitted with the nickel samples to document that each sample analyzed was taken under the conditions reported.

### **5.6 Use of Thoroughly Cleaned Glassware**

All glassware and probe lines were cleaned prior to the tests with hot tap water and then with 40% nitric acid solution. The trains were then rinsed with 0.1 Normal nitric acid solution and sealed until the tests.

### **5.7 Use of Standardized Data Reduction Techniques**

Data reduction was accomplished by the use of step by step calculation sheets. The calculations are systematic and easy to follow. All calculations for the source tests are included in the Appendices.

### **5.8 Analytical Quality Assurance Procedures**

Filter and reagent samples from an unused but charged nickel sampling train carried to the field were submitted to the laboratory and analyzed with the other samples to detect any possible contamination of sampling media or problems with lab analyses. No corrections were made to the measured concentrations of the collected samples, but the blank train results are reported on the calculation sheets. In addition, one sample in the group submitted was spiked and re-analyzed to check for matrix effects, and a duplicate analysis was performed on one sample in the group. Acceptance criteria for the analytical QA procedures are summarized in Table 8.

### **5.9 Interference With Nickel Analyses**

CARB Method 433 addresses the possibility of chromium interference with nickel when using inductively coupled plasma mass spectrometry (ICPMS). PES reviewed the ICPMS method with West Coast Analytical Service, Inc. (WCAS) before the testing was conducted. According to WCAS, it is very unlikely that chrome was an interferent in the ICPMS analytical technique, used for the nickel analyses in this project. The laboratory routinely evaluates multiple isotopes to assure interference is not present. The mass numbers typically monitored for chromium are 52 and 53; the mass numbers routinely monitored for nickel are 58, 60, or 62. The nearest elements that can create

an interferent with the nickel analysis are chrome oxide or argon carbide, which will yield a mass number of 64, which is closer to the mass number of zinc than it is to nickel. Also, according to the laboratory, interference becomes a problem when the chrome concentration in solution is on the order of several hundred parts per million (which occurs when analyzing chromium or nickel bath solutions). This was not the case for this analysis. The SCAQMD also used the same laboratory with ICPMS analyses for their nickel source samples collected at Foss Plating, Inc on October 25, 1998.

**Table 8**

**Quality Assurance Objectives for  
Precision and Accuracy**

<b>Data Quality Parameter</b>	<b>Method of Determination</b>	<b>Frequency</b>	<b>Precision</b>	<b>Accuracy</b>
CARB Method 433 Nickel	Duplicate analysis	1 per test series	< 10% RPD	
	Spike	1 per test series		75 to 125 % recovery
	Field blanks	1 per test series	NA	NA
	Initial Calibration reference standard. Certified standard independent of working calibration standards.	Prior to sample analysis	NA	10%
	Check - standard midpoint standard verification	After every 10 samples and at end of analytical run	NA	10%

