Chemetco
FIRST IN PEOPLE – QUALITY – SERVICE
P.O. Box 67 • Hartford, IL 62048
618-254-4381 • 800-444-5564

December 6, 2000

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

All roads and areas requiring dust suppressant were treated as scheduled during the November 2000, reporting period. As stated in the letter to dated September 7, 2000, to the Illinois EPA, a 95% average control efficiency by means of ground inventory has been achieved and the dust suppressant is being put down in applications as specified by the maintenance program.

Water Flooding of Paved, Unpaved Areas and Piles

All area were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the November 2000, reporting period with the following exceptions:

10/31-11/1 – All zones missed due to an equipment failure, starter problem
11/13 – All zones were missed between 11:00 am and 2:00 pm due to an equipment failure, starter problem.

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U.S. EPA, REGION 5

11/18 – All zones were missed between 9:00 am and 11:00 am due to an equipment failure, starter problem.
11/26 – All zones were missed between 11:30 am and 12:45 pm due to an operator error.
11/28 – 11/30 – North end of scrapyard was not watered due to concrete work.

Sweeping of Paved Roads

All areas were documented as being swept during the November 2000, reporting period with the following examples:

11/8 – All zones missed due to an equipment failure, broken brake line and motor problems with both the side and main brushes.
11/9 - All zones missed due to an equipment failure, broken brake line and motor problems with both the side and main brushes.
11/26 – 11/29 - All zones missed due to an equipment failure, bearings on the main brushes had to be replaced.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen
File

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November 7, 2000

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U. S. EPA, REGION 5

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

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Dust Suppressant

All roads and areas requiring dust suppressant were treated as scheduled during the October 2000, reporting period. As stated in the letter to dated September 7, 2000, to the Illinois EPA, a 95% average control efficiency by means of ground inventory has been achieved and the dust suppressant is being put down in applications as specified by the maintenance program.

Water Flooding of Paved, Unpaved Areas and Piles

All area were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the October 2000, reporting period with the following exceptions:

10/7 – all zones missed due to employee being injured.
10/10 – The scrap pile was missed at 2:40 a.m. was missed due to operator error.

Sweeping of Paved Roads

All areas were documented as being swept during the October 2000, reporting period with the following examples:

10/1 – Zones 1 (Oldenburg Rd/Scale), 3 (AAF Area), and 4 (Employee Lot), were missed due to an equipment malfunction. The steering went out on the sweeper.
10/2 through 10/5 – All zones missed due to an equipment malfunction, steering problems, with the sweeper. Delay in obtaining proper parts.
10/6 - One treatment in Zone 1 and Zone 3 were missed due to operator error.
10/7 - One treatment in Zone 1 and Zone 3 were missed due to operator error.
10/11 - One treatment in Zone 1 was missed due to PM on the sweeper.
10/16 – Zone 4 was missed due to an equipment malfunction, problem with the axle.
10/17 - One treatment in Zone 1 and Zone 3 were missed due to an equipment malfunction, problem with the axle.
10/19 – One treatment in Zone 1 and Zone 3 were missed due to operator error.
10/25 – One treatment in Zone 1 and Zone 4 were missed due to operator error.
10/26 – One treatment in Zone 1 and Zone 4 were missed due to operator error.
10/27 – One treatment in Zone 1 and Zone 4 were missed due to operator error.
10/28 – One treatment in Zone 1 and Zone 4 were missed due to operator error.
10/29 – No log was turned in for the 2:30 to 10:30 pm shift.

Corrective Action
Chemetco is working with Tenant on revising the service agreement to include 24 hrs per day, 7 days a week. Chemetco/Tenant are also analyzing the maintenance record for the sweeper to determine a better parts inventory to have on hand to avoid delays caused by lack of parts, ordering, etc. Chemetco is also evaluating the purchase of a second sweeper.

As for the operator errors experienced, responsibilities will be reviewed with the new drivers that started during the past month.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen
File

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U.S. EPA, REGION 5

October 6, 2000

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

All roads and areas requiring dust suppressant were treated as scheduled during the September 1999, reporting period. As stated in the letter to dated September 7, 2000, to the Illinois EPA, a 95% average control efficiency by means of ground inventory has been achieved and the dust suppressant is being put down in applications as specified by the maintenance program.

Water Flooding of Paved, Unpaved Areas and Piles

All area were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the September 2000, reporting period with the following exceptions:

8/31-9/1 – No log was obtained for the 10:30 pm to 6:30 am shift.
9/1-9/3 – No water was put down at the scale receiving area due to the prepping and asphalting of the entire scale area.
9/7 – No log was obtained for the 6:30 am to 2:30 pm shift.

9/9 – All zones were missed due to an equipment malfunction. Problems arose with the ignition, brake/gas pedals and the water sprays.
9/10 – No log was obtained for the 2:30 am to 2:30 pm shift.
9/23-9/24 – No log was obtained for the 2:30 pm to 2:30 am shift.

Sweeping of Paved Roads

All areas were documented as being swept during the September 2000, reporting period with the following examples:

9/1 – One treatment in Zone 1 (Oldenburg Rd/Scale) was missed due to operator error.
9/3 - One treatment in Zone 1 (Oldenburg Rd/Scale) was missed due to operator error.
9/5 – One treatment in Zone 1 and Zones 3 and 4 were missed due to an equipment malfunction, a bad ball joint.
9/6 – All zones missed due to the above equipment malfunction.
9/7 - One treatment in Zone 1 (Oldenburg Rd/Scale) was missed due to operator error.
9/9 – No log was obtained for the 2:30 am to 2:30 pm shift.
9/10 - No log was obtained for the 2:30 am to 2:30 pm shift.
9/11 - One treatment in Zone 1 (Oldenburg Rd/Scale) was missed due to operator error.
9/19 - One treatment in Zone 1 (Oldenburg Rd/Scale) was missed due to operator error.
9/20 – Both treatments in Zone 1 (Oldenburg Rd/Scale) were missed due to preventative maintenance being performed on the sweeper.
9/23-9/25 – All zones missed due to the ball joint (tie rod) breaking again and were unable to get a tenant representative here on the weekend.

Corrective Action
The operator, which did not turn in logs, has recently been terminated and a replacement is being trained. In addition, Chemetco has gotten with Tenant and is working on revising service agreement to include 24 hrs per day, 7 days a week.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen
File

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September 7, 2000

Don Sutton, Manager
Permits
Illinois Environmental Protection Agency
Bureau of Air
P. O. Box 19276
Springfield, Illinois 62794-9276

RE: Monthly Report - Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of each calendar month.

Dust Suppressant

Beginning January 1, 2000, Chemetco resumed regularly scheduled applications of Coherex as required to build up ground inventory. Attainment of a 95 % average control efficiency by means of ground inventory for 2000 for the dust suppressant applications has been achieved. Therefore, Chemetco is reducing the frequency of dust suppressant applications as follows:

- Oldenburg Road/Chemetco Lane between East and West gates – monthly application;
- Oldenburg Road/Chemetco Lane between the East plant gate and the east end of the road – as needed;
- Truck Lot – as needed;
- Granulated Slag Haul Road – bi-monthly applications (two times per month); and,
- East Canal Road – bi-monthly applications (two times per month).

The truck lot and that portion of Chemetco Lane east of the east gate shall be inspected on a weekly basis. When it is determined that further application of dust suppressant is needed, Chemetco will contact the dust suppressant applicators to arrange application of the suppressant to the truck lot and a portion of Chemetco Lane as outlined above.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being flooded unless freezing temperatures, snow or rain prevailed during the August 2000, reporting period with the following exceptions;

8/5 – Missed all zones between 4:45 pm to 2:30 am due to an equipment failure. The truck overheated and experienced steering problems..

8/20 – Zones missed between 7:30 pm and 8:00 pm due to an operator error.
8/20-8/21 – No log was turned in for the 10:30 pm to 6:30 am shift. Operator called off and no replacement could be found.
8/28-8/29 – Missed all zones for the 10:30 pm to 6:30 am shift due to operator and supervisor error.
8/29-8/30 – Missed all zones for the 10:30 pm to 6:30 am shift due to operator and supervisor error.
8/30-8/31 – Missed all zones for the 10:30 pm to 6:30 am shift due to operator and supervisor error.
8/31 - Missed Zone A (scale) between 3:30 pm to 7:30 pm. They are prepping the area for the application of asphalt.
8/30-8/29 – Missed all zones for the 10:30 pm to 6:30 am shift due to operator and supervisor error.

Sweeping of Paved Roads

All areas were documented as being swept during the August 2000, reporting period with the following exceptions:

8/9 – Treatments in Zones 1, 3, and 4 missed due to PM day for the sweeper (weekly preventative maintenance performed by a Tenant representative).
8/14 – One treatment in Zone 1 missed due to an operator error.
8/15 – One treatment in Zone 1 missed due to an operator error.
8/15 – One treatment in Zones 1 and 4 missed due to an operator error..
8/16 - One treatment in Zone 1 missed due to an operator error
8/17 – One treatment in Zone 1 missed due to an operator error.
8/20 – One treatment in Zone 1 missed due to an operator calling off. No replacement was able to be found.
8/22-8/23 – No log was turned in for the 10:30 pm to 6:30 am shift
8/23 – All zones missed due to an equipment failure. The right front wheel axle bearing broke.
8/27 – Zone 1 was missed due problems with the transmission.
8/28 – Zones 1, 3, and 4 missed due to problems with the transmission.
8/29 – One treatment in Zone 1 missed due to an operator error.
8/30 - Treatments in Zones 1, 3, and 4 missed due to PM day for the sweeper.

Corrective Actions

Operator and supervisor errors have been addressed.

If you have any questions, please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young
Environmental Manager
Chemetco, Inc.

cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, U.S. EPA, Region 5
Dan Suarez, Chemetco
Kim Fock, Chemetco
Maintenance Foreman
Labor Foreman
file

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U.S. EPA, REGION 5

August 8, 2000

Don Sutton, Manager
Permits
Illinois Environmental Protection Agency
Bureau of Air
P. O. Box 19276
Springfield, Illinois 62794-9276

RE: Monthly Report - Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of each calendar month.

Dust Suppressant

Beginning January 1, 2000, Chemetco resumed regularly scheduled applications of Coherex as required to build up ground inventory.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being flooded unless freezing temperatures, snow or rain prevailed during the July 2000, reporting period with the following exceptions;

7/1 – Missed all zones between 4:00 pm to 5:40 pm due to operator error.
7/2 - No log turned in for the 2:30 am to 2:30 pm shift.
7/6 – All zones missed between 1:30 pm and 7:45 pm due to an equipment failure, starter and PTO pump.
7/16 – No log turned in for the 2:30 pm to 10:30 pm shift. Individual covering this shift and the shift on 7/2/00 in which no log was turned in was terminated and therefore no logs have been recovered.
7/22 - Missed all zones between 10:30 am to noon due to operator error.

Sweeping of Paved Roads

All areas were documented as being swept during the July 2000, reporting period with the following exceptions:

7/1 – One treatment in Zone 1 (Oldenburg Rd/Scale) due to operator error.
7/2 – - No log turned in for the 2:30 am to 2:30 pm shift.

7/4 - One treatment in Zone 1 due to operator error.
7/6 – Treatments in Zones 1, 3, and 4 missed due to PM day for the sweeper (weekly preventative maintenance performed by a Tenant representative).
7/10 – One treatment in Zone 1 and Zone 4 (Employee Parking Lot) due to operator error.
7/12 – One treatment in Zone 1 and Zone 4 (Employee Parking Lot) due to operator error.
7/16 - No log turned in for the 2:30 pm to 10:30 pm shift. Individual covering this shift and the shift on 7/2/00 in which no log was turned in was terminated and therefore no logs have been recovered.
7/19 – One treatment in Zones 1 missed due to PM day for the sweeper (weekly preventative maintenance performed by a Tenant representative).
7/25 - All zones missed between 10:30 pm and 6:30 am due to an equipment failure, blown hydraulic line.
7/29 - One treatment in Zone 1 due to operator error.
7/30 – One treatment in Zone 1 due to operator error.

If you have any questions, please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young
Environmental Manager
Chemetco, Inc.

cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, U.S. EPA, Region 5
Dan Suarez, Chemetco
Kim Fock, Chemetco
Maintenance Foreman
Labor Foreman
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August 8, 2000

Don Sutton, Manager
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Illinois Environmental Protection Agency
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Dust Suppressant

Beginning January 1, 2000, Chemetco resumed regularly scheduled applications of Coherex as required to build up ground inventory.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being flooded unless freezing temperatures, snow or rain prevailed during the July 2000, reporting period with the following exceptions;

7/1 – Missed all zones between 4:00 pm to 5:40 pm due to operator error.
7/2 - No log turned in for the 2:30 am to 2:30 pm shift.
7/6 – All zones missed between 1:30 pm and 7:45 pm due to an equipment failure, starter and PTO pump.
7/16 – No log turned in for the 2:30 pm to 10:30 pm shift. Individual covering this shift and the shift on 7/2/00 in which no log was turned in was terminated and therefore no logs have been recovered.
7/22 - Missed all zones between 10:30 am to noon due to operator error.

Sweeping of Paved Roads

All areas were documented as being swept during the July 2000, reporting period with the following exceptions:

7/1 – One treatment in Zone 1 (Oldenburg Rd/Scale) due to operator error.
7/2 – - No log turned in for the 2:30 am to 2:30 pm shift.

7/4 - One treatment in Zone 1 due to operator error.
7/6 – Treatments in Zones 1, 3, and 4 missed due to PM day for the sweeper (weekly preventative maintenance performed by a Tenant representative).
7/10 – One treatment in Zone 1 and Zone 4 (Employee Parking Lot) due to operator error.
7/12 – One treatment in Zone 1 and Zone 4 (Employee Parking Lot) due to operator error.
7/16 - No log turned in for the 2:30 pm to 10:30 pm shift. Individual covering this shift and the shift on 7/2/00 in which no log was turned in was terminated and therefore no logs have been recovered.
7/19 – One treatment in Zones 1 missed due to PM day for the sweeper (weekly preventative maintenance performed by a Tenant representative).
7/25 - All zones missed between 10:30 pm and 6:30 am due to an equipment failure, blown hydraulic line.
7/29 - One treatment in Zone 1 due to operator error.
7/30 – One treatment in Zone 1 due to operator error.

If you have any questions, please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young
Environmental Manager
Chemetco, Inc.

cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, U.S. EPA, Region 5
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Kim Fock, Chemetco
Maintenance Foreman
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July 7, 2000

Don Sutton, Manager
Permits
Illinois Environmental Protection Agency
Bureau of Air
P. O. Box 19276
Springfield, Illinois 62794-9276

RE: Monthly Report - Fugitive Particulate Matter

Dear Mr. Sutton,

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Dust Suppressant

Beginning January 1, 2000, Chemetco resumed regularly scheduled applications of Coherex as required to build up ground inventory. The Coherex continues to be applied as weather permits.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being flooded unless freezing temperatures, snow or rain prevailed during the June 2000, reporting period with the following exceptions;

6/1 – No log turned in for the 10:30 pm to 6:30 am shift
6/7 - All zones missed between 10:30 pm and 6:30 am. There was a misunderstanding between the Environmental Department and the maintenance supervisor and subsequently the driver regarding the time that fugitive dust samples were to be collected.
6/9 – All zones missed between 4:20 am and 5:40 am due to above.
6/15 – All zones missed between 11:40 am and 12:40 pm due to an equipment failure, broken water sprays.
6/17 - Zones A and B missed between 10:30 pm and 10:45 pm due to operator error.
6/18 - All zones missed between 10:30 pm and 6:30 am due to the driver calling off
6/19 - All zones missed between 10:30 pm and 6:30 am due to the driver calling off.
6/21 –All zones missed between 2:30 am and 6:30 am due to driver sick, called off.
6/22 -. All zones missed between 2:30 am and 6:30 am due to driver sick, called off.
6/23 – Zones A,B and C missed between 2:30 pm and 2:45 pm due to driver taking a test.
6/28 – No log turned in for the 6:30 am to 2:30 pm shift.
6/29 – No log turned in for the 6:30 am to 2:30 pm shift.

Sweeping of Paved Roads

All areas were documented as being swept during the June 2000, reporting period with the following exceptions:

6/2 – Zone 1 (Oldenburg Rd/Scale), two treatments due to an equipment failure, SRP plate.
6/3 – One treatment in Zones 1, and 4 (Oldenburg Road/Truck Scale and Employee Parking Lot, respectively) missed due to an equipment failure, SRP plate.
6/4 – All zones missed due to an equipment failure, .
6/5 – One treatment in Zone 1 missed due to operator error.
6/6 – One treatment in Zone 1 missed due to an equipment failure, main brush.
6/7 – One treatment in Zone 1 missed due to an equipment failure, main brush.
6/14 - One treatment in Zones 1, and 3 (Oldenburg Road/Truck Scale and AAF Area, respectively) missed due to an equipment failure, hydraulic hose.
6/15 – All zones missed due to equipment failure and repair (see above)
6/18 - All zones missed between 10:30 pm and 6:30 am due to the driver calling off
6/19 - All zones missed between 10:30 pm and 6:30 am due to the driver calling off.
6/21 – One treatment in Zone 1 and Zone 3 missed due to PM day for the sweeper (weekly preventative maintenance performed by a Tenant representative).
6/22 – Two treatments in Zone 1 missed due to operator error.
6/25 – One treatment in Zone 1 missed due to operator error.
6/26 through 6/30 - No logs turned in for the 6:30 am to 2:30 pm shift.

Corrective Actions
Several of the logs that were not turned in can be contributed to one individual who has since received disciplinary action. In addition, a meeting was held on July 7, 2000 with several of the driver to again go over their duties and responsibilities. Those that did not or could not attend the meeting were/will be spoken to individually. Additional drivers are also to be trained.

If you have any questions, please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young
Environmental Manager
Chemetco, Inc.

cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, U.S. EPA, Region 5
Dan Suarez, Chemetco
Kim Fock, Chemetco
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June 9, 2000

Don Sutton, Manager
Permits
Illinois Environmental Protection Agency
Bureau of Air
P. O. Box 19276
Springfield, Illinois 62794-9276

RE: Monthly Report - Fugitive Particulate Matter

Dear Mr. Sutton,

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Dust Suppressant

Beginning January 1, 2000, Chemetco resumed regularly scheduled applications of Coherex as required to build up ground inventory. The Coherex continues to be applied as weather permits.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being flooded unless freezing temperatures, snow or rain prevailed during the May 2000, reporting period with the following exceptions;

5/1 – All zones missed between 10:20 pm and 11:40 pm due to a driver not showing up.
5/2 - All zones missed between 10:20 pm and 11:40 pm due to a late driver.
5/4 – All zones missed between 11:30 am and 12:30 pm due to watering the fill piles in the truck lot.
5/8 – All zones missed between 10:30 am and 11:40 am due to shuttling water from the retention basin into the plant.
5/10 - All zones missed between 10:20 pm and 6:30 am due to an equipment failure, wheel broke.
5/11 - All zones missed between 8:40 am and 2:20 pm due to an equipment failure, replaced the wheel and wheel seal.
5/12 - All zones missed between 10:30 am and 11:40 am due to an equipment failure regarding the wheel again.
5/12 – No log turned in for the 2:30 pm to 2:30 am shift.
5/13 - All zones missed between 1:30 am and 2:30 pm due to an equipment failure.
5/18 - All zones missed between 10:30 am and 2:30 pm due to an equipment failure, boot on the back broke.
5/23 - All zones missed between 7:30 pm and 10:30 pm due to an equipment failure, transmission and clutch.
5/25 – No log was turned in for the 6:30 am to 2:30 pm shift.

5/26 – The regular driver called off and the replacement did not turn in a log for the 6:30 am to 2:30 pm shift.
5/28 - All zones missed between 2:30 am and 4:00 pm due to an equipment failure, brake problems.
5/31 - All zones missed between 10:00 am and 5:20 pm due to an equipment failure, brake, clutch, and PTO.

Sweeping of Paved Roads

All areas were documented as being swept during the May 2000, reporting period with the following exceptions:

5/1 – Zone 4 (Employee Parking Lot) missed due to an equipment failure, brushes.
5/3 – One treatment in Zone 1, and 4 (Oldenburg Road/Truck Scale and Employee Parking Lot, respectively) missed due to an equipment failure, brushes.
5/10 – One treatment in Zone 1 missed due to PM day for the sweeper (weekly preventative maintenance (PM) performed by a Tenant representative).
5/18 – One treatment in Zone 1 missed due to PM day for the sweeper (weekly preventative maintenance performed by a Tenant representative).
5/20 – One treatment in Zone 1 missed due to an equipment failure.
5/24 – One treatment in Zone 1 missed due to PM day for the sweeper (weekly preventative maintenance performed by a Tenant representative).
5/25 – 5/27 – All zones missed due to the replacement of chains on the sweeper.
5/31 - One treatment in Zone 1 missed due to PM day for the sweeper (weekly preventative maintenance performed by a Tenant representative).

Corrective Action

Driver turnover has been almost 100% recently due to drivers advancing into other areas of the plant. A meeting has been called for next week (6/12/00) with drivers to address the problems encountered in May. All duties will be reviewed and the importance of filing complete logs with the Environmental Department will be emphasized. In addition, the Environmental Department will communicate with all maintenance foreman and the labor foreman in both verbal and written form regarding the importance of insuring that their drivers not only turn in the paperwork but complete the paperwork as required and the penalties that can be incurred for noncompliance.

If you have any questions, please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young
Environmental Manager
Chemetco, Inc.

cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, U.S. EPA, Region 5
Dan Suarez, Chemetco
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file

Chemetco
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P.O. Box 67 • Hartford, IL 62048
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May 15, 2000

Mr. Jeff Trevino
Assistant Regional Counsel
USEPA, Region 5
77 West Jackson Blvd (C-14J)
Chicago, IL 60604-3590

Dear Mr. Trevino,

Enclosed are the fugitive dust reports for the months of March and April. They were submitted to the Illinois EPA within the specified time frame (copy of receipts included) but due to a clerical error were not forwarded to your office at the same time. I am forwarding these reports to your office immediately upon discovery. I will see to it that it does not happen in the future and apologize for any inconvenience it may have caused.

If you have any questions, please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young
Environmental Manager
Chemetco, Inc.

Chemetco
FIRST IN PEOPLE – QUALITY – SERVICE
P.O. Box 67 • Hartford, IL 62048
618-254-4381 • 800-444-5564

May 8, 2000

Don Sutton, Manager
Permits
Illinois Environmental Protection Agency
Bureau of Air
P. O. Box 19276
Springfield, Illinois 62794-9276

RE: Monthly Report - Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of each calendar month.

Dust Suppressant

Beginning January 1, 2000, Chemetco resumed regularly scheduled applications of Coherex as required to build up ground inventory. The Coherex continues to be applied as weather permits.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being flooded unless freezing temperatures, snow or rain prevailed during the April 2000, reporting period with the following exceptions;

4/6 – All zones missed between 2:30 pm and 6:30 pm due to a driver calling off.
4/16 - No log was turned in for the 2:30 am to 2:30 pm shift.
4/20 -- No log was turned in for the 2:30 pm to 10:30 pm shift.
4/23 – No log was turned in for the 2:30 pm to 10:30 pm shift.

Sweeping of Paved Roads

All areas were documented as being swept during the April 2000, reporting period with the following exceptions:

4/9 – One treatment in Zone 1 (Oldenburg Road/Scale) missed due to operator error.
4/10 – Zones 1, and 4 (Employee Parking Lot) missed due to an equipment failure. There was a hole in the main brush

4/12 to 4/14 – All treatments missed due a malfunction of the main hydraulic pump. Diagnosis was lengthy due to never having experiencing such a problem on this type of sweeper. The corporate office had to be involved with the warrenty repair. All maintenance is performed under a professional service agreement with Tenant by there representatives.
4/16 – No log was turned in for the 2:30 am to 2:30 pm shift.
4/22 – Zone 4, the AAF area, was missed due to operator error.
4/26 – One treatment in Zone 1 (Oldenburg Road/Scale) missed due to operator error.

Corrective Action

As requested, holes in the Truck Lot were repaired on 5/1/00 with asphalt.

If you have any questions, please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young
Environmental Manager
Chemetco, Inc.

cc: Sarah Phelps, IEPA Collinsville Field Office
Dan Suarez, Chemetco
Kim Fock, Chemetco
Maintenance Foreman
file

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Chemetco

FIRST IN PEOPLE — QUALITY — SERVICE

P.O. Box 67 • Hartford, IL 62048
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April 10, 2000

Don Sutton, Manager
Permits
Illinois Environmental Protection Agency
Bureau of Air
P. O. Box 19276
Springfield, Illinois 62794-9276

RE: Monthly Report - Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of each calendar month.

Dust Suppressant

Beginning January 1, 2000, Chemetco resumed regularly scheduled applications of Coherex as required to build up ground inventory. The Coherex continues to be applied as weather permits.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being flooded unless freezing temperatures, snow or rain prevailed during the March 2000, reporting period with the following exceptions;

3/3 – All zones missed due to no log on file. Employee quit and left no log.
3/7– Missed all zones between 10:30 am and 2:20 pm due to a driver calling off. The previous driver stayed over from the prior shift as long as possible since the driver called off.
3/8 - Missed all zones between 4:20 am and 5:40 am due to a plant emergency.
3/14 – No log was turned in for the 2:30 pm to 10:30 pm shift.
3/15 - Missed all zones between 10:30 am and 2:30 pm due to a driver calling off. The previous driver stayed over from the prior shift as long as possible since the driver called off.
3/16 – No log was turned in for the 2:30 pm to 10:30 pm shift.
3/17 – Missed all zones between 10:30 am and 2:30 pm due to a driver calling off. The previous driver stayed over from the prior shift as long as possible since the driver called off.
3/17 – Missed all zones between 10:30 pm to 11:30 pm due to operator being late.
3/19 – No log was turned in for the 2:30 am to 2:30 pm shift.
3/31 – Zones A (Oldenburg Road/Scale) and Zone E (AAF Area) missed due to operator error.

Sweeping of Paved Roads

All areas were documented as being swept during the March 2000, reporting period with the following exceptions:

3/8 – One treatment in Zone 1 (Oldenburg Road/Scale) missed due to the sweeper being down for preventative maintenance and brush replacement.
3/9 and 3/10 – Zones 1, 3 (AAF Area), and 4 (Employee Parking Lot) missed due to an equipment failure. Problems arose with the conveyors, brushes and hopper.
3/11 - One treatment in Zone 1 (Oldenburg Road/Scale) missed due to operator error.
3/14 – No log was turned in for the 2:30 pm to 10:30 pm shift.
3/15 – All zones missed between 10:30 am (3/15) through 2:30 pm on 3/16 due to preventative maintenance and consequential repairs (replaced the hopper and conveyor chains)..
3/19 – No log was turned in for the 2:30 am to 2:30 pm shift.
3/21 - One treatment in Zone 1 (Oldenburg Road/Scale) missed due to operator error.
3/22 - One treatment in Zone 1 (Oldenburg Road/Scale) missed due to preventative maintenance.

Corrective Action

Over the past month as exemplified by the above information there was a large number of call offs. Normal procedure is that the driver on the previous shift stays over 4 hours while the driver for the next shift is called in early. Additional water/sweeper driver are being trained to fill in when others call off. An additional driver is being added to each shift. This should insure that if one driver calls off during a shift there will always be another person to take over their duties.

Also, the importance of the water/sweeper logs was discussed with the maintenance foreman who in turn discuss this with their crew. The logs are checked daily to insure compliance. If a problem arises, a message is sent to the shift maintenance foreman, their supervisor, and the manager of Engineering and Maintenance.

If you have any questions, please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young
Environmental Manager
Chemetco, Inc.

cc: Sarah Phelps, IEPA Collinsville Field Office
Dan Suarez, Chemetco
Kim Fock, Chemetco
Maintenance Foreman
file

U.S. Postal Service
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BOA, Permits
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P.O. Box 19276
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618-254-4381 • 800-444-5564

March 8, 2000

Don Sutton, Manager
Permits
Illinois Environmental Protection Agency
Bureau of Air
P. O. Box 19276
Springfield, Illinois 62794-9276

RE: Monthly Report - Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of each calendar month.

Dust Suppressant

Beginning January 1, 2000, Chemetco resumed regularly scheduled applications of Coherex as required to build up ground inventory. The Coherex continued to be applied as weather permitted.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being flooded unless freezing temperatures, snow or rain prevailed during the February 2000, reporting period with the following exceptions;

2/2 – Missed all zones between 12:30 am and 2:40 am. The driver called off and a replacement was called in
2/12– Missed all zones between 2:30 pm and 7:20 pm. The driver called off so a replacement was called in.
2/13 - Missed all zones between 2:30 am and 5:20 am. The driver came in late.
2/23 - Missed zones A, B, and E (Scale, Scrap Yard Roads, and the AAF area) between 7:20 pm to 7:45 pm due to an equipment failure. The starter on the truck was broken.
2/27 - Missed all zones between 4:20 am and 5:40 am due to operator error.

Sweeping of Paved Roads

All areas were documented as being swept during the February 2000, reporting period with the following exceptions:

2/21 – Zones 4, the employee parking lot, was missed due to operator error.

If you have any questions, please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young
Environmental Manager
Chemetco, Inc.

cc: Sarah Phelps, IEPA Collinsville Field Office
Dan Suarez, Chemetco
Kim Fock, Chemetco
Maintenance Foreman
file

Chemetco
FIRST IN PEOPLE — QUALITY — SERVICE
P.O. Box 8 • Hartford, IL 62048
618-254-4381 • 800-444-5564

February 7, 2000

Don Sutton, Manager
Permits
Illinois Environmental Protection Agency
Bureau of Air
P. O. Box 19276
Springfield, Illinois 62794-9276

RE: Monthly Report - Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of each calendar month.

Dust Suppressant

Beginning January 1, 2000, Chemetco resumed regularly scheduled applications of Coherex as required to build up ground inventory.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being flooded unless freezing temperatures, snow or rain prevailed during the January 2000, reporting period with the following exceptions;

1/13 – Missed all zones between 11:00 am and 3:00 pm due to an equipment failure. The whole front end of the truck was replaced.
1/28– Missed all zones between 2:30 pm and 4:00 pm due to an equipment failure. The PTO for the sprays had to be repaired. Starter problems were also experienced.

Sweeping of Paved Roads

All areas were documented as being swept during the January 2000, reporting period with the following exceptions:

1/13 – Zone 4, Employee Parking Lot, was missed due to equipment failure. Chains on the conveyor had to be repaired.
1/14 – Zone 1, Oldenburg Rd and Truck Scale, was missed once due to above.
1/15 - Zone 1, Oldenburg Rd and Truck Scale, was missed once due to operator error.
1/20 – Zones 1 and 4 were missed due to an equipment failure. The hydraulic line broke on the sweeper and steering problems were experienced.

If you have any questions, please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young
Environmental Manager
Chemetco, Inc.

cc: Sarah Phelps, IEPA Collinsville Field Office
Dan Suarez, Chemetco
Kim Fock, Chemetco
Maintenance Foreman
file

Chemetco
FIRST IN PEOPLE – QUALITY – SERVICE
P.O. Box 67 • Hartford, IL 62048
618-254-4381 • 800-444-5564

February 7, 2001

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

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AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

Due to the weather, Coherex was not applied during the month of January. Applications will be applied as the weather permits pursuant to the plan.

Water Flooding of Paved, Unpaved Areas and Piles

All area were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the January 2001, reporting period with the following exceptions:

1/11 – No log was turned in for the 10:30 pm to 6:30 am shift. Temperatures were at or below freezing.
1/15 – No logs were turned in from 10:30 on 1/14 to 2:30 pm 1/15. Temperatures were at or below freezing.
1/16 – No log was turned in for the 6:30 am to 2:30 pm shift. Temperatures were at or below freezing..

Sweeping of Paved Roads

All areas were documented as being swept during the January 2001, reporting period with the following examples:

1/1 – One treatment was missed in Zone 1 (Oldenburg Rd/Scale) due to operator error.
1/3 – Several zones were missed due to preventative maintenance day (PM day)
1/5 – Zone 3 (AAF Area) missed due to operator error.
1/6 – Zone 3 missed due to operator error.
1/7 – 1/11 - All zones missed due to an equipment failure, hydraulic leak and brush (trouble getting parts).
1/12 – Zone 3 missed due to operator error.
1/15 – No logs were turned in for the 10:30 pm to 6:30 am shift or the 6:30 am to 2:30 pm shift.
1/16 - All zones missed due to an equipment failure, bad water pump.
1/17 - All zones missed due to an equipment failure, bad water pump.
1/21 – Zones 1, 3, and 4 were missed due to operator error.
1/23 - All zones missed due to an equipment failure, hydraulic leak.
1/24 - All zones missed due to an equipment failure, hydraulic leak.

Corrective Action

A second Tenant sweeper has been purchased and is now on site. Operators training will be conducted during this week. The second sweeper should obviously reduce down time experienced due to equipment failures. Zone 3 missed due to operator error

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen
File

Chemetco
FIRST IN PEOPLE – QUALITY – SERVICE
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January 8, 2001

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

All roads and areas requiring dust suppressant were treated as required and weather permitted during the December 2000, reporting period. As stated in the letter to dated September 7, 2000, to the Illinois EPA, a 95% average control efficiency by means of ground inventory has been achieved and the dust suppressant is being put down in applications as specified by the maintenance program.

Dust suppressant was applied to the zinc oxide bunker on October 17, 2000. Dust suppressant was to be applied to the slag pile in the late fall, early winter just as the year before. Weather has not cooperated. Dust suppressant will be applied as soon as the weather allows.

Water Flooding of Paved, Unpaved Areas and Piles

All area were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the December 2000, reporting period. The following exceptionse noted:

LTP
1-11-01

12/3 – No log was turned in for the 2:30 pm to 10:30 pm shift.

12/6 – Zones 1, 3, and 4 were missed due to an equipment failure, charging system.

12/7 - All zones were missed due to an equipment failure, brake canister.

All zones were missed on the following dates due to snow and ice. Areas of concern were scraped with either a front end loader or bobcat when possible.

12/14
12/15
12/17
12/18
12/19
12/20
12/21
12/22
12/29

Sweeping of Paved Roads

All areas were documented as being swept during the December 2000, reporting period with the following exceptions:

12/19 – No log was turned in for the 6:30 am to 2:30 pm shift
12/20 - No log was turned in for the 6:30 am to 2:30 pm shift

Corrective Actions

Chemetco has moved up the order for a second Tennant sweeper from the second quarter 2001 to the first quarter 2001. Chemetco has already placed an order for the sweeper with delivery expected at the end of January 2001. This should eliminate the down time with the present sweeper.

The individual who did not turn in several of the logs is no longer employed therefore the logs cannot be retrieved.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen
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OPEN
FUGITIVE EMISSION
DUST CONTROL PLAN

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Chemetco, Inc.
March 2001

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1.0 INTRODUCTION

Fugitive particulate emissions are emitted by a wide variety of sources both in the industrial and in the nonindustrial sectors. Fugitive emissions refer to those air pollutants that enter the atmosphere without first passing through a stack or duct designed to direct or control their flow.

Sources of fugitive particulate emissions may be separated into two broad categories: process sources and open dust sources. Process sources of fugitive emissions are those associated with industrial operations that alter the chemical or physical characteristics of a feed material. Open dust sources are those that entail generation of fugitive emissions of solid particles by the forces of wind or machinery acting on exposed materials.

Illinois air pollution regulations address fugitive emissions at Title 35, Subtitle B, Chapter I, Subchapter C, Part 212, Subpart K. These regulations require certain facilities to develop an operating program that is designed to significantly reduce fugitive particulate matter emissions. The regulations outline the minimum requirements of the operating program and require periodic amendment of this program to ensure that it is current.

This document serves as the operating program for the control of fugitive emissions ("Control Plan") at the Chemetco, Inc. facility. This document focuses on the open source fugitive emissions at Chemetco that contribute to the facility's total lead and particulate emissions.

1.1 Industrial Source Description

Chemetco, Inc. is a copper scrap recycler that reclaims the copper values from various types of copper-bearing materials. Chemetco is located within a primarily agricultural, light residential area south of Hartford, Illinois and slightly north of St. Louis, Missouri. Chemetco is bounded on the west by Highway 3, a heavily traveled highway, and a Norfolk and Southern railway. Chemetco is bounded on the south by Chemetco Lane, a limited use secondary road which is owned by Chemetco, and on the north and east sides by agricultural land, some of which is also owned by Chemetco. A parking lot for trucks delivering scrap to Chemetco lies south of West Chemetco Lane. South and east of the truck lot is property belonging to Chemetco. Facility maps are located in Appendix A.

1.2 Control Plan Description

The purpose of this plan is to identify the sources of fugitive particulate emissions at the Chemetco facility and to describe Best Management Practices that have been implemented to control fugitive emissions and to ensure continued compliance with applicable regulations. Control efficiencies are calculated and summarized in Table 3-1 for each source area. An overall control efficiency for the facility is also reported.

The original fugitive dust plan was developed in 1993. This plan has been amended periodically to ensure that it remains up-to-date. Changes incorporated in this current revision include: incorporation of current silt and lead data, update of emission calculations to include the equations from the most recent edition of AP-42, and update of source information, as required.

1.3 Identification of Fugitive Dust Sources

Chemetco applied the following criteria in identifying sources that may contribute to open fugitive dust emissions:

1) Areas where the pulverization and abrasion of surface materials by the mechanical force of equipment (such as tires) may generate dust;

2) Areas where the action of turbulent air currents, such as wind erosion of piles or the passing of truck traffic, may cause entrainment of dust particles in the air.

Identified source areas are listed in Table 2-1. Samples were collected of the materials that may be affected by mechanical grinding or turbulent air from each of the identified source areas and the silt content determined. Silt is the fraction of particulate matter that passes through a 200 mesh screen. These samples were collected and analyzed in accordance with Appendices C and D of EPA Document EPA-450/3-88-008, "Control of Open Fugitive Dust Sources." Determination of the size of the dust is important due to the potential of the smaller sized particles to drift. The greater the

percentage of smaller sized particles, the greater the measures required to control particulate emissions. The silt data is presented in Table 2-2. Lead analysis was performed on the silt fraction of the dust sample and is included in Appendix C with the raw data.

2.0 SOURCE AREAS

Identified fugitive dust source areas at the Chemetco facility are listed in Table 2-1. For each source area, an uncontrolled emission rate was calculated, Best Management Practices for the control of fugitive emissions were defined, and expected control efficiencies were determined. Sections contained in this chapter demonstrate the calculations used to determine the uncontrolled emission rates and expected control efficiencies, and describe the Best Management Practices that have been implemented for each source area. The Best Management Practices for each source area are also summarized in Table 2-1. An estimated surface area for each source was determined from surveyed facility drawings. A facility map is provided in Appendix A.

A unique emission rate is associated with each source area, depending on the source type (e.g. paved road, unpaved road, storage pile) and specific source characteristics (silt content, vehicle weight, etc). The equations used to estimate fugitive emissions from the identified sources at Chemetco are taken from widely accepted references and are shown in Table 2-3. These equations were used to calculate the uncontrolled emissions from each source area. Where possible, actual data obtained from the source areas at the Chemetco facility is used in the calculations, rather than default values. Silt data is reported in Table 2-2 for the source areas.

TABLE 2-1: IDENTIFIED SOURCE AREAS AT THE CHEMETCO FACILITY

Source	Area*	Best Management Practices
Scrap Yard (storage piles and traffic)	17,200 yd^2	Enforcement of speed limit, work practices (limiting height of front-end loader when dropping, unloading in pile area rather than drive area when possible, dust collection/management), hand sweeping, mechanical sweeping, inspection of concrete, watering.
AAF and Stack Area	5,580 yd^2	Enforcement of speed limits, operating practices to minimize generation of dust (cleaning, baghouse bin changing procedure, storage bin lid fit), watering, sweeping, inspection/repair of concrete.
Truck/Scale Drive	2,934 yd^2	Enforcement of speed limits, water flushing and sweeping, work practices.
West Chemetco Ln (Oldenburg Rd)	819 yd^2	Enforcement of speed limits, limiting road access, watering, sweeping, work practices.
Truck Lot	16,527 yd^2	Application of petroleum resin emulsion dust suppressant.
Kress Haul Road	3,022 yd^2	Enforcement of speed limits, watering.
Slag Handling	5,288 yd^2	Insignificant emissions due to nature of operation.
Zinc Oxide Bunker	10,845 yd^2	High moisture content of ZnO, formation of surface crust, protection of pile (concrete wall, dirt/slag embankment), application of petroleum resin emulsion dust suppressant.
Slag Storage Piles	12.92 acres	Application of petroleum resin emulsion dust suppressant.
Employee Parking Lot	3,750 yd^2	Sweeping.
ZnO Loading/Baghouse2 Access Rd	3,231 yd^2	Watering, sweeping, work practices (close containers prior to moving).
Granulated Slag Haul Road	1,014 yd^2	Enforcement of speed limits, application of petroleum dust suppressant, watering.
Fines Building Entrance	400 yd^2	Unloading inside of building, watering.
E/W Canal Road	1,540 yd^2	Application of petroleum resin emulsion dust suppressant.

*Roads are included in the reported area, where applicable.

Chemetco has implemented various appropriate Best Management Practices for each source area to control fugitive dust emissions. As outlined in the EPA Document "Control of Open Fugitive Dust Sources," EPA-450/3-88-008, a reduction in either the source extent or the uncontrolled emission factor reduce the emission rate. The implemented control measures demonstrate the reduction of the source extent and/or the uncontrolled emission factor. Each Best Management Practice is explained fully in the following sections. This plan, along with the ambient monitoring data, will be reviewed at least annually to determine if any modifications to the control measures implemented at each source area are needed. Any quarter that the ambient air monitoring data shows exceedences will require corrective action, which may or may not necessitate revision of this plan.

Table 2-2: Silt and Silt Loading Data for Source Area

Source Area	% Silt	Silt Loading, sL (g/m^2)
Parking Lot	1.39	0.09
Truck/Scale Drive	11.85	3.95
Truck Lot	3.81	0.47
West Chemetco Lane	2.11	0.82
ZnO Access Road	33.09	9.80
Scrap Yard	38.10 49.79	114.10 31.49
Granulated Slag Road	2.08	17.76
Fines Building Entrance	13.43	34.80
Kress Haul Road	16.82	147.47
AAF Area Drive	23.24	23.14

Samples collected 6/6/00.
Scrap Yard Resampled 12/4/2000.
Raw data is located in Appendix C

TABLE 2-3: EMISSION FACTOR EQUATIONS

SOURCE TYPE	EMISSION EQUATION	EQUATION SOURCE
UNPAVED INDUSTRIAL ROADS* Kress Haul Road Granulated Slag Haul Rd E/W Canal Road Scrap Yard Traffic Fines Building Entrance	$E = \frac{k(s/12)^a(w/3)^b}{(M_{dry}/0.2)^c}[(365-p)/365]$ E = calculated emission factor, lb/VMT k = constant, lb/VMT (k = 10 lb/VMT for TSP) a = constant (unitless) (a = 0.8 for TSP) b = constant (unitless (b = 0.5 for TSP) c = constant (unitless) (c = 0.4 for TSP) s = surface material silt content, % W = mean vehicle weight, ton M_{dry} = surface material moisture content dry conditions, % p = number of days with at least 0.01 in. precipitation p = 114 days (AP-42 Figure 13.2.2-1)	AP-42 Section 13.2.2 Equation 2 9/98
PAVED INDUSTRIAL ROADS West Chemetco (Oldenburg Rd) AAF & Stack Area Truck/Scale Drive Employee Parking Lot ZnO Loading/Baghouse2 Access Road Truck Lot	$E = k(sL/2)^{0.65}(W/3)^{1.5}$ lb/VMT E = calculated emission factor, lb/VMT k = base emission factor for particle size range & units k = 0.082 lb/VMT for TSP sL = road surface silt loading, g/m^2 W = average vehicle weight, ton	AP-42 Section 13.2.1 Equation 1 10/97
BATCH AND CONTINUOUS DROP Scrap Yard Material Handling	$E = k(0.0032)\{(U/5)^{1.3}/(M/2)^{1.4}\}$ lb/ton E = calculated emission factor, lb/ton k = particle size multiplier (unitless) (k = 0.74 for PM30) U = mean wind speed, mph M = material moisture content, %	AP-42 Section 13.2.4 Equation 1 1/95
WIND EROSION OF PILES Zinc Oxide Bunker Slag Storage Piles	$E = k\sum P_i$, g/m^2 (for I = 1 to N) k = particle size multiplier (unitless) (k = 1 for PM30) N = number of disturbances per year P_i = erosion potential corresponding to the observed (or probable) fastest mile of wind for the ith period between disturbances, g/m^2 $P = 58(u^*-u_t^*)^2 + 25(u^* - u_t^*)$ $P = 0$ for $u^* \le u_t^*$ u^* = friction velocity, m/s u_t^* = threshold friction velocity, m/s	AP-42 Section 13.2.5 1/95

*Per AP-42: If vehicle speed is less than 15 mph, the unpaved road equation should be multiplied by (S/15), where S is the average speed and is less than or equal to 15 mph to prevent the overestimation of emissions for vehicle at slow speeds

TABLE 2-3: EMISSION FACTOR EQUATIONS (CONTINUED)

SOURCE TYPE	EMISSION EQUATION	EQUATION SOURCE
WIND EROSION OF PILES Scrap Piles	E = 1.7(s/1.5)((365-p)/235)(f/15) lb/day/acre E = calculated emission factor, lb/day/acre s = surface material silt content, % p = number of days with greater than 0.01 in precipitation f = percentage of time that the unobstructed wind speed exceeds 12 mph at the mean pile height.	AP-42 Section 11.2.3-5 9/85

The control efficiencies of the identified control measures were calculated in accordance with USEPA document EPA-450/3-88-008 "Control of Open Fugitive Dust Sources" (September 1988), where appropriate. It should be noted this document (EPA-450/3-88-008) has been reformatted for EPA document 450/2-92-004, "Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures" (September 1992).

Control efficiency for the watering of unpaved roads was calculated using the following equation:

C = 100 - (0.8 pdt/I) (Equation 3-2 from EPA document 450/3-88-008)

where:

C= average control efficiency, %

p = potential average hourly daytime evaporation rate, mm/hr

d = average hourly daytime traffic rate in vehicles per hour

t = time between applications, hours

I = application intensity, L/m^2

Control efficiency for watering and sweeping of paved roads was calculated using the following equation:

C = 96 - 0.263V (Equation from Table 2-4 in EPA document 450/3-88-008)

where:

C = average control efficiency, %

V = vehicle passes since application

The average control efficiency for the application of chemical dust suppressant was calculated based on the control performance model presented in Figure 3-4 of EPA document 450/3-88-008. Figure 3-4 is included in Section 5.0.

It should be noted that the control efficiency calculations do not reflect the reduction in particulate emissions due to the implementation of work practices which reduce the generation of dust.

2.1 Unpaved Industrial Roads

Fugitive emissions from unpaved roads at the Chemetco facility are calculated using the unpaved road emissions equation from AP-42 Section 13.2.2 (9/98). In previous editions of Chemetco's Fugitive Dust Plan, the unpaved road equation was used to calculate emissions from some of the concrete paved roads. It was believed that the unpaved road equation more appropriately characterized some of the paved roads due to the nature of the associated industrial operations and the actual conditions of the roads at that time (littered with scrap and dust from the storage piles). However, since the implementation of appropriate Best Management Practices (e.g. sweeping, work practices, inspection of roads, watering, etc.), the condition of the paved roads is much improved and the emissions from most paved roads can be appropriately characterized using the paved road emissions equation from AP-42.

However, due to the nature of the operations, some of the paved roads have a high surface loading that is more characteristic of an unpaved surface. The "Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures" (EPA-450/2-92-004) states that the use of the paved road emission factor may result in a higher emissions estimate than that obtained from the unpaved road emission factor when the paved road has a high silt loading. In such cases, this document recommends using the unpaved emission factor to estimate emissions.

Conversely, some of the unpaved roadways and surfaces have received regularly scheduled applications of petroleum resin emulsion dust suppressant for many years and have formed a hardened solid surface. These roadways and surfaces can be best controlled by paved road control techniques with spot treatment of dust suppressant. (See Appendix D, EPA-450/3-88-008 page 3-19, for documented explanation).

2.1.1 East Chemetco Lane (Oldenburg Road)

The Chemetco facility is accessed via Chemetco Lane (formerly Oldenburg Road). The section adjacent to the Chemetco property is owned by Chemetco and is intended for industrial and plant traffic only. Prior to Chemetco ownership, the road was maintained by the county (tarred and graveled).

There are two entrances to the Chemetco facility from Chemetco Lane. The east entrance is used primarily for maintenance, emergency, and security purposes only. The east entrance is chained to prevent unauthorized traffic from accessing this area.

Fugitive emissions from East Chemetco Lane result solely from the carry-out and turbulence caused by traffic. The road is not composed of slag or other aggregates, but portions of it retain the appearance of a graveled road. Emissions would be insignificant as this road is seldom used due to its restricted use. Therefore, fugitive emissions from East Chemetco Lane are not addressed in this plan.

2.1.2 Kress Haul Road

The Kress is the piece of equipment used to haul molten slag from the foundry building to the slag granulation barge (Note: The Kress no longer travels to the Slag Pits. Therefore, this distance is no longer included in the emission calculations). The Kress Haul Road runs between the north-west end of the foundry building and the slag granulation barge. The Kress is the primary vehicle that travels this road. The only other vehicles that use this road are the water truck and an occasional front-end loader. Travel in general is limited. The Kress only travels the road when slag is removed from the furnace process, which is approximately 12 times per day. The front-end loader traffic is mainly limited to occasional trips to the maintenance shop. A portion of the Kress Haul Road is paved; however, the unpaved road equation was used to calculate emissions from the entire road since it is believed that the unpaved road equation better characterizes emissions from the entire road segment due to the nature of the operations associated with the Kress Haul Road. The following support the use of the unpaved road equation:

-High silt loading of the road.
-The AP-42 paved road equation was developed for vehicle speeds of 10 to 55 mph.
-The development of the AP-42 paved road equation did not include "stop-and-go" traffic or vehicles under load.
-The "Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures" (EPA-450/2-92-004) states that the use of the paved road emission factor may result in a higher emissions estimate than that obtained from the unpaved road emission factor when the paved road has a high silt loading. In this case, the road is better characterized as unpaved in nature for emissions estimation.

2.1.2.1 Sources

Fugitive particulates are composed of ground slag particles which are stirred up by the turbulence of passing vehicles. The loaded Kress does not cause much turbulence since it moves slowly due to the weight of the load. The front-end loaders and empty Kress are not under a heavy load and can move faster than the loaded Kress, resulting in more turbulence and a greater potential for the generation of fugitive particulates. These particulates, however, tend to be heavy and settle quickly before they can become airborne, especially since they are initially close to the ground.

2.1.2.2 Control Methods

Appropriate Best Management Practices have been selected and implemented to control fugitive dust emissions. This area is impractical to sweep, as it is unpaved. Speed limits have been established since the speed of the vehicles traveling on this road impacts the generation of fugitive emissions. Enforcement of the established speed limits is the responsibility of both the foundry manager and the slag plant manager. Watering of the road surface is also used as a control measure. Due to the low quantity of emissions generated at this area, control efficiency calculations require the road to be watered only once per day. The area is flooded when it is watered.

2.1.2.3 Calculations

Kress Haul Road - Unpaved Road Equation

$$E = \frac{k(s/12)^a(w/3)^b[(365-p)/365]}{(M_{dry}/0.2)^c}$$ (AP-42, Section 13.2.2-1, 9/98)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT
k = 10 lb/VMT(constant for TSP)
a = 0.8 (constant for TSP)
b = 0.5 (constant for TSP)
c = 0.4 (constant for TSP)
s = 16.82 % silt content (from sampling data)
W = 103 tons, loaded
= 31 tons, empty
= 67 tons, average weight
M_{dry} = 0.2 % (default value for surface material moisture content dry conditions)
p = 114 days with rainfall ≥ 0.01 inch (AP-42 Figure 13.2.2-1)
S= 5 mph, loaded
15 mph, unloaded
10 mph, average speed

(Per AP-42 Section 13.2.2-1 (9/98): The unpaved road equation should be multiplied by (S/15), where S is the average speed (mph) and S is less than 15 mph to prevent overestimation of emissions for slow moving vehicles.)

E = 42.58 lb/VMT x (10/15) = 28.39 lb/VMT (adjusted for slow moving vehicles)

Basis and Daily Emission Calculation Assumptions:

- Average 12 round trips per day, everyday.
- 699 ft one way, 1398 ft round trip
- Vehicle passes per hour = (12 round trips/day x 2 passes/trip)/24 hour per day = 1 pass/hour

VMT =(# of round trips) x (round trip distance) = (12 trips)(1398 ft/trip)(1 mile/5280 ft)
= 3.18 miles/day

Emissions, lb/day = Emission factor, lb/VMT x VMT = (28.39 lb/VMT)(3.18 miles/day)

= 90.28 lb/day Kress Haul Road

Control and Control Efficiency Calculation
Control Method: Watering

C = 100 - (0.8 pdt/I) (EPA-450/3-88-008, Control of Open Fugitive Dust Sources, Eqn 3-2)

C= average control efficiency, %
p = 0.233 potential average hourly daytime evaporation rate, mm/hr (or 0.013 in/hr)
where p = 0.0049 x (value in Fig. 3-2 of EPA document) for annual conditions
d = 1.000 vehicle pass/hour
t = 24.0 hours between applications
I = 2.722 application intensity, minimum L/m^2 (or 0.601gal/yd^2) (taken from actual site data)

C = 98.36 %

2.1.3 Slag Haul Road

The Slag Haul Road, located along the east plant property boundary, is no longer used for transporting screened slag off-site. This road may be used for occasional maintenance or delivery; however, emissions would be insignificant as it is seldom used. Therefore, fugitive emissions from the Slag Haul Road are not addressed in this plan.

2.1.4 Granulated Slag Haul Road

The Granulated Slag Haul Road runs between the Granulated Slag Screening Plant and the Granulated Slag Storage/Rail Loadout building. This road is only used during the Granulated Slag Screening Plant operating hours. A portion of the Granulated Slag Haul Road is paved. However, the unpaved road equation was used to calculate emissions from the entire road since it is believed that the unpaved road equation better characterizes emissions from the entire road segment due to

the nature of the operations associated with the Granulated Slag Haul Road. The following support the use of the unpaved road equation:

-High silt loading of the road.

-The AP-42 paved road equation was developed for vehicle speeds of 10 to 55 mph.

-The development of the AP-42 paved road equation did not include "stop-and-go" traffic or vehicles under load.

-The "Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures" (EPA-450/2-92-004) states that the use of the paved road emission factor may result in a higher emissions estimate than that obtained from the unpaved road emission factor when the paved road has a high silt loading. In this case, the road is better characterized as unpaved in nature for emissions estimation.

2.1.4.1 Sources

The source of particulates on the road is the grinding of slag aggregates against each other under the weight of the trucks. These particles can become windborne as they are disturbed by the truck tires and the turbulence of the wind resulting from the passing vehicles.

2.1.4.2 Control Methods

Control methods used for this source area include: watering every four hours, monthly applications of a petroleum resin emulsion dust suppressant (such as Coherex, PennzSuppressD, or other similar product) and controlled speed limits. The Environmental Coordinator and Foundry Manager are responsible for ensuring that the control methods are followed and are effective.

2.1.4.3 Calculations

Granulated Slag Haul Road - Unpaved Road Equation

$$E = \frac{k(s/12)^a(w/3)^b}{(M_{dry}/0.2)^c}[(365-p)/365]$$ (AP-42, Section 13.2.2-1, 9/98)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT
k = 10 lb/VMT(constant for TSP)
a = 0.8 (constant for TSP)
b = 0.5 (constant for TSP)
c = 0.4 (constant for TSP)
s = 2.08 % silt content (from sampling data)
W = 35.0 tons, loaded
= 17.5 tons, empty
= 26.25 tons, average weight
M_{dry} = 0.2 % (default value for surface material moisture content dry conditions)
p = 114 days with rainfall ≥ 0.01 inch (AP-42 Figure 13.2.2-1)
S= 10 mph, average

(Per AP-42 Section 13.2.2-1 (9/98): The unpaved road equation should be multiplied by (S/15), where S is the average speed (mph) and S is less than 15 mph to prevent overestimation of emissions for slow moving vehicles.)

E = 5.01 lb/VMT x (10/15) = 3.34 lb/VMT (adjust for slow moving vehicles)

Basis and Daily Emission Calculation Assumptions:

- All trucks are 6 wheel dump trucks.
- 11 loads per day.
- 844 ft one way, 1688 ft round trip
- Vehicle passes per hour = (11 round trips/day x 2 passes per trip)/8 hour per day = 3 passes/hour

VMT =(# of round trips) x (round trip distance) = (11 trips)(1688 ft/trip)(1 mile/5280 ft)
= 3.52 miles/day

Emissions, lb/day = Emission factor, lb/VMT x VMT = (3.34 lb/VMT)(3.52 mile/day)
= 11.76 lb/day Granulated Slag Haul Road

Control and Control Efficiency Calculation

Control Method: Watering

C = 100 - (0.8 pdt/I) (EPA-450/3-88-008, Control of Open Fugitive Dust Sources, Eqn 3-2)

C= average control efficiency, %

p = 0.233 potential average hourly daytime evaporation rate, mm/hr (or 0.013 in/hr)
where p = 0.0049 x (value in Fig. 3-2 of EPA Document) for annual conditions

d = 3.000 vehicle pass/hour

t = 4.0 hours between applications

I = 2.722 application intensity, minimum L/m^2 (or $0.601 gal/yd^2$) (taken from actual site data)

C = 99.18 %

In addition to watering, petroleum resin emulsion dust suppressant (Coherex, PennzSuppressD, or similar product) is routinely applied to this source area. Dust suppressant has been applied to this area for several years and is reapplied on a monthly basis to ensure continued effectiveness. Additional applications may be applied if deemed necessary by the Environmental Manager.

2.1.5 E/W Canal Road

The E/W Canal Road runs between the East Gate and the E/W Canals. The primary vehicle that uses this road is the water truck. An occasional service vehicle may use the road. The water truck uses this road when refilling the water tank. As traffic on this road is limited to the water truck, silt and silt loading data were not obtained for this road. Since this road is similar to the Granulated Slag Haul Road, the percent silt and silt loading of the E/W Canal Road are assumed to be similar to that of the Granulated Slag Haul Road.

2.1.5.1 Sources

The source of particulates on the road is the grinding of slag aggregates against each other under the weight of the water truck. These particles can become windborne as they are disturbed by the truck tires and the turbulence of the wind resulting from the passing vehicles.

2.1.5.2 Control Methods

Dust management consists of regularly scheduled applications of a petroleum resin emulsion dust suppressant (such as Coherex, PennzSuppressD, or other similar product) and limited use of the road. The schedule for application of dust suppressant is discussed in Subsection 2.1.5.3. The Environmental Coordinator and Foundry Manager are responsible for ensuring that the control methods are followed and are effective.

2.1.5.3 Calculations

E/W Canal Road - Unpaved Road Equation

$$E = \frac{k(s/12)^a(w/3)^b}{(M_{dry}/0.2)^c}[(365-p)/365]$$ (AP-42, Section 13.2.2-1, 9/98)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT
k = 10 lb/VMT(constant for TSP)
a = 0.8 (constant for TSP)
b = 0.5 (constant for TSP)
c = 0.4 (constant for TSP)
s = 2.08 % silt content (from sampling data - assumed to be the same as the Granulated Slag Haul Rd)
W = 22.6 tons, loaded
= 6 tons, empty
= 14.3 tons, average weight
M_{dry} = 0.2 % (default value for surface material moisture content dry conditions)
p = 114 days with rainfall ≥ 0.01 inch (AP-42 Figure 13.2.2-1)

E = 3.70 lb/VMT

Basis and Daily Emission Calculation Assumptions:

- Truck capacity - 4000 gallons of water
- Truck refills 25 times per day, maximum
- 577 ft one way, 1154 ft round trip
- Silt content of road is similar to that of the Granulated Slag Haul Road

VMT =(#round trips) x (round trip distance) = (25 trips)(1154 ft/trip)(1 mile/5280 ft)
= 5.46 miles/day

Emissions, lb/day = Emission factor, lb/VMT x VMT = (3.70 lb/VMT)(5.46 miles/day)
= 20.20 lb/day E/W Canal Road

Control and Control Efficiency Calculation

Control Method: Petroleum Resin Emulsion Dust Suppressant

Petroleum resin emulsion dust suppressant (Coherex, PennzSuppressD, or similar product) has been applied routinely and is reapplied at a minimum of every two weeks, on a maintenance basis for continued effectiveness. For a two week reapplication frequency, an average control efficiency of 95 percent is expected, based on the control performance model illustrated in Figure 3-2 of "Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures" (EPA-450/2-92/004) or Figure 3-4 of "Control of Open Fugitive Dust Sources" (EPA-450/3-88-008). This figure is included in Section 5.0 of this document. Additional applications may be applied if deemed necessary by the Environmental Manager.

Control Efficiency for Dust Suppressant Application: 95 percent

2.1.6 Fines Building Entrance

The Fines Building has one entrance where material is hauled into the building and the empty trucks exit. All purchased fines are unloaded into the Fines Building rather than onto the scrapyard, except those in closed containers.

2.1.6.1 Sources

Dust carry-out from the purchased fines materials stored in the Fines Building is the primary source of fugitive dust. Vehicular traffic includes a front-end loader and semi-trailers traveling in and out of the building. The entrance to the Fines Building is composed of a concrete slab. However, due to the poor condition of the concrete (e.g. cracked, broken up), which makes the area impractical to sweep, the Fines Building Entrance resembles an unpaved area. Therefore, this area has been classified as unpaved.

2.1.6.2 Control Methods

Work practices and airborne reduction methods focus on dust management and on reducing materials deposited on the surface of the Fines Building Entrance. Work practices and control methods that have been implemented include:

-Watering every 4 hours.
-Not dropping truck loads until they are inside the building

The Fines Building consists of a concrete slab. However, due to the poor condition of the concrete, it is impractical to sweep the area with the Tennant sweeper. Due to the poor condition of the concrete, the Fines Building Entrance is best characterized as unpaved and unpaved road control techniques (watering) are used to control emissions from this area.

2.1.6.3 Calculations

Fines Building Entrance- Unpaved Road Equation

$$E = \frac{k(s/12)^a(w/3)^b}{(M_{dry}/0.2)^c}[(365-p)/365]$$ (AP-42, Section 13.2.2-1, 9/98)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT
k = 10 lb/VMT(constant for TSP)
a = 0.8 (constant for TSP)
b = 0.5 (constant for TSP)
c = 0.4 (constant for TSP)
s = 13.43 % silt content (from sampling data)
W= 17 tons, empty semi
40 tons, loaded semi
17 tons, front-end loader
90 percent of traffic is front-end loaders, 10 percent is semi traffic

Average Vehicle Weight (weighted average) = 0.10{(17 + 40)/2} + 0.90(17) = 18.15 tons, average

M_{dry} = 0.2 % (default value for surface material moisture content dry conditions)
p = 114 days with rainfall ≥ 0.01 inch (AP-42 Figure 13.2.2-1)

E = 18.51 lb/VMT

Basis and Daily Emission Calculation Assumptions:

- 16 round trips per day
- Round trip distance = 40 feet
- Vehicle passes per hour = (16 round trips per day x 2 passes per trip)/10 hour per day = 3.2

VMT = (# of round trips) x (round trip distance) = (16 trips/day)(40 ft/trip)(1mile/5280 ft)
= 0.121 mile/day

Emissions, lb/day = Emission factor, lb/VMT x VMT/day = (18.51 lb/VMT)(0.121 mile/day)
= 2.24 lb/day, total

Control and Control Efficiency Calculation

Control Method: Watering

C = 100 - (0.8 pdt/I) (EPA-450/3-88-008, Control of Open Fugitive Dust Sources, Eqn 3-2)

C= average control efficiency, %
p = 0.233 potential average hourly daytime evaporation rate, mm/hr (or 0.013 in/hr)
where p = 0.0049 x (value in Fig. 3-2 of EPA Document) for annual conditions
d = 3.2 vehicle pass/hour
t = 4.0 hours between applications
I = 2.722 application intensity, minimum L/m^2 (or 0.601gal/yd^2) (taken from actual site data)

C = 99.12 %

2.2 Paved Industrial Roads

Areas at Chemetco that are classified as paved include concrete paved areas that do not have raw scrap material storage and that experience limited traffic, but may contribute to sources of open fugitive particulate emissions. Also, some of the unpaved roadways and surfaces that have received regularly scheduled applications of petroleum resin emulsion dust suppressant for many years are classified as paved as they have formed a hardened solid surface. These roadways and surfaces can be best controlled by paved road control techniques with spot treatment of dust suppressant.

Due to the nature of the operations, some of the paved roads have a high surface loading that is more characteristic of an unpaved surface. The "Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures" (EPA-450/2-92-004) states that the use of the paved road emission factor may result in a higher emissions estimate than that obtained from the unpaved road emission factor when the paved road has a high silt loading. In such cases, the EPA document recommends using the unpaved emission factor to estimate emissions.

2.2.1 Truck Lot

The truck lot is located just to the south of Chemetco Lane, across from the employee parking lot. Chemetco receives slightly over half of its raw material by rail "piggy-back" trailers. These trailers are picked up by a local drayage company at the rail yard and brought to the truck lot, where they remain until the material is used. Approximately 20 full trailers are brought into the facility daily and approximately 20 empty trailers are removed from the facility daily. In addition, Chemetco removes approximately 20 full trailers from the lot daily to use the raw material contained in the trailer and returns approximately 20 empty trailers per day to the lot.

2.2.1.1 Sources

The Truck Lot is constructed of limestone and Chemetco-produced slag. It has received regularly scheduled applications of petroleum resin emulsion dust suppressant for many years and has the appearance of a paved surface. Due to the formation of a hardened surface, dust emissions from the grinding of the limestone and slag due to the truck weight are minimal. Dust sources include dust generated as the trailers are transported to and moved within the Chemetco facility (moved to the point-of-use and returned to the lot).

2.2.1.2 Control Methods

Control methods include limited use of the lot and continued application of petroleum resin emulsion dust suppressant (see Section 2.2.1.3 for the application schedule). Receiving hours are from 7:00 a.m. to 5:00 p.m, six days/week; therefore, the truck lot is active only during this time period. Not all of the truck lot is used; therefore, unused areas are not addressed.

2.2.1.3 Calculations

Truck Lot - Paved Road Equation

$E = k(sL/2)^{0.65}(w/3)^{1.5}$ (AP-42, Section 13.2.1.3, 10/97)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT
k = 0.082 lb/VMT(constant for TSP)
sL = 0.47 g/m^2 , surface silt Loading (from sampling data)
W = 30 tons, average weight of trucks

E = 1.012 lb/VMT

Basis and Daily Emission Calculation Assumptions:

- Average distance traveled in lot: 0.23 miles.
- 20 drops and pick-ups per day to the Chemetco facility, 20 trailers unloaded/day.
- Daily distance traveled: 9.2 miles (2 X 20 X 0.23 miles).

Emissions, lb/day = Emission factor, lb/VMT x VMT = (1.012 lb/VMT)(9.2 miles)
= 9.31 lb/day (6 days per week)

Control and Control Efficiency Calculation

Control Method: Petroleum Resin Emulsion Dust Suppressant

Petroleum resin emulsion dust suppressant (Coherex, PennzSuppressD, or similar product) has been applied routinely for several years and is reapplied every two weeks, on a maintenance basis for

continued effectiveness. For a two week reapplication frequency, an average control efficiency of 95 percent is expected, based on the control performance model illustrated in Figure 3-2 in "Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures" (EPA-450/2-92/004) or Figure 3-4 in "Control of Open Fugitive Dust Sources" (EPA-450/3-88-008). This figure is included in Section 5.0 of this document. Additional applications may be applied if deemed necessary by the Environmental Manager.

Control Efficiency for Dust Suppressant Application: 95 percent

2.2.2 AAF and Stack Area

The roadway through the AAF and Stack Area is subject primarily to traffic from fork trucks loading finished anodes. This area is relatively lightly traveled in terms of the number and weight of the vehicles. It is also protected on three sides from the wind.

2.2.2.1 Sources

Dust on the road that is stirred up by the traffic is from two main sources: (1) dust from the small baghouse and (2) dried material that has been cleaned out of the scrubber system during maintenance and spilled. The AAF area is an important consideration in evaluating particulate emissions due to the type of particulate sources. The scrubber system and baghouse both collect process materials which contains high levels of metals and metal oxides. Consequently, particulate from this source area may contain relatively high levels of lead.

2.2.2.2 Control Methods

Methods to control particulate emissions are aimed at minimizing the sources of dust and preventing the dust that is generated from becoming airborne until it can be collected and removed. Work practices and control methods that have been implemented include:

- maintaining low speed limits,
- cleaning the concrete under the AAF after downtime maintenance,
- ensuring that the baghouse chutes are closed before changing storage bins,
- ensuring that the storage bin lids fit securely after changing,
- wet sweeping the roadway with the Tennant sweeper every day after anode loading,

- thoroughly wetting the area prior to beginning to haul anodes and ensuring that the area remains wet by using a fire hose;
- sweeping underneath the baghouse whenever the bins are changed,
- inspections and repair of broken concrete that causes increased amounts of dust or impedes effective sweeping of dust.

It is a standard work practice to use a fire hose to water the area to ensure that the area remains wet. The water truck is also used to water the area. The sweeper truck driver will note on his daily checklist the time at which the AAF area was swept. The water truck driver will note on his check list each time the area is flooded using the water truck.

It should be noted that the AAF and Stack Area was designed as a basin for the collection of water in the event that the wet scrubbers overflow. Due to the nature of its design, the water applied for particulate control is contained in the basin and the area tends to remain continuously wet.

2.2.2.3 Calculations

AAF and Stack Area - Paved Road Equation

$E = k(sL/2)^{0.65}(w/3)^{1.5}$ (AP-42, Section 13.2.1.3, 10/97)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT
k = 0.082 lb/VMT (constant for TSP)
sL = 23.14 g/m^2, surface silt Loading (from sampling data)
W = 10.8 tons, average weight of fork trucks

E = 2.751 lb/VMT

Basis and Daily Emission Calculation Assumptions:

- 320 tons/day average anode cast.
- 10 anodes per load, average 84 trips to load cars.
- The distance to the furthest loading dock is 0.13 miles, or 0.26 miles round-trip.
- VMT = 84 trips x 0.26 mile/round trip = 21.84 miles
- Vehicle passes per hour = (84 round trips/day x 2 passes/trip)/10 hours/day = 16.8

Emissions, lb/day = Emission factor, lb/VMT x VMT = (2.751 lb/VMT)(21.84 miles)
= 60.08 lb/day AAF and Stack Area

Control and Control Efficiency Calculation

Control Method: Water Flushing and Sweeping

C = 96 - 0.263V
where:

C = average control efficiency, %
V = vehicle passes since application (16.8 vehicle passes/hour, water every 1/4 hours. Note: Area is watered by the water truck and by hand using a fire hose)

C = 94.90 %

2.2.3 Truck/Scale Drive

Chemetco receives most of its raw materials by tractor-trailers. Approximately 40 loads are received into the yard each day. About half of the loads are drop trailers from the truck lot and the other half either live scrap trucks or foundry supplies, such as sand or limestone, coming in directly from the highway. The drop trailers are transported by Chemetco-owned tractors for weighing and unloading. Chemetco receives loads from 7:00 a.m. through 5:00 p.m. daily.

2.2.3.1 Sources

Emissions generated within the Truck Lot are addressed in Section 2.2.1. This section addresses emissions carried onto the truck/scale drive from the truck lot and over the scale, and emissions generated from the live tractor-trailers. The dust source is mainly dust carry-out from the truck lot, spillage from the back of open vans and open trailers or dumps, dust carried in from the highway, and dust carried out from the scrap yard. The dust consists primarily of ground rock particles.

2.2.3.2 Control Methods

Work practices and airborne reduction methods focus on dust management and on reducing materials on the road. Work practices and control methods that have been implemented include:

- not opening trucks until they are in the fenced-in plant,
- informing outside drivers of plant speed limit,
- enforcing plant speed limit of 10 mph in this area,
- ensuring loaded trucks exiting Chemetco are securely closed before leaving the area in which they were loaded,
- water flushing and sweeping of area.

Watering of the area is recorded in the operator's logs by the water truck driver. The driver will also report any problems that occur in the area. The sweeper truck driver will note on his daily checklist the time at which the area was swept.

2.2.3.3 Calculations

Truck/Scale Drive - Paved Road Equation

$E = k(sL/2)^{0.65}(w/3)^{1.5}$ (AP-42, Section 13.2.1.3, 10/97)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT

k = 0.082 lb/VMT(constant for TSP)

sL = 3.95 g/m^2, surface silt Loading (from sampling data)

W = 17 tons, empty
40 tons, loaded
28.5 tons, average weight

E = 3.74 lb/VMT

Basis and Daily Emission Calculation Assumptions:

- 40 tractor-trailers in and out per day.
- 420 ft one way, 840 ft round trip (5 days per week).
- Vehicle passes per hour = (40 round trips/day x 2 passes/trip)/10 hours/day = 8
- VMT = (# of trips) x (round trip distance) = (40 trips/day)(840 ft/trip)(1 mile/5280 ft)
  = 6.36 mile/day

Emissions, lb/day = Emission factor, lb/VMT x VMT/day = (3.74 lb/VMT)(6.36 mile/day)
= 23.79 lb/day Truck/Scale Drive

Control and Control Efficiency Calculation

Control Method: Water Flushing and Sweeping

C = 96 - 0.263V
where:

C = average control efficiency, %
V = vehicle passes since application (8 vehicle passes/hour, water every 2 hours)
C = 91.79 %

2.2.4 Employee Parking Lot

The Chemetco facility operates for three shifts, seven days per week. On any given day, approximately 99 employees are working at the facility. Chemetco hosts less than 20 visitors per day, based on a review of the Visitor Log.

2.2.4.1 Sources

All visitors and employees enter via the west entrance to Chemetco Lane, travel over the railroad tracks and part of the same area trucks and trailers travel going into the plant. The source of dust for this area is mainly from dust blown over from the truck lot or dust that is tracked in by trailers and cars.

2.2.4.2 Control Measures

The employee parking lot is swept once per day using the Tennant Vacuum Sweeper. Sweeping is performed after the day shift, which is the most highly staffed shift, when there are the least number of cars in the lot.

2.2.4.3 Calculations

Employee Parking Lot - Paved Road Equation

$E = k(sL/2)^{0.65}(w/3)^{1.5}$ (AP-42, Section 13.2.1.3, 10/97)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT
k = 0.082 lb/VMT(constant for TSP)
sL = 0.09 g/m^2, surface silt Loading (from sampling data)
W = 2 tons, average weight

E = 0.0059 lb/VMT

Basis and Daily Emission Calculation Assumptions:

- The parking lot covers approximately 3750 yd^2.
- Cars travel 0.10 miles per day (traffic pattern in the lot is a 1-way loop with a total distance of 0.10 miles)
- 99 employee cars per day.
- 20 visitor cars per day.
- VMT = (# of trips) x (round trip distance traveled) = (99 + 20)x(0.1 mile) = 11.9 mile/day

Emissions, lbs/day = Emission factor, lbs/VMT x VMT/day = (0.0059 lb/VMT)(11.9 mile/day)
= 0.07 lb/day, Employee Parking Lot

Control and Control Efficiency Calculation

Control Method: Daily Sweeping with Tennant Vacuum Sweeper
Control Efficiency: 80 %

Note: The Tennant Model 830 II sweeper (which is the type of sweeper used at Chemetco) has been certified by the South Coast Air Quality Management District in California as meeting the Rule 1186 sweeper certification procedures and requirements for PM10-efficient sweepers. The purpose of Rule 1186 is to reduce the amount of particulate matter entrained in the ambient air as a result of vehicular traffic. One of the key points of this rule is the requirement that significant roads are swept with PM10 efficient sweepers. Appendix A of Rule 1186 establishes a standard testing procedure for determining the PM10 efficiency of street sweeping equipment. In order to be certified, the pick-up efficiency of the sweeping equipment must be greater than or equal to 80 percent. Information supporting the certification of the Tennant Model 830 II sweeper per Rule 1186 requirements is included in Appendix F.

2.2.5 ZnO Loading/Baghouse2 Access Road

The ZnO Loading/Baghouse2 Access road lies alongside what was once the tankhouse. This road is used on a limited basis for the loading of Zinc Oxide onto front-end loaders, as an access route for the delivery of some maintenance equipment, and for an occasional fork truck traveling through to the casting wheel.

2.2.5.1 Sources

The main sources of dust are dried Zinc Oxide from loading, spilled baghouse dust, and carry-out from the Scrap Yard and the Granulated Slag Haul Road. The entrainment of the dust into the air is due to the limited truck traffic.

2.2.5.2 Control Methods

The primary control methods for this source area are watering and sweeping with the Tennant Vacuum Sweeper. The water truck floods this area when the Scrap Yard Roads are flooded (every hour); however, this does not necessarily coincide with the loading of zinc oxide. Sweeping is performed once per day. Work practices have also been implemented to reduce fugitive dust emissions. After a zinc oxide container is loaded, it is moved out enough so that any spilled Zinc Oxide may be shoveled and swept. Zinc oxide containers are closed before they are moved so that zinc oxide is not spilled on the roadway.

2.2.5.3 Calculations

ZnO Loading/Baghouse2 Access Road- Paved Road Equation

$E = k(sL/2)^{0.65}(w/3)^{1.5}$ (AP-42, Section 13.2.1.3, 10/97)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT

k = 0.082 lb/VMT(constant for TSP)

sL = 9.80 g/m^2, surface silt Loading (from sampling data)

W = 25 tons, average

E = 5.542 lb/VMT

Basis and Daily Emission Calculation Assumptions:

- Approximately one truck load of zinc oxide per day.
- Baghouse trailer is changed approximately every other day.
- Limited use road. Occasionally used by water truck and sand delivery trucks.
- Total of approximately 8 front-end loaders per day.

- Average distance traveled per round trip is 690 ft.
- Vehicle passes per hour = (8 round trips/day x 2 passes/trip)/10 hours per day = 1.6
- VMT = (# of trips) x (round trip distance) = (8 trips)(690 ft/trip)(1 mile/5280 ft)
  = 1.045 mile/day

Emissions, lb/day = Emission factor, lb/VMT x VMT/day = (5.542 lb/VMT)(1.045 mile/day)
= 5.79 lb/day

Control and Control Efficiency Calculation
Control Method: Water Flushing and Sweeping

C = 96 - 0.263V
where:

C = average control efficiency, %
V = vehicle passes since application (1.6 vehicle passes/hour, water every 1 hour)

C = 95.58 %

2.2.6 West Chemetco Lane (Oldenburg Road)

The Chemetco facility is accessed via Chemetco Lane (formerly Oldenburg Road). The section adjacent to the Chemetco property is owned by Chemetco and is intended for industrial and plant traffic only. Prior to Chemetco ownership, the road was maintained by the county (tarred and graveled). There are two entrances to the Chemetco facility from Chemetco Lane. The west entrance is the main entrance to the plant and is used by employees entering the parking lot, delivery trucks, incoming material loads, contractors and visitors. Most traffic activity occurs between 7:00 a.m. and 5:00 p.m. weekdays. The gates to the plant and scrap yard areas are identified as the Scale Gate, the Southwest Truck Gate, and the Southeast Truck Gate. Raw material delivery trucks enter the facility by the front entrance and access the scrap yard via the Scale Gate or Southwest Gate.

2.2.6.1 Sources

Fugitive sources are exclusively from the carry-out and turbulence caused by traffic on this section of road. The dust sources are mainly dust carried out from the truck lot, dust carried in from the highway and dust carried out from the scrapyard.

2.2.6.2 Control Methods

Work practices and airborne reduction methods focus on dust management and on reducing materials on the road. Work practices and control methods that have been implemented include:

- Prevent unauthorized use of the road beyond the southwest truck gate during off-hours,
- Not opening trucks until they are into the fenced-in plant,
- Post maximum speed limit and inform outside drivers of plant speed limit,
- Enforce plant speed limit of 10 mph,
- Ensure loaded trucks exiting Chemetco are securely closed before leaving the area where they were loaded,
- Water flushing every 2 hours and sweeping of area twice daily.

West Chemetco Lane has a black-topped surface and is water flushed every 2 hours and swept twice a day with the Tennant Vacuum Sweeper. Sweeping is performed at mid-day and at the end of receiving hours (after 5 p.m.) and is recorded in the operators logs. The driver will also report any problems that occurred in the area.

2.2.6.3 Calculations

West Chemetco Lane- Paved Road Equation

$E = k(sL/2)^{0.65}(w/3)^{1.5}$ (AP-42, Section 13.2.1.3, 10/97)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT

k = 0.082 lb/VMT(constant for TSP)

sL = 0.82 g/m^2, surface silt Loading (from sampling data)

W = 17 tons, empty
40 tons, loaded
28.5 tons, average weight

E = 1.35 lb/VMT

Basis and Daily Emission Calculation Assumptions:

- All delivery vehicles are semi-trucks.
- Maximum of 40 incoming loads per day, consisting of 20 live loads and 20 drop loads, 5 days per week.
- For live loads: 100 ft in, 100 ft out (200 ft total).
- For drop trailers, 520 ft in to drop, 420 ft to scale, 420 ft from scale to lot, and 520 ft from lot to road. Section 2.2.3 Truck/Scale Drive reports emissions for travel to scale (round trip travel distance of 2 x 420 ft). Therefore; round trip travel distance for drop trailers is 2 x 520 ft = 1040 ft.
- Hours for receiving delivery trucks are from 7 AM to 5 PM.
- Vehicle passes per hour = (40 round trips per day x 2 passes per trip)/10 hours/day = 8

VMT for Raw Material Delivery (round trip) =
(# of live trailers x round trip distance) + (# of drop trailers x round trip distance) =
(20 x 200 ft) + (20 x 1040 ft) = 4.70 mile/day

Emissions, lb/day = Emission factor, lb/VMT x VMT/day = (1.35 lb/VMT)(4.70 mile/day)
= 6.35 lb/day, West Chemetco Lane

Control and Control Efficiency Calculation
Control Method: Water Flushing and Sweeping

$C = 96 - 0.263V$
where:

C = average control efficiency, %
V = vehicle passes since application (8 vehicle passes/hour, water every 2 hours)

C = 91.79 %

2.3 Scrap Yard

Due to the nature of its operations, the source area generating the largest amount of fugitive particulate emissions at the Chemetco facility is the Scrap Yard. Traffic in the Scrap Yard is heavy during material receiving hours due to the following activities: the raw material receiving, grading and sampling is ongoing; charges for the upcoming 24 hour period are being made up; and loaders are gathering high grade material for refine and melting cycles. The roadways through the scrap yard are generally well-defined, but may shift periodically with the size of the pile and the use of materials. Scrap Yard fugitive emissions result from a combination of wind erosion, traffic and pile management. This section addresses each of the components of the Scrap Yard fugitive emissions so that Best Management Practices for the entire source area can be identified and implemented.

Incoming raw material loads are weighed as they come across the scale into the Scrap Yard. The weighed loads then stop at the receiving building, where personnel open the trailers to visually inspect the material to ensure that it resembles the material contracted for prior to unloading. If the material passes inspection, the driver is instructed where to unload the material in the Scrap Yard. Depending on the trailer type and the material packaging, a drag may be used to pull material out of the trailer, the trailer may be dumped, or the trailer may be backed up to the dock where a fork truck is used to unload drums or pallets. Most of the raw material has some amount of dust associated with it. Some loads, such as those with large solids or turnings with moisture, may have minimal dust, but other loads may contain scrap that includes floor sweepings, fines, slags, skimmings or drosses and may contain a greater quantity of dust.

After material is unloaded, grading or sampling personnel inspect the material again. The price paid for the scrap material is based on three criteria: copper and tin content, copper recovery, and the degree to which the material must be processed to produce copper anode. Grading personnel consider each of the three criteria in assigning a material assay for payment and for subsequent process charge calculations. If the material cannot be visually graded or there is insufficient history to assign an assay, the material is representatively sampled.

Once the material assay is accepted by Chemetco and the supplier, Chemetco may proceed with processing the material, which includes "making up charges". Making up the charges involves adding specific amounts of certain assayed materials until the proper combination of copper and reductants or oxidants is achieved for optimal thermodynamics and recovery. Front-end loaders move material around to make up the charges, as well as carry the material into the foundry to be loaded into the pans for charging to the furnaces. Chemetco has implemented a Dust Handling System for the storage and charging of purchased fines, which greatly reduces Scrap Yard fugitive emissions from both vehicular traffic and material handling. The Dust Handling System is further discussed in Section 2.3.2: Control Methods.

2.3.1 Sources

Most of the particulate material in the Scrap Yard is from dirt in the scrap and containerized fines in purchased slags, skimmings and drosses. The particulates become airborne due to disturbance of material piles, wind erosion of the piles, and turbulence from truck and tractor traffic through the area.

2.3.2 Control Methods

Since the Scrap Yard is the largest contributor of fugitive emissions, Chemetco has identified and implemented several Best Management Practices to reduce Scrap Yard fugitive emissions. Work practices and dust management techniques have been employed. Work practices include:

- lowering speed limits to prevent dust from becoming airborne,
- dropping front-end loader charges only as high as necessary, rather than the entire 12-14 foot span of the bucket,
- hand broom sweeping small areas so that the Tennant sweeper can pick up dust,

- inspections of concrete to ensure that it is intact and that it is capable of being effectively swept,
- unloading scrap in pile areas when possible, rather than in drive areas where it is necessary that a front-end loader scrape it into a pile.

Dust management focuses primarily on lowering the amount of dust in the Scrap Yard where the wind is most able to pick up and scatter particulate matter. To accomplish this, Chemetco has implemented a Dust Handling System for storing and charging purchased fines. (Note: See the construction permit application for "Material Handling and Dust Injection System" for details of the equipment and the types of material and scrap that are usable). All raw materials containing large amounts of fines (purchased fines) are stored in the Fines Building, which prevents the generation of fugitive emissions due to wind erosion. The purchased fines are then conveyed directly to the process where they are injected, which prevents fugitive emissions associated with the handling of the fines.

Other methods for dust control include watering of the scrap storage areas during high traffic periods and sweeping. Dust that is hand swept is placed inside the Dust Handling System building or placed in a closed 55 gallon drum marked "Sweeps."

2.3.3 Calculations

A. Scrap Yard: Material Handling - Batch Drop

Emission Equation

$E = k(0.0032)(U/5)^{1.3}/(M/2)^{1.4}$ (AP-42, Section 13.2.4, 1/95)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/ton
k = 0.74, aerodynamic particle size multiplier
U = 5.5 mph, mean wind speed
M = 1.0 %, material moisture content, uncontrolled, solids
1.0 %, material moisture content, uncontrolled, miscellaneous

E = 0.00708 lb/ton, solids
E = 0.00708 lb/ton, miscellaneous

Basis and Emission Calculation Assumptions

-Purchased fines are handled and stored using the Dust Handling System.

-Fines are no longer included in the charges made up to go to the pans.

-All loads of purchased fines are delivered to the Fines Building, unless contained in closed container.

-The front-end loaders only drop material outside when making charges.

-Material dropped from trailers: 40 trucks/day x 42,000 lb/trailer = 1,680,000 lbs/day, or 840 ton/day

-Material breakdown from stockpile inventories: approximately 80% solids, 20% miscellaneous. A negligible amount of fines (less than 1%) is contained in the solids and miscellaneous materials. Based on an analysis of materials handled in 2000, fines constitute approximately 0.3 % of the solids and miscellaneous materials.

-Based on current operating conditions, the average charge is 47.5 tons. Eight charges are made up per day. Total quantity of charge material: (47.5 tons/charge)(8 charges/day) = 380 tons/day. Charges consist of solid and miscellaneous materials.

Trailer Unloading Emissions (5 days/week):

Emissions, lbs/day = Emission factor, lbs/ton x ton/day = (0.00708 lb/ton)(840ton/day)
= 5.95 lb/day

Charge-Make-up/Pile Maintenance Emissions:

Emissions, lbs/day = Emission factor, lbs/ton x ton/day
= (0.00708 lb/ton)(47.5tons/charge)(8 charges/day)
= 2.69 lb/day

Total Emissions: 8.64 lbs/day

Control and Control Efficiency Calculation

Control Method: Increased moisture content due to watering of scrap piles.

The EPA document "Control of Open Fugitive Dust Sources" (EPA-450/3-88-008) does not specify any control efficiencies for the batch drop of materials from front-end loaders or the end of trailers. Emissions from the scrap piles are controlled using water spray, which results in an increased moisture content of the material contained in the piles. Control efficiency

for the batch drop of material will be determined by calculating a controlled emissions rate based on an increased moisture content of the material.

$C = [1 - Ec/Eu]100$

where,
C = % Control Efficiency
Ec = Controlled Emissions
Eu = Uncontrolled Emissions

Emission Equation
$Ec = k(0.0032)(U/5)^{1.3}/(M/2)^{1.4}$ (AP-42, Section 13.2.4, 1/95)

Variables:

k	=	0.74, aerodynamic particle size multiplier
U	=	5.5 mean wind speed
Mc	=	3.0 % moisture content, controlled, solids
		3.0 % moisture content, controlled, miscellaneous
Ec	=	0.00152 lb/ton, solids
Ec	=	0.00152 lb/ton, miscellaneous

Control Efficiency = 78.53 %, solids
Control Efficiency = 78.53 %, miscellaneous

B. Scrap Yard: Storage Piles

Emissions associated with the wind erosion of Scrap Yard storage piles were calculated using the equation taken from AP-42 Section 11.2.3-5, 9/85 rather than the equation from AP-42 Section 13.2.5, 1/95. Based on discussion with IEPA, the "old" equation was used as it is believed that it is more representative of conditions in the Scrap Yard and it is consistent with previous calculation methodology.

Emission Equation

E = 1.7(s/1.5)((365-p)/235)(f/15) lb/day/acre (AP-42, Section 11.2.3-5, 9/85)

Variables and Emission Factor Calculation

s = 0.5 % silt, solids
1.0 % silt, miscellaneous

p = 114 days with precipitation exceeding 0.01 inches (AP-42 Figure 13.2.2-1)

f =

QTR 1 37.5 % of time unobstr. wind speed > 12 mph at the mean pile ht
QTR 2 35.9 % of time unobstr. wind speed > 12 mph at the mean pile ht
QTR 3 15.9 % of time unobstr. wind speed > 12 mph at the mean pile ht
QTR 4 20.0 % of time unobstr. wind speed > 12 mph at the mean pile ht

From Scrap Storage Piles

E QTR 1 = 1.513 lb/day/acre solids
E QTR 2 = 1.449 lb/day/acre solids
E QTR 3 = 0.642 lb/day/acre solids
E QTR 4 = 0.807 lb/day/acre solids
E Avg = 1.103 lb/day/acre solids

E QTR 1 = 3.026 lb/day/acre miscellaneous
E QTR 2 = 2.897 lb/day/acre miscellaneous
E QTR 3 = 1.283 lb/day/acre miscellaneous
E QTR 4 = 1.614 lb/day/acre miscellaneous
E Avg = 2.205 lb/day/acre miscellaneous

Basis and Emission Calculation Assumptions:

-High grade scrap is generally solids; the area is about 1 acre @ ½ in storage = 0.5 acres (Solids area = 0.5 acres)

-Low grade scrap is a mix of solids and miscellaneous. Conservatively, the emission factor will only be that for miscellaneous. The area is about 2 acres @ 3/4 in storage = 1.5 acres. (Miscellaneous area = 1.5 acres)

-Purchased fines are stored in Fines Building, except when in enclosed container.

From scrap storage piles:
Emissions, lb/day = Emission Factor, lb/day/acre x storage pile area, acres

Emissions 0.7565 lb/day QTR 1 solids
0.7245 lb/day QTR 2 solids
0.3210 lb/day QTR 3 solids
0.4035 lb/day QTR 4 solids
Average = 0.5514 lb/day solids

Emissions 4.5390 lb/day QTR 1 miscellaneous
4.3455 lb/day QTR 2 miscellaneous
1.9245 lb/day QTR 3 miscellaneous
2.4210 lb/day QTR 4 miscellaneous
Average = 3.3075 lb/day miscellaneous

Total = 3.8589 lb/day

Control Methods: Watering of Scrap Piles & Work Practices
Target Control Efficiency: 90%

% Control Efficiency = [1-Ec/Eu]x100
For a target control efficiency of 90 percent:
Ec = Eu(1-0.90)

To achieve that control efficiency, the moisture content should be increased. Use the following equation to determine the controlled moisture needed to achieve the target control efficiency:

$E_u/E_c = M_c^2/M_u^2$ (EPA-450/3-88-008, Control of Open Fugitive Dust Sources, p. 4-43)

where, Mc = % moisture, controlled
Mu = % moisture, uncontrolled

Mu = 1 %, uncontrolled moisture for solids and miscellaneous materials
Mc = 3 %, controlled moisture

Use the following equation to determine the quantity of water required to achieve 3 % moisture:

$Pw = (Mc - Mu - 1.41)/0.13$ (EPA-450/3-88-008, Control of Open Fugitive Dust Sources, Eqn 4-10)

where, Pw = mm of water to achieve control efficiency

use the following conversion from mm of water to gal/acre/day:
gal/acre/day = Pw(1065)

For Scrap Storage Piles:

	Ec	Mc	Pw	Gal/acre/day	Acres	Gal/day
Solids	.05514	3	4.54	4835	0.5	2418
Miscellaneous	.33075	3	4.54	4835	1.5	7253

C. SCRAP YARD: TRAFFIC

Based on conversations between IEPA, Shell Engineering, and Chemetco, it is believed that the Scrap Yard area is best characterized as unpaved. The classification as unpaved is based upon visual inspection of the Scrap Yard and high silt readings obtained from the Scrap Yard area. Since it is believed that the area is best characterized as unpaved, the unpaved road equation was used to determine emissions associated with scrap yard traffic.

Scrap Yard Traffic- Unpaved Road Equation

$$E = \frac{k(s/12)^a(w/3)^b}{(M_{dry}/0.2)^c}[(365-p)/365]$$ (AP-42, Section 13.2.2-1, 9/98)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/VMT
k = 10 lb/VMT(constant for TSP)
a = 0.8 (constant for TSP)
b = 0.5 (constant for TSP)
c = 0.4 (constant for TSP)
s = 38.10 % silt content (initial sample result)
49.79 % silt content (repeat sample result)
43.95 % silt content (average)
W = 17 tons, empty semi
= 40 tons, loaded semi
= 17 tons, front-end loaders
= 27.5 tons, drag

AP-42 states that the unpaved road emissions equation was not intended to calculate a separate emission factor for each vehicle class within a mix of traffic. Rather, an emission factor should be calculated that represents the "fleet" average of the vehicles traveling the road. For example, if 98 percent of the traffic is 2 ton cars and trucks while the remaining 2 percent consists of 20 ton trucks, then the mean weight is 2.4 tons. Therefore, a weighted average of vehicles traveling in the Scrap Yard was calculated based on the number of trips per day by each vehicle type. (See the Basis and Daily Emission Calculation Assumptions for further information supporting the number of trips/day).

Vehicle Type	Vehicle Weight	Trips/Day	% of Traffic
Empty Semi	17 tons	40	25
Loaded Semi	40 tons	40	25
Drag	27.5 tons	18	10
Front End Loaders	17 tons	64	40

Weighted Vehicle Average = 0.25(17 tons) + 0.25(40 tons) + 0.10(27.5 tons) + 0.40(17 tons) = 23.8 tons
M_{dry} = 0.2 % (default value for surface material moisture content dry conditions)
p = 114 days with rainfall ≥ 0.01 inch (AP-42 Figure 13.2.2-1)
S= 10 mph, average
(Per AP-42 Section 13.2.2-1 (9/98): The unpaved road equation should be multiplied by (S/15), where S is the average speed (mph) and S is less than 15 mph to prevent overestimation of emissions for slow moving vehicles.)

E = 54.72 lb/VMT x (10/15) = 36.48 lb/VMT (adjust for slow moving vehicles)

Basis and Daily Emission Calculation Assumptions:

- Live trucks enter at the front gate, drive the length of the Scrap Yard and exit at the front gate: 0.25 miles total each truck. (Note: The traffic pattern of the trucks in the Scrap Yard is a loop pattern. Therefore, the trucks do not retrace the same path when exiting the Scrap Yard).
- Drop trailers enter at the front gate, drive the entire length of the scrap yard and exit at the storeroom gate: 0.4 miles total each truck. (Note: The traffic pattern of the trucks in the Scrap Yard is a loop pattern. Therefore, the trucks do not retrace the same path when exiting the Scrap Yard).
- Assume 50% of loads are straight and can be dumped from trailer.
- Assume 50% of loads are mixed: 45% can be unloaded with a drag and 5% are unloaded with forktrucks at the dock.
- Of the maximum 40 loads per day, the drag follows 18 of the trucks and travels the same distance as the trucks. The average is 0.33 miles total for each truck.
- Maximum of 20 live trailers and 20 drop trailers per day.
- Front-end loaders are used to make-up charges for the foundry. Based on current operating conditions, the average charge is 47.5 tons. 8 trips are made to the yard to make up one charge. 8 charges are made up per day: 64 trips to scrap yard. The average trip to the scrap yard is 0.15 miles. Charge retrieval for the foundry requires the same number of trips. The average trip from the foundry to the charge pile is 0.053 miles. The front end loaders travel an average of 12.99 mile/day.

VMT, live loads = 20 trips x 0.25 miles/trip = 5 mile/day
VMT, drop loads = 20 trips x 0.4 miles/trip = 8 mile/day
VMT, drag loads = 18 x 0.33 miles/trip = 5.94 mile/day
VMT, front-end loaders = (distance traveled in yard) + (distance traveled in foundry)
= (64 trips x 0.15 mile/trip) + (64 trips x 0.053 mile/trip)
= 12.99 mile/day
Total VMT = 31.93 mile/day

Emissions, lbs/day = Emission factor, lb/VMT x VMT/day
= 36.48 lb/VMT x 31.93 miles/day
= 1164.81 lb/day

Control and Control Efficiency Calculation

Control Method: Watering.

Scrap Yard Traffic	**Vehicles/day**	**Passes/day**
Live Truck (Note: 1)	20	20
Drop Truck (Note: 1)	20	20
Drag (Note: 2)	18	18
Front-end Loaders (Note: 3)	64	~~96~~ 128
Total:		~~154~~ 186

Operating Hours: 10 hours/day

Vehicle passes/hr: ~~15.4~~ 18.6

Notes:

1 - Trucks drive in a loop through the Scrap Yard.

2 - The drag follows the trucks in a loop through the Scrap Yard.

3 - Front-end loaders travel randomly in the Scrap Yard. Assume that they retrace their path 50 percent of the time.

C = 100 - (0.8 pdt/I) (EPA-450/3-88-008, Control of Open Fugitive Dust Sources, Eqn 3-2)

where:

C= average control efficiency, %

p = 0.233 potential average hourly daytime evaporation rate, mm/hr (or 0.013 in/hr)
where p = 0.0049 x (value in Fig. 3-2 of EPA Document) for annual conditions

d = ~~15.4~~ vehicle pass/hour 18.6

t = 1.0 hours between applications

I = 2.722 application intensity, minimum L/m^2 (or 0.601gal/yd^2) (taken from actual site data)

C = ~~98.95 %~~
98.73%

SP 3-14-01

Scrap Yard: Overall Control Efficiency

	Uncontrolled Emissions (lb/day)	%	Controlled Emissions (lb/day)
Batch Drop	8.64	78.53	1.86
Wind Erosion - Piles	3.86	90	0.39
Traffic	1164.81	~~98.95~~ 98.73	~~12.23~~ 14.95
Total	1177.31		~~14.48~~ 17.20

Overall Control Efficiency: 98.77 %

SP
3-14-01

2.4 Slag Handling and Storage

Chemetco's metallurgical processes produce an inert slag. Slag can be produced via a water-cooled or air-cooled process. Currently, Chemetco processes slag using a water-cooled process. When Chemetco has removed all the copper, lead, and tin metal values from the slag and the metal is of sufficient purity, the molten slag is poured into the Kress Slag Pot. The Kress Slag Pot is transported to the slag granulation station where the molten slag is poured into a ladle which funnels a thin stream of the slag into a high pressure stream of water. When the water hits the slag, particles are formed and are carried with the water into the water barge below. The average time for the granulation pour is 3 to 4 minutes. After a day of granulating slag, the water barge is drained to the reservoir barge and a front-end loader is used to remove the wet granulated slag from the barge. The wet granulated slag is piled within a three-sided bin to drain. After excess water is drained from the slag, the wet slag is fed to a hopper for drying and screening in the Granulated Slag Screening Plant. (Note: Chemetco has been issued a permit by IEPA for the operation of the Granulated Slag Screening Plant. Emissions associated with this process are addressed in this permit).

A thin layer of residual slag will remain in the Kress Slag Pot after the molten slag is poured into the ladle in the slag granulation process. As this residual layer cools in the ambient air, a hardened layer of slag known as a "pot skull" will form.

2.4.1 Sources

Due to the nature of the process, insignificant emissions are associated with the molten slag and water-cooled slag granulation process. Negligible emissions are associated with the handling of the wet slag due to the high moisture content. Screening and drying of the wet slag is performed inside the Granulated Slag Screening Building. (Note: Chemetco has been issued a permit by IEPA for the operation of the Granulated Slag Screening Plant. Emissions associated with this process are addressed in this permit).

2.4.2 Control Methods

As emissions from the molten slag and water-cooled granulation process are insignificant, the implementation of control methods is not necessary and would do little to decrease emissions.

Control methods are focused on the slag handling and storage processes. As previously described, control methods have been implemented for the Kress Haul Road and Granulated Slag Haul Road. The slag historical storage piles are surface coated with a petroleum resin emulsion dust suppressant (such as Coherex, PennzSuppressD, or other similar product) to control particulate emissions.

2.4.3 Calculations

A) Slag Handling

1) Molten Slag Handling

Average Slag Analysis (%)

CuO	0.24
FeO	37.22
PbO	0.57
SnO	0.36
ZnO	6.65
SiO_2	30.14
CaO	2.23
Al_2O_3	4.15

Average temperature of slag out of furnace: 2080 degrees F
ZnO Melting Temperature: 3587 degrees F
ZnO Boiling Temperature: >3600 degrees F
PbO Melting Temperature: 1626 degrees F
PbO Boiling Temperature: 2761 degrees F

The lead oxide content of the slag is 0.57 %.
Lead oxide starts to fume at 2761 degrees F.
(Reference: Thermodynamic Properties of Minerals and Related Substances at 298.15 K (25.0 C) and one Atmosphere (1.013 Bars) Pressure and at Higher Temperatures).

The average temperature of the slag coming out of the furnace is well below the temperature at which lead oxide starts to fume. Therefore, no emissions are expected from the handling of molten slag, which includes Kress Pot Hauling and Slag Granulation.

Emissions = 0 lb/day for molten slag handling

2) Granulated Slag Screening

After a day of granulating slag, the water barge is drained to the reservoir barge and a front-end loader is used to remove the wet granulated slag from the barge. The granulated slag is removed from the water barge via a front-end loader and is piled within a 3-walled bin to drain. After excess water is drained from the slag, the wet slag is dried and screened inside the Granulated Slag Screening Plant. Due to the high moisture content of the slag, negligible emissions are expected from the handling of the wet slag.

Batch Drop Emission Equation

$E = k(0.0032)(U/5)^{1.3}/(M/2)^{1.4}$ (AP-42, Section 13.2.4, 1/95)

Variables and Emission Factor Calculation

E = calculated emission factor, lb/ton
k = 0.74, aerodynamic particle size multiplier
U = 5.5 mph, mean wind speed
M = 20 %, material moisture content

E = 0.00011 lb/ton

Basis and Daily Emission Calculation Assumptions:

- Maximum throughput for the Granulated Slag Screening Plant is 37.5 tons/hr
- In 2000, actual throughput for the Granulated Slag Screening Plant range from 17 ton/hr to 33.89 ton/hr. Average throughput = 25.45 ton/hr.
- Hours of operation for the Granulated Slag Screening Plant are 10 hours/day, 4 days/week. Front-end loader operates approximately 5 hours/day, 4 days/week.
- Assuming worst-case conditions for front-end loader: 37.5 ton/hr x 10 hour/day = 375 ton/day.

Emissions, lb/day = Emission factor, lb/ton x ton/day = (0.00011 lb/ton)(375 ton/day)
= 0.04 lb/day, at worst-case conditions

Total Emissions for Slag Handling = 0.0 lb/day (molten) + 0.04 lb/day (wet) = 0.04 lb/day

B) Existing Slag Storage

$E = k\sum P_i$, g/m^2 (for I = 1 to N) (AP-42, Section 13.2.5, 1/95)

Variables and Emission Factor Calculation

k = particle size multiplier (unitless) (k = 1 for PM30)

N = number of disturbances per year

P_i = erosion potential corresponding to the observed (or probable) fastest mile of wind for the ith period between disturbances, g/m^2

$P = 58(u^*-u_t^*)^2 + 25(u^* - u_t^*)$

$P = 0$ for $u^* \leq u_t^*$

u^* = friction velocity, m/s

u_t^* = threshold friction velocity, m/s

1) From Table 13.2.5-2 of AP-42: $u_t^* = 1.33$ m/s (material most similar to that expected at Chemetco)
2) Fastest Mile of record: 45 mph = 20 m/s (from wind speed data recorded at Chemetco site)
3) Correct height of anemometer from 7 m to 10 m:
   $u_{10}^+ = u_7^+ [\ln(10/0.005)/\ln(7/0.005)]$

   $u_{10}^+ = 1.05\ u_7^+ = 21$ m/s

4) $u^* = 0.053\ u_{10}^+$ (width of pile >> height)
   $u^* = 1.11$ m/s
5) $u^* < u_t^*$; therefore, P = 0
6) Emissions = 0 lb/day

Basis and Emission Calculation

Total area of processed and unprocessed slag is 12.92 acres.

Control and Control Efficiency Calculation

Control Method: Application of petroleum resin emulsion dust suppressant

Control Efficiency: 95 percent

Petroleum resin emulsion dust suppressant (Coherex, PennzSuppressD, or similar product) is applied to the slag storage piles to control emissions. The slag piles consist of large rock, are undisturbed, and are not located in a traffic area. A crust has formed on the surface of the slag piles due to repeated applications of the petroleum resin emulsion dust suppressant.

Based on the nature of the piles (large rock, undisturbed, no traffic) and the formation of a surface crust due to the application of dust suppressant, a control efficiency of 95 percent is expected. This expected control efficiency is consistent with the average control efficiency achieved for the application of petroleum resin emulsion dust suppressant to paved roads.

2.5 Zinc Oxide Bunker

The Zinc Oxide bunker is a concrete structure used to store Zinc Oxide. The Zinc Oxide was stored due to economics in the mid-1980's. The bunker is an approximate square structure with 1 ft wide concrete walls of varying heights. The zinc oxide material consists of metal oxides generated in the metallurgical foundry process. The following describes the process that produced the Zinc Oxide. A wet scrubber system was used to collect particulate containing Zinc Oxide from the furnace exhaust. Water from the scrubber was placed in settling ponds to allow the particulate to settle. Chemetco pumped the Zinc Oxide from the settling ponds to two earthen pits, where the Zinc Oxide was allowed to settle. The water was then pumped off the top of the settled material and returned to the ponds. Periodically, when the pits were full, a clam-shell loader was used to remove the Zinc Oxide from the pits. The Zinc Oxide was then placed on drying pads next to the pits. As the Zinc Oxide accumulated, it was moved to an area where the bunker is now located. Historical records show that the lowest moisture content achieved in drying the Zinc Oxide in this manner was 45 percent. Also, due to the hygroscopic nature of the caustic used to maintain the appropriate pH range in the scrubber water, the Zinc Oxide tends to always remain somewhat wet. Approximately 65,000 tons of material is stored in the bunker, including dirt and the slag that covers the north and west sides of the pile.

2.5.1 Sources

This pile remains undisturbed, except for occasional samples which are collected. The only source of fugitives is from wind erosion to the pile surface.

2.5.2 Control Methods

As previously stated, the Zinc Oxide is a wet material. In the undisturbed pile, the surface crusts over while the material below the surface remains wet. Chemetco has employed several control methods to prevent wind erosion of the pile. On the south side, the surface of the Zinc Oxide pile is below the level of the concrete wall and is protected from the wind. On the north side, dirt was piled up and large pieces of slag were placed on top of the dirt to provide wind protection. In addition, a petroleum resin emulsion dust suppressant (Coherex, PennzSuppressD, or similar product) is applied annually to form an adhesive crusted layer.

2.5.3 Calculations

$E = k\sum P_i$, g/m^2 (for I = 1 to N) (AP-42, Section 13.2.5, 1/95)

Variables and Emission Factor Calculation

k = particle size multiplier (unitless) (k = 1 for PM30)

N = number of disturbances per year

P_i = erosion potential corresponding to the observed (or probable) fastest mile of wind for the ith period between disturbances, g/m^2

$P = 58(u^*-u_t^*)^2 + 25(u^* - u_t^*)$

$P = 0$ for $u^* \leq u_t^*$

u^* = friction velocity, m/s

u_t^* = threshold friction velocity, m/s

1) From Table 13.2.5-2 of AP-42: $u_t^* = 1.33$ m/s (material most similar to that expected at Chemetco)
2) Fastest Mile of record: 45 mph = 20 m/s (from wind speed data recorded at Chemetco site)
3) Correct height of anemometer from 7 m to 10 m:
   $u_{10}^+ = u_7^+ [\ln(10/0.005)/\ln(7/0.005)]$

   $u_{10}^+ = 1.05\ u_7^+ = 21$ m/s

4) $u^* = 0.053\ u_{10}^+$ (width of pile >> height - only top surface exposed due to bunker walls)
   $u^* = 1.13$ m/s
5) $u^* < u_t^*$; therefore, P = 0
6) Emissions = 0 lb/day

Control Efficiency Calculation

Control Methods: High moisture content of material & application of dust suppressant

Expected Control Efficiency due to high moisture content:

$$E_u/E_c = M_c^2/M_u^2$$

Where:

M_c = 45 %, controlled moisture

M_u = 1 %, uncontrolled moisture

Expected Control Efficiency: 99.95 %

3.0 OPEN SOURCE FUGITIVE DUST CONTROL PLAN

This section describes the Control Plan organization, procedures, and documentation requirements for the control of sources of open fugitive dust at Chemetco, Inc. The primary objective of this section is to document that the control measures outlined in this Control Plan have been fully implemented. Applicable procedures and forms are shown and discussed. Program auditing procedures are included so that deficiencies can be identified and corrected through planning, design, work instructions and procedures, and the selection and training of qualified personnel.

3.1 Estimated Control Efficiencies

Uncontrolled emissions can be reduced by reducing the source area, the source material, or by implementing appropriate control methods. Table 3-1 summarizes the calculated uncontrolled emissions, the expected control efficiency, and the calculated controlled emissions for the identified source areas. An overall control efficiency is also reported.

Emissions were calculated using the equations presented in the most recent edition of AP-42, with the exception of the Scrap Yard storage piles. Based on conversations with IEPA, emissions from the Scrap Yard storage piles were calculated using the equation from the previous edition of AP-42 (9/85) since it is believed that this equation would better represent emissions due to the nature of operations at the scrap yard. Prior revisions of the Control Plan utilized equations taken from previous editions of AP-42; therefore, the emissions reported in the prior Plan revisions were calculated using different estimation techniques. Since different estimation techniques were used, the direct comparison of emissions reported in this document to emissions reported in prior editions of the Control Plan is not possible.

TABLE 3-1
EMISSIONS SUMMARY TABLE

Area of Control	Uncontrolled Emission (lbs/day)	Control Efficiency (percent (%))	Controlled Emissions (lbs/day)
Kress Haul Road	90.28	98.36	1.48
Truck Lot	9.31	95.00	0.47
AAF and Stack Area	60.08	94.90	3.06
Truck/Scale Drive	23.79	91.79	1.95
Employee Parking Lot	0.07	80.00	0.01
ZnO Loading/Baghouse	5.79	95.58	0.26
Scrap Yard	1177.31	98.77	~~14.48~~ 17.20
Zinc Oxide Bunker	0.00	99.95	0.00
Slag Handling	0.04	0.00	0.04
Slag Storage	0.00	95.00	0.00
Granulated Slag Haul Rd	11.76	99.18	0.10
West Chemetco Lane	6.35	91.79	0.52
Fines Building Entrance	2.24	99.12	0.02
E/W Canal Road	20.20	95.00	1.01
TOTALS	**1407.22**		~~23.40~~ 26.12

Overall Efficiency: 98.34 %

somewhat lower

3-14-01
Confirmed with Paula Morgan

3.2 Organization/Responsibilities

Key to the success of any plan are the personnel that manage, organize and are responsible for key tasks. Responsible personnel for the implementation and on-going maintenance of this plan are:

Environmental Coordinator/ Manager: The Environmental Coordinator's responsibilities include review of all control plans and data, authorization of revisions to work plans and to this control plan, record-keeping and documentation assurance. It will be the Environmental Coordinator's responsibility to insure that all responsible managing personnel understand their areas of responsibility.

Managing Personnel: Managing personnel are responsible for ensuring that employees working for them follow prescribed work practices. These personnel will have a responsibility to ensure that their work area is adequately cleaned and managed in accordance with this plan. It is their responsibility to inform the Environmental Coordinator/ Manager of defects in the plan, inadequate cleaning or fugitive reduction in their area or problems in the system. The Area Managers are:

Yard/Foundry Manager: Manages the receiving and sampling of incoming scrap. Responsibilities include: ensuring that drivers in the Scrap Yard obey the speed limits; ensuring that loader drivers follow prescribed work practices for emissions reduction; ensuring that the area is swept and watered thoroughly when needed. Changes to the daily plan should be discussed with the Environmental Coordinator and documented.

Mobile Maintenance Manager:	The Mobile Maintenance Manager is responsible for preventative and corrective maintenance of cleaning equipment such as the Tennant sweeper and the truck and for documenting maintenance procedures (Note: The Tennant Sweeper is maintained by a Tennant Representative. A Tennant Service representative visits the facility weekly to perform maintenance checks and activities on the Tennant Sweeper). Efforts will be made to coordinate maintenance with operating schedules as much as possible. If a piece of control equipment will be down for several unscheduled days, back-up measures will be taken.

Project personnel performing key tasks that directly affect the quality of results achieved by this plan will each receive a copy of this plan. Each plan holder is responsible for implementing the plan provisions as it applies to his or her role in the project.

3.3 Quality Control - Field Activities

This section describes the specific activities aimed at the prevention and early detection of circumstances adversely affecting the quality of any of the control actions or work practices.

3.3.1 Document Control

Document Control is a formal system that ensures:

1) All participants in the project are promptly informed of revisions to Work Practice Procedures or changes in the work plan; and

2) All critical documents generated during the course of the operations, inspections and corrective actions are accounted for.

All Work Practices, Inspections, Standard Operating Procedures and Operating Plans have the following information on each page:

- Page Number;
- Total Number of pages in the document; and
- Revision date.

When any of these documents are revised, the affected pages are reissued to all personnel listed as document holders with updated revision dates. The revised document(s) is accompanied by explicit instructions as to which documents or portions of documents have become obsolete.

Control of and accounting for documents generated during the course of the project is achieved by assigning a responsible person for document issuance, execution and archiving. The individual responsible for these tasks is the Environmental Coordinator, with the exception of the Wang Mobile Maintenance Reports, Tennant Maintenance Reports, and Work & Purchase Orders for which the responsible individual is the Manager of Mobile Maintenance.

Table 3-2 lists the key documentation media for the project and corresponding responsible parties for issuance, execution and archiving.

TABLE 3-2
DOCUMENTATION MEDIA

Daily Vehicle Driver Logsheets
Sampling Data Sheets
Ambient Air Monitoring Quarterly Reports
Wang Mobile Maintenance Reports
Tennant Maintenance Records
Employee Training Records
Work and Purchase Orders
Monthly Fugitive Emissions Report (as audit)
Efficiency Calculations

All documentation for the project will be recorded in indelible ink. Table 3-3 summarizes the applicable Standard Operating Procedures for fugitive control.

TABLE 3-3
STANDARD OPERATING PROCEDURES

Procedures for Collecting Representative Dust Samples
Procedures for Collecting Representative Pile Samples
Analyses (Drying and Screening) of Dust Samples
Pavement Inspection
Changing Baghouse1 Dust Bins
Changing Baghouse2 Freight Containers

3.4 Training

All personnel working on fugitive emission control will be properly trained. Personnel will be given instructions specific to their job and any related activities covering the following areas:

- Organization and lines of communication and authority;
- Overview of this Control Plan and individual work plans; and
- Documentation requirements.

3.5 Control Assurance Auditing and Corrective Action Procedures

Supporting documentation will be reviewed for completeness, correctness and legibility along with ambient air monitoring results, visual results and the comments of responsible personnel to assess the effectiveness of the control program. This audit process is the responsibility of the Environmental Manager. Actions taken to correct deficiencies identified in an audit are referred to as corrective action. The following establishes procedures for closed-loop corrective actions to the noted deficiencies.

Monthly reports are used as an audit tool and are distributed to the appropriate individuals, including: Maintenance Supervisor, Shift Maintenance Foreman, Labor Foreman, and drivers, when necessary. Deficiencies noted in the monthly reports are discussed, and appropriate corrective actions are determined. The following month's report documents the successful execution of the corrective actions.

The Environmental Office maintains a file of the monthly reports. The Control Plan is

reviewed annually to determine if any changes are necessary based upon the information obtained in the monthly reports.

3.6 Tennant Vacuum Sweeper Control Plan and Maintenance

The Tennant Vacuum Sweeper will be used on all paved plant surfaces as identified in Table 3-4 These areas are numerically labeled and can be coordinated with areas shown on Drawing 1 in Appendix A.

The Sweeper Daily Logsheet is shown in Figure 3-1 and will be used by the sweeper driver to record the sweeper operation. The daily logsheet will reflect any scheduled or unexpected downtime, and any cursory observations such as pavement condition, excessive dust in any particular area, etc. Weather conditions will be reported strictly from observation. Rain or other precipitation does not usually impede the operation of the sweeper, unless the conditions are extreme (e.g. heavy rain, snow and/or ice accumulation).

Maintenance of the sweeper is contracted through the manufacturer. Tennant service representatives perform preventative maintenance of the sweeper once per week per the manufacturer's recommended service schedule. The Tennant Service representatives are also called in on an as-needed basis for any other maintenance needs (e.g. sweeper goes down).

Chemetco has purchased a second Tennant Sweeper (2/2001). The addition of a second sweeper allows more flexibility in the sweeping schedule and provides a backup sweeper in the event of sweeper mechanical problems.

TABLE 3-4
TENNANT SWEEPER ASSIGNMENTS

Area Number	Name	Planned Frequency
1	Receiving - Front Drive - West Chemetco Lane to Farm Road - Truck Scale	Twice/day after receiving
2	Scrap Yard - North Pad - ZnO Loading/Baghouse2 Access - Dust Handling/North End	Once/day after receiving
3	AAF Area	Once/day after anode loading
4	Employee Parking Lot	Once/day after day shift

* Does not exclude pile areas or areas where there is equipment.

FIGURE 3-1
SWEEPER TRUCK DAILY LOGSHEET

Date: _____ Shift: _____ Operator: _____

Weather: _____ Rain? _____Yes _____No Temperature: _____

Odometer Reading at Start: _____ Service Hours at Start: _____

Odometer Reading at End: _____ Service Hours at End: _____

ZONE	ZONE NAME	TREATMENT TIMES			REMARKS*
1	Chemet. Lane/Truck Scale Drive	_____	_____		_____
After Receiving Hours					
2	Scrap Yard Roads	_____			_____
After Receiving Hours					
3	AAF Area	_____			_____
After Anode Loading					
4	Employee Parking Lot	_____			_____
Empty Bin		_____	_____	_____	_____

COMMENTS: _____

Date: _____ Signature asserting review: _____

*Note items that could cause problems. For example, large pieces of scrap in roadways, broken concrete, etc. or of situations that someone should be aware of that you might notice. This includes problems at the deep well, excessive dust in an area that may need to be cleaned, etc. The "COMMENTS" section should note any problems with the truck itself that the Mobile Shop should know about.

3.7 Water Truck Control Plan and Maintenance

The water truck will be used on all paved and unpaved plant surfaces identified in Table 3-6. (Note: In addition to the water truck, a hose is also used to wet the AAF and Stack Area). The frequency each area will be watered is also shown in this table. The areas are labeled alphabetically and can be coordinated with areas shown on Drawing 2 in Appendix A.

Figure 3-3 shows the driver record that will be maintained for water truck operation. This record includes a section for corrective action maintenance. Preventative maintenance schedules are shown in Figure 3-4. Daily sheets will reflect any scheduled or unexpected downtime. Cursory observations such as pavement condition, excessive dust in any particular area, etc. will also be noted.

Weather conditions will be reported from driver observation on the water truck daily logsheet and are a consideration in the effective implementation of the watering program. Rainfall may be substituted for water treatments. As a general rule, one-quarter inch of rainfall will be substituted for one treatment, unless, the pavement dries quickly (e.g. summer) and watering is necessary to control the dust. In the event of freezing weather that results in ice formation and dangerous driving conditions, treatments may be temporarily suspended until conditions permit the safe implementation of the watering program.

TABLE 3-5
WATER TRUCK ASSIGNMENTS

Area Number	Name	Planned Frequency
Zone A	Truck/Scale Drive/West Chemetco Ln.	Every 2 hours during receiving
Zone B	Scrap Yard Roads	
	- Scrap Yard	Every 1 hour during receiving
	- North Pad	Every 1 hour during receiving
	- Fines Bldg. Entrance	Every 4 hours during receiving
	- Granulated Slag Haul Road	Every 4 hours during shipping
	- Zn/Oxide Loading/BH2 Road	Every 1 hours during shipping
Zone C	Scrap Yard Piles	
	- Solids - High Grades	300 gallons every 3 hours
	- Miscellaneous - Low Grades	900 gallons every 3 hours
Zone D	Kress Road	At least once per day
Zone E	AAF Area (AAF Area also watered by hand with a fire hose)	Every 4 hour between 7 a.m. and 5 p.m.

FIGURE 3-2 WATER TRUCK DAILY LOGSHEET

Date: _____ Day: _____ Shift: _____ Operator: _____
Weather: _____ Rain? ___Yes ____No Temperature: _____

Odometer Reading at Start: _____ Service Hours at Start: _____
Odometer Reading at End: _____ Service Hours at End: _____

ZONE	ZONE NAME	TREATMENT TIMES										
A	**Scale / Receiving**											
	Every 2 hours during receiving	_____	_____	_____	_____							
B	**Scrap Yard Roads**											
	(Scrap Yard & North Pad)	Every hour during receiving	_____	_____	_____	_____	_____	_____	_____	_____	_____	
B	(Fines Bldg. Entrance)	Every 4 hours during receiving	_____	_____								
B	(Granulated Slag Haul Rd.)	Every 4 hours during shipping	_____	_____	_____							
B	(Zn/Oxide Loading/BH2 Road)	Every 1 hours during shipping	_____	_____	_____	_____	_____	_____				
C	**Scrap Piles - Solids**											
	300 gallons every 3 hours	_____	_____	_____	_____							
C	**Scrap Piles - Misc.**											
	900 gallons every 3 hours	_____	_____	_____	_____							
D	**Kress Road**											
	At least once per day	_____										
E	**AAF Area**											
	Every 4 hours during anode loading	_____	_____	_____								
	Refill Tank	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

CODES *
M = Missed Treatment
S = As Scheduled
A = Already Wet
E = Equipment Failure
If a treatment is missed more than 15 minutes, it is considered "MISSED."

COMMENTS: _____

CORRECTIVE ACTION (If necessary): _____

Date: _____ Signature asserting review: _____

* Note items that could cause problems. For example, large pieces of scrap in roadways, broken concrete, etc. or of situations that someone should be aware of that you might notice. This includes problems at the deep well, excessive dust in an area that may need to be cleaned, etc.
The "COMMENTS" section should note any problems with the truck itself that the Mobile Shop should know about.

FIGURE 3-3
WATER TRUCK
PREVENTATIVE MAINTENANCE SCHEDULE

Wang Master File Code:	715*, 720*, 721*, or 722*
Description:	Water Truck
Equipment Type:	TT
Annual^ Days Maintenance:	45, 90, 270, 365

Maintenance Description	45 days	90 days	270 days	365 days
Check Lights, W/S Wiper, B/U Alarm & Instruments	X	X	X	X
Check Electrolyte Level in Batteries & Record Hydrometer Reading	X	X	X	X
Clean & Inspect Battery Connections	X	X	X	X
Drain Air Tank	X	X	X	X
Replace Air Cleaner Element Only If Restriction Gauge Is in Red Zone	X	X	X	X
Torque Wheel Rim Lug Nuts	X	X	X	X
Check All Drive Belts for Wear, Tension & Alignment	X	X	X	X
Check Motor Mounts and Transmission Mounts for Tightness	X	X	X	X
Check Entire Frame for Any Cracks or Signs Of Bending, Loose Bolts, Etc.	X	X	X	X
Wash out Radiator	X	X	X	X
Record Freezing/Boiling Points of Coolant	X	X	X	X
Check Fluid Level in Differential	X	X	X	X
Torque Axle Flange Nuts to 130 Lb. Ft.		X	X	X
Drain Water & Sediment from Fuel Tank			X	X
Lubricate Chassis per Lubrication Schedule L			X	X
Change Engine Oil & Oil Filters			X	X
Change Fuel Filters			X	X
Change Coolant Filter			X	X
Replace All Four Drive Axles				X

* To Look Up PM and Corrective Action Work Completed
^ After Put in Service

4.0 COMPLIANCE

Chemetco, Inc. shall ensure the implementation and on-going performance of the control methods identified in this control plan. Incorporated throughout this plan are checks and documentation requirements that will help ensure that the elements of the plan are carried out. This section addresses the course of action Chemetco will take should a part of the plan fail to be carried through.

4.1 Inclement Weather

General observations of weather conditions are recorded on the daily logsheets. In addition, Chemetco maintains records of precipitation amounts. As previously stated, Chemetco will substitute one flooding treatment for 0.25 inches of rain, when appropriate, as long as substitution does not allow drying out of the pavement between required application times. For weather conditions that will result in the formation of ice from any flooding, Chemetco will temporarily suspend the watering activities; however, sweeping will continue to be performed as conditions allow.

4.2 Equipment Malfunctions

Chemetco keeps records of all maintenance to all mobile equipment. Each of the logsheets contains an area for comments on equipment malfunctions and corrective action. Chemetco has a second water truck that will be used in case the primary equipment is down. In the case of a malfunction that will cause Chemetco to miss more than several treatments, Chemetco will notify the Agency within seven days.

As previously stated, Chemetco has purchased a second Tennant sweeper (2/2001). The addition of a second sweeper allows a backup sweeper in the event one of the sweepers is down due to mechanical problems.

4.3 Continued Compliance

Illinois air pollution regulations address fugitive emissions at Title 35, Subtitle B, Chapter I, Subchapter C, Part 212, Subpart K. These regulations require certain facilities to develop an operating program that is designed to significantly reduce fugitive particulate matter emissions. The regulations outline the minimum requirements of the operating program and require periodic amendment of this program to ensure that it is current.

It is Chemetco's intention to comply with all plans and actions outlined in this document, which serves as the operating program for the control of fugitive emissions at the Chemetco facility. Chemetco will evaluate the effectiveness of this plan in achieving the significant reduction of fugitive emissions, as required, and the requirements of any new regulation. Control measures have been included in this plan that can be expected to continuously achieve a minimum overall control efficiency of 90 percent in accordance with calculation consistent with the USEPA document "Control of Open Fugitive Dust Sources" (EPA -450/3-88-008) (as summarized in Table 3-1). Should Chemetco feel the plan needs to be modified to ensure continued compliance, a written proposal shall be submitted to the Agency prior to implementing that change. If necessary, the entire document will be modified, but it is also acceptable to submit only individual sections or pages to reflect changes.

5.0 MAINTENANCE FOR UNPAVED ROADS

This section defines maintenance guidelines for the application of petroleum resin emulsion dust suppressant, such as Coherex, PennzSuppressD, or other similar product, to the unpaved roads at the Chemetco, Inc. facility. This maintenance section becomes effective after a 95% average control efficiency has been achieved based upon ground inventory levels. The term "ground inventory" is a measure of residual effects from previous applications. Ground inventory is found by adding together the total volume (per unit area) of concentrate applied since the start of the dust control program. Figure 3-4 of EPA- 450/3-88-008 (included in this section) shows the ground inventory (in gallons per square yard) of dust suppressant required and the frequency of application to obtain and maintain the 95% control efficiency. Because dust suppressants must be periodically reapplied to unpaved roads, the use of the time-average values given in Figure 3-4 are appropriate. (Note: Figure 3-4 of EPA-450/3-88-008 can also be found as Figure 3-2 of EPA-450/2-92-004).

Chemetco has routinely been applying dust suppressant on the unpaved roads and has achieved the 95 percent average control efficiency as determined by ground inventory in the figure included in this section (Figure 3-4 of EPA- 450/3-88-008). In order to maintain the 95 percent average control efficiency, Chemetco reapplies dust suppressant on a scheduled or maintenance basis.

All areas of unpaved road are subject to periodic review to ensure proper maintenance is being achieved. Additional applications of petroleum resin emulsion dust suppressant, such as Coherex, PennzSuppressD, or other similar product, to an area will be performed if conditions warrant such treatment.

Information on petroleum resin emulsion dust suppressant can be found in Appendix B.

5.1 Reporting

Chemetco shall notify the Agency in writing when each road segment has achieved 95 percent average control efficiency based on ground inventory. Notification is mandatory before the maintenance guidelines can be implemented. Notification can be made in conjunction with the monthly fugitive dust program reports.

All areas of unpaved road are subject to periodic review to ensure that proper maintenance is achieved. Petroleum resin emulsion dust suppressant treatments, in addition to the regularly scheduled treatments, will be performed if conditions warrant supplemental treatments.

5.1.1 Granulated Slag Haul Road

Petroleum resin emulsion dust suppressant has been applied to this area for several years and is reapplied on a monthly basis to ensure continued effectiveness. Watering is also used as a control technique.

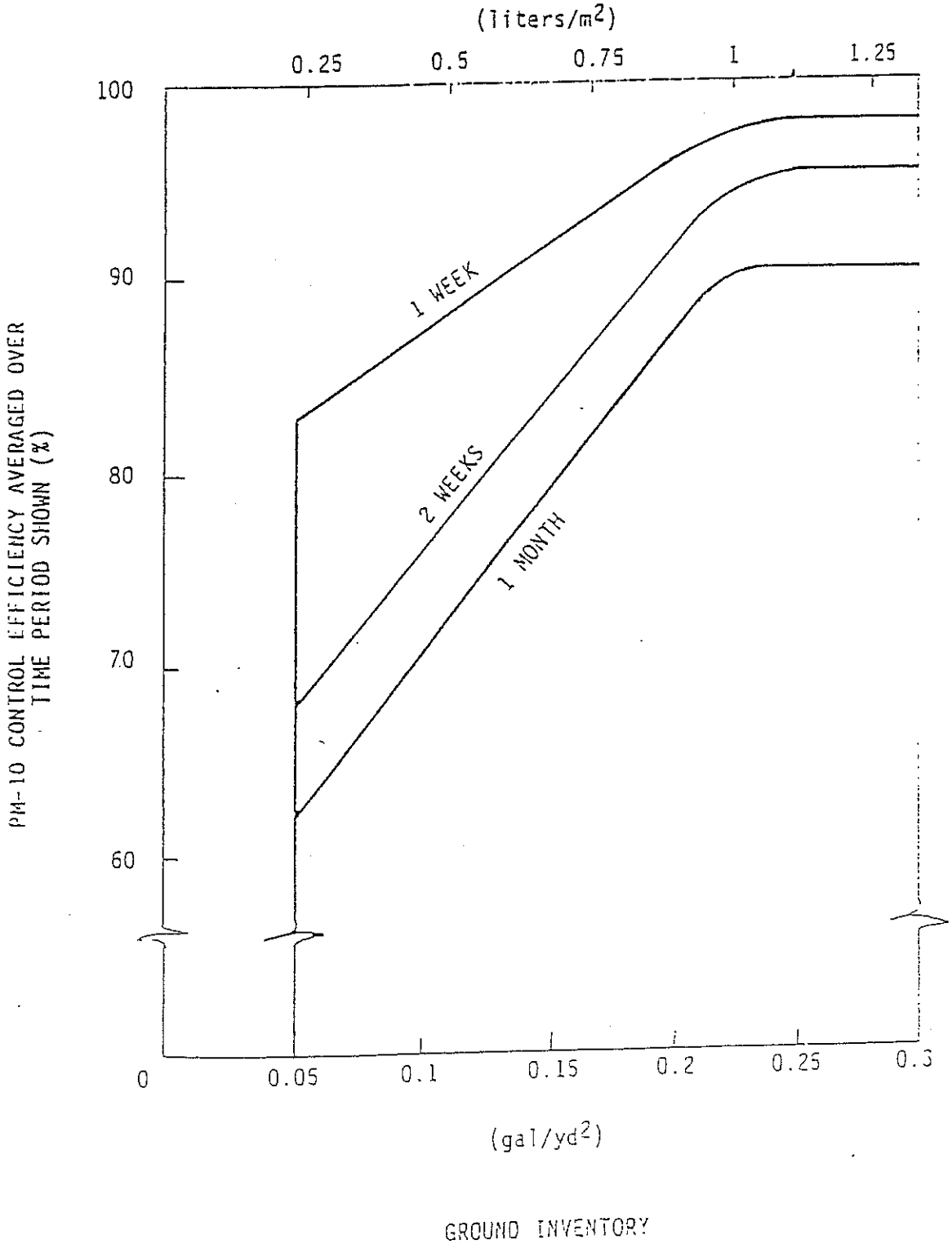
5.2.2 E/W Canal Road

Petroleum resin emulsion dust suppressant has been applied to this area in the past and is reapplied at a minimum of every two weeks to ensure continued effectiveness

5.2.3 Truck Lot

Petroleum resin emulsion dust suppressant has been applied to this area for several years and is reapplied every two weeks to ensure continued effectiveness.

Figure 3-4. Average PM10 Control Efficiency for Chemical Suppressants (Taken from CONTROL OF OPEN FUGITIVE DUST SOURCES, Midwest Research Institute, Kansas City, MO, 9/88, U.S. Department of Commerce - NTIS)



6.0 REFERENCES

Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. AP-42 Fourth Edition, September 1985.

Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. AP-42 Fifth Edition, September 1988.

Control of Open Fugitive Dust Sources, EPA-450/3-88-008, September 1988.

Operating Records, Chemetco, Inc. 2000.

Fugitive Dust Sampling, Shell Engineering, June, 2000.

Fugitive Dust Sampling Analysis, Prairie Analytical Systems, Inc., June, 2000.

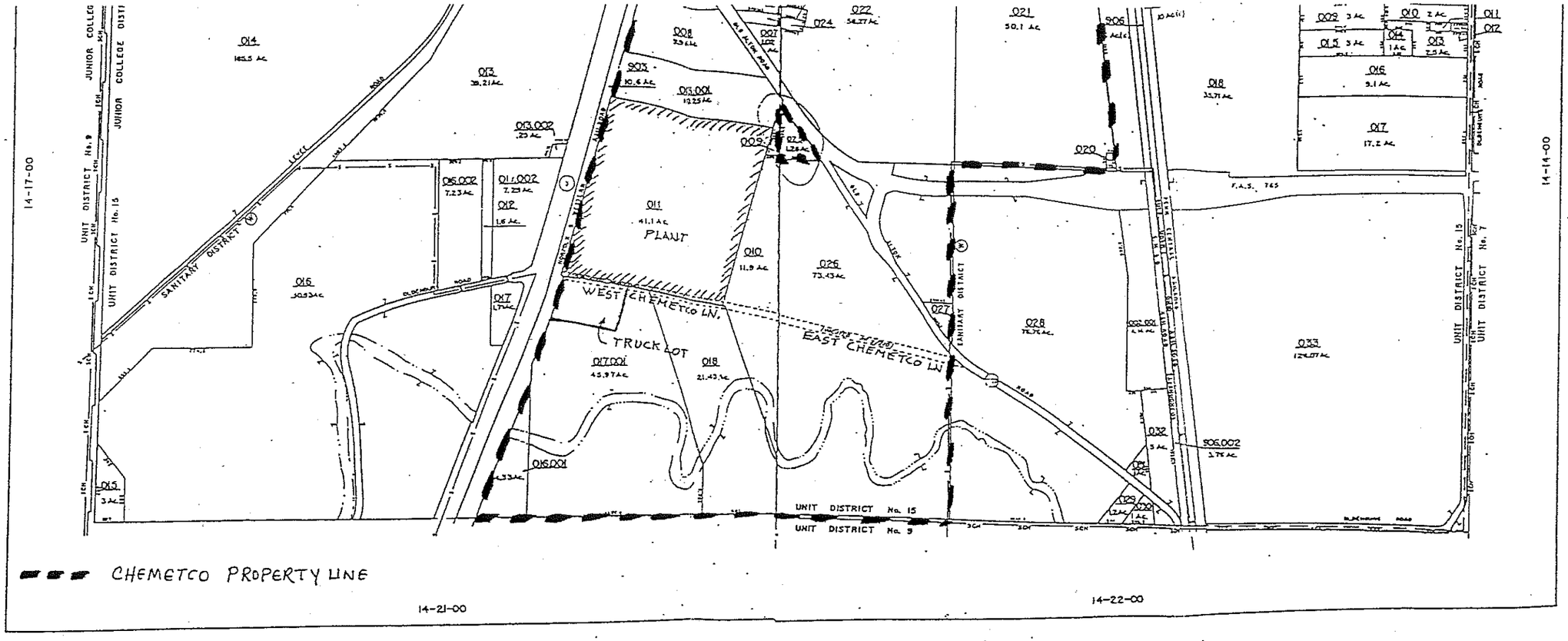
Inspection Manual for PM10 Emissions from Paved/Unpaved Roads & Storage Piles, USEPA, PB91-145946, 1989.

Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures, EPA-450/2-92-004, September 1992.

Thermodynamic Properties of Minerals and Related Substances at 298.15 K (25.0 C) and One Atmosphere (1.013 Bars) Pressure and at Higher Temperatures, Geological Survey Bulletin 1259.

Appendix A

Facility Maps



CHOUTEAU TOWNSHIP

MADISON COUNTY, ILLINOIS

LEGEND

SPECIAL DISTRICTS

CLT BALANCED GOVERNMENTAL SERVICES

REAL PROPERTY MAP

MADISON COUNTY BOARD MEMBERS

CONGRESSIONAL TOWNSHIP NO.

SECTION 16

TOWN 04 NORTH, RANGE 09 WEST

14-16-00

CHEMETCO

CHOUTEAU TOWNSHIP

MADISON COUNTY, ILLINOIS

LEGEND

SPECIAL DISTRICTS

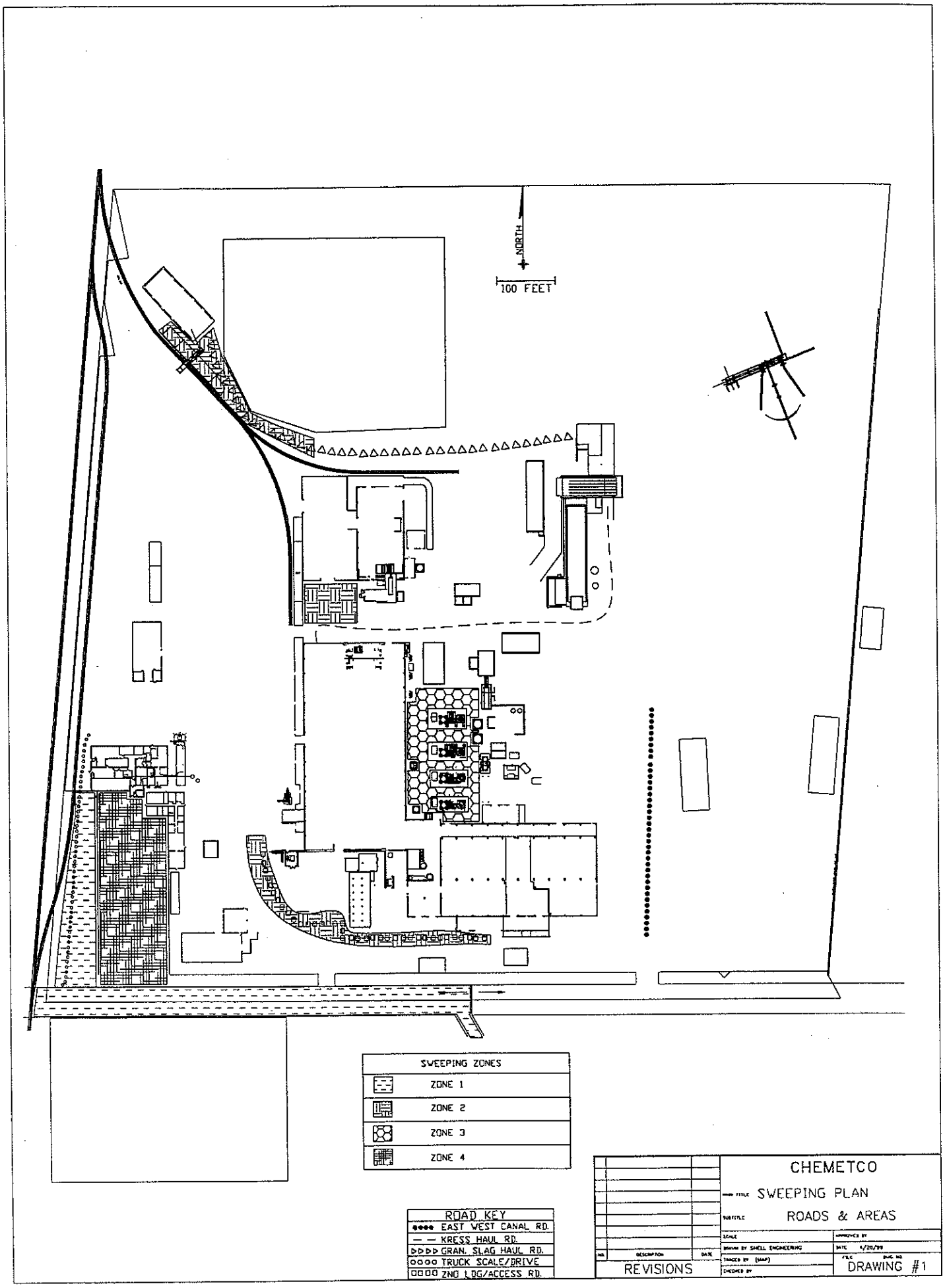
CONGRESSIONAL TOWNSHIP NO.

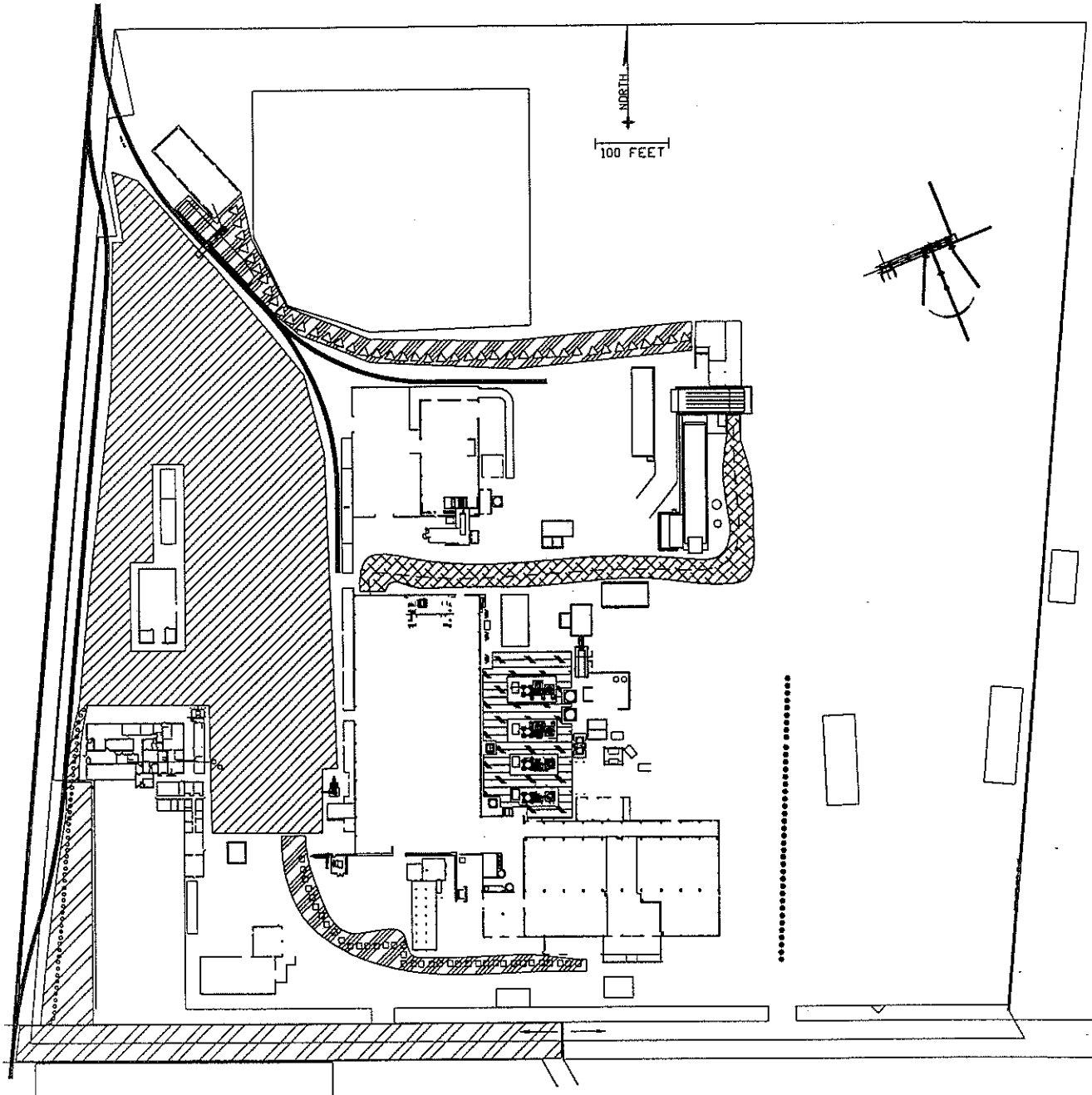
SECTION 15

TOWN 04 NORTH, RANGE 09 WEST

14-15-00

CHEMETCO


NORTH
100 FEET
SWEEPING ZONES
ZONE 1
ZONE 2
ZONE 3
ZONE 4
ROAD KEY
EAST WEST CANAL RD.
KRESS HAUL RD.
GRAN. SLAG HAUL RD.
TRUCK SCALE/DRIVE
ZNO LDG/ACCESS RD.
REVISIONS
CHEMETCO
SWEEPING PLAN
ROADS & AREAS
DRAWING #1



WATER FLUSHING ZONES
ZONE A
ZONE B
ZONE C
ZONE D
ZONE E

ROAD KEY
EAST WEST CANAL RD.
KRESS HAUL RD.
GRAN. SLAG HAUL RD.
TRUCK SCALE/DRIVE
ZNO LDG/ACCESS RD.

NO.	DESCRIPTION	DATE

REVISIONS

CHEMETCO

MAIN TITLE WATER FLUSHING PLAN

SUBTITLE ROADS & AREAS

SCALE

APPROVED BY

DRAWN BY SHELL ENGINEERING

DATE 4/20/99

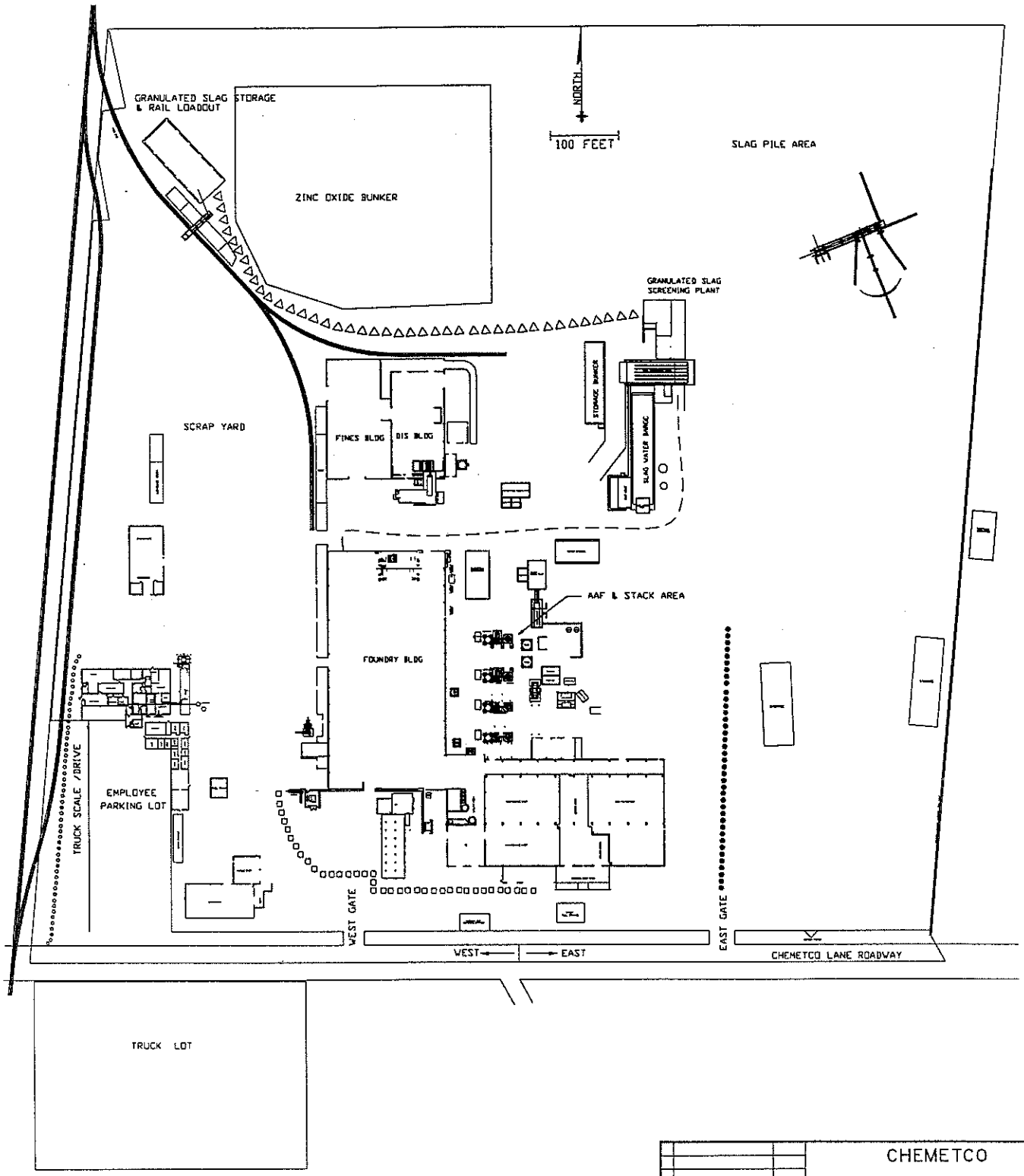
CHECKED BY (MAP)

CHECKED BY

FILE

DWG NO.

DRAWING #2



ROAD KEY
●●●● EAST WEST CANAL RD.
— — KRESS HAUL RD.
▷▷▷▷ GRAN. SLAG HAUL RD.
○○○○ TRUCK SCALE/DRIVE
□□□□ ZNO LDG/ACCESS RD.

NO.	DESCRIPTION	DATE

REVISIONS

CHEMETCO

FACILITY

ROADS & AREAS

DRAWN BY SHELL ENGINEERING

DATE 4/20/99

DRAWING #3

Appendix B

Petroleum Resin Dust & Suppressant Information

APPENDIX B: PETROLEUM RESIN EMULSION DUST SUPPRESSANT

The application of chemical dust suppressants is a type of control technique for reducing fugitive emissions from roadways. Chemical dust suppressants are generally applied to the road surface as a water solution of the agent. The degree of control achieved is a direct function of the application intensity (volume of solution per area), dilution ratio, and frequency (number of applications per unit time) of the chemical applied to the surface. Petroleum resin emulsion dust suppressants are a type of chemical dust suppressant that are designed to cement loose material into a fairly impervious surface by forming a hard cemented surface (thus simulating a paved surface). Besides water, petroleum resins have historically been the products most widely used in industry.

EPA document 450/2-02-004 "Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures" and EPA document 450/3-88-008 "Control of Open Fugitive Dust Sources" discuss the use of petroleum resins as a fugitive dust control technique. These documents present a chemical dust suppressant control efficiency model to estimate time-averaged PM control performance which was developed based on average performance curves for four chemical dust suppressants: (a) a commercially available petroleum resin (Coherex), (b) a generic petroleum resin for on-site production at an industrial facility, © an acrylic cement, and (d) an asphalt emulsion, along with other test results. Because suppressants must be periodically reapplied to unpaved roads, use of the time-averaged values given in this model are appropriate.

During the 1980's, EPA conducted a series of field test programs to determine the efficiency of a variety of commercially available dust suppressants for unpaved roads. These included petroleum resins, asphalt emulsions, acrylics, lignin sulfonates, and salts. As part of the testing programs, an appropriate test methodology was defined. Most of these evaluations took place on roads at iron and steel plants. The last major EPA field evaluation was completed in 1985. During that study, four chemical dust suppressants were compared in side-by-side tests (the "AQ" test series) conducted at a remote area of a steel plant in Kansas City. Data from these studies was used to develop the control efficiency model presented in EPA documents 450/2-02-004 and 450/3-88-008.

Coherex is a commercially available petroleum resin which has been used for dust control since the 1950's and was therefore available for inclusion in the EPA testing. Coherex has been evaluated by Midwest Research Institute (MRI) in EPA-600/2-84-027 and other reference documents. PennzSuppress D is another commercially available petroleum resin, which is a relatively new product that appeared after the conclusion of the EPA testing. MRI conducted a field evaluation of PennzSuppress D to assess its effectiveness in controlling particulate emissions from unpaved roads (MRI Project No. 4599, 2/11/98). A major objective of this testing was to demonstrate the effectiveness of PennzSuppress D relative to dust suppressants evaluated in the EPA tests. The methods used in the MRI evaluation were analogous to those used in the EPA test programs. The MRI report concluded that the study demonstrated that PennzSuppress D as an unpaved road dust control product compares very well with products previously tested by EPA.

Based on the MRI study, PennzSuppress D and Coherex would be expected to perform comparably in the control of dust emissions. It should be noted that the MRI investigators that evaluated Coherex and other dust suppressants (Muleski and Cowherd) in the 1980's for EPA also participated in the MRI study for PennzSuppress D as project leader and principal authors.

PennzSuppress D was recently precertified by the California Air Resources Board.

The following supporting information is included in this appendix:

- Table of Comparative Test Results for Coherex and PennzSuppress
- Material Safety Data Sheets
- Excerpts from EPA documents 450/2-02-004 "Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures" and EPA document 450/3-88-008 "Control of Open Fugitive Dust Sources".
- MRI Report "Field Evaluation of PennzSuppress D" and summary.
- California Air Resources Board Precertification documentation

COMPARISON OF PETROLEUM RESIN DUST SUPPRESSANT PERFORMANCE
COHEREX VS. PENNZSUPPRESS D

Product	Total Gallons Applied	Vehicle Passes	Control Efficiency
Coherex	0.241 gal/yd^2	9,400	85 %
PennzSuppress D			
- Linda Vista Test Site	0.15 gal/yd^2	2,750	98%
		3,000	97%
		6,500	91%
		7,000	85%
-Sierrita Test Site	0.30 gal/yd^2	5,503	98%

Note: The reported control efficiencies are instantaneous control efficiencies (that is, at a particular time after application) and are not average control efficiencies (that is, the average control efficiency during a period ending T days after application). The EPA Control Efficiency model developed for dust suppressants is based on average control efficiency.

References:

For Coherex:
Muleski, Cuscino, and Cowherd, "Extended Evaluation of Unpaved Road Dust Suppressants in the Iron and Steel Industry", October, 1983.

For PennzSuppress D:
Muleski and Cowherd, "Field Evaluation of PennzSuppress D", February, 1998.

COHEREX
MSDS

GOLDEN BEAR OIL SPECIALTIES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: COHEREX®

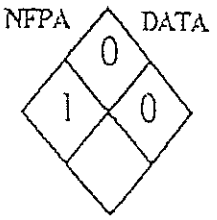
HMIS DATA

H	1
F	0
R	0
PP	

NFPA and HMIS Hazard Rating

4 = Extreme	1 = Slight
3 = High	0 = Insignificant
2 = Moderate	

NFPA DATA



COMPANY NAME AND LOCATION - SECTION 1

COMPANY: Golden Bear Oil Specialties.
LOCATION: P.O. Box 5446, 1134 Manor Street, Oildale, CA 93388-5446.
EMERGENCY TELEPHONE NUMBER: (805) 393-7110.
TRANSPORTATION EMERGENCY: CHEMTREC (800) 424-9300 (U.S. and Canada).

CHEMICAL AND PHYSICAL PROPERTIES - SECTION II

CHEMICAL NAME: Petroleum hydrocarbon in water emulsion.
FORMULA: Not Applicable.
HAZARDOUS DECOMPOSITION PRODUCTS:
- Carbon monoxide and carbon dioxide from burning.
- Oxides of nitrogen.
- Oxides of sulfur.

INCOMPATIBILITY (Keep away from):
- Strong oxidizers such as hydrogen peroxide, bromine, and chromic acid.

TOXIC AND HAZARDOUS INGREDIENTS:

	CAS NUMBER
Heavy naphthenic distillate (petroleum) and/or	64742-34-3
Heavy naphthenic extract (petroleum)	64742-11-6

FORM: Oily liquid emulsion.
ODOR: No objectionable odor.
APPEARANCE:
COLOR:
SPECIFIC GRAVITY (water = 1): About 1.0.
BOILING POINT: Greater than 100°C (212°F).
MELTING POINT: Not applicable.
SOLUBILITY IN WATER (by weight %) : Readily dispersible.
VOLATILE (by weight %) : Less than 45 at 25°C.
EVAPORATION RATE (water = 1) : 1.0.
VAPOR PRESSURE (mm Hg at 20°C) : Same as water.
VAPOR DENSITY (air = 1) : Same as water.
pH (as is) : 4.5 to 6.5.
STABILITY: Product is stable under normal conditions.
VISCOSITY (SUS at 100°F): Greater than or equal to 100.
OTHER PHYSICAL PROPERTIES: Viscosity greater than or equal to 18.6 cSt at 40°C.

(Continued on Next Page)

GOLDEN BEAR OIL SPECIALTIES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: COHEREX®

FIRE AND EXPLOSION DATA - SECTION III

SPECIAL FIRE FIGHTING PROCEDURES: None.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Dense smoke. Fire fighters should wear an approved self-contained breathing apparatus.
FLASHPOINT (method used): Not applicable
FLAMMABLE LIMITS, %: No data available.
EXTINGUISHING AGENTS:

Drychemical, Waterspray, CO_2 or Foam.
Water may cause frothing.
Water may be ineffective.
Closed containers exposed to fire may be cooled with water.

HEALTH HAZARD DATA - SECTION IV

PERMISSIBLE CONCENTRATIONS (air):

If used in applications where a mist may be generated, observe a TWA/PEL of 5 mg/m^3 for mineral oil mist (OSHA and ACGIH).

CHRONIC EFFECTS OF OVEREXPOSURE:

Prolonged skin contact may cause irritation and under extreme conditions, skin cancer.
See COMMENTS section.

ACUTE TOXICOLOGICAL PROPERTIES:

No data available.

EMERGENCY FIRST AID PROCEDURES:

Eyes: Immediately flush with large quantities of water for at least 15 minutes and call a physician.

Skin Contact: Wash with soap and water.

Inhalation: Remove victim to fresh air.

If Swallowed: Contact a physician immediately.

ROUTES OF ENTRY: Ingestion and, if a mist is generated, inhalation.
TARGET ORGAN(S): Skin. Respiratory tract if a mist is generated (the respiratory tract may become irritated).
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Persons susceptible to dermatitis (skin rash) may aggravate their condition by skin contact with this product.

GOLDEN BEAR OIL SPECIALTIES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: COHEREX®

SPECIAL PROTECTION INFORMATION - SECTION V

VENTILATION TYPE REQUIRED (local, mechanical, special): Local if necessary to maintain allowable PEL (permissible exposure limit) or TLV (threshold limit value).
RESPIRATORY PROTECTION (specify type): Use NIOSH/MSHA certified respirator with organic vapor cartridge if vapor concentration exceeds permissible exposure limit.
PROTECTIVE GLOVES: Oil resistant.
EYE PROTECTION: Chemical safety goggles.
OTHER PROTECTIVE EQUIPMENT: None.

HANDLING OF SPILLS OR LEAKS - SECTION VI

PROCEDURES FOR CLEAN-UP: In case of spill or leak absorb on an inert material such as earth, sand or vermiculite; sweep up and dispose of in accordance with federal, state and local regulations. If spilled into water, remove bulk of the product by skimming. If spilled into a navigable waterway and a film, sheen or discoloration of any water surface is noted, the spill must be reported to the National Response Center by calling (800) 424-8802.
WASTE DISPOSAL: Dispose of in accordance with all applicable federal, state and local regulations.

SPECIAL PRECAUTIONS - SECTION VII

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Avoid prolonged or repeated contact with skin or breathing of vapors, mists or fumes. Launder contaminated clothing before reuse. Keep containers tightly closed. Avoid strong oxidizers. Eliminate all sources of ignition such as flames or sparks.

TRANSPORTATION DATA - SECTION VIII

D.O.T.: Not regulated.
REPORTABLE QUANTITY: Not applicable.
FREIGHT CLASSIFICATION: 65 Petroleum Oil, n.o.i.b.n.
SPECIAL TRANSPORTATION NOTES: None.

ENVIRONMENTAL/SAFETY REGULATIONS - SECTION IX

SECTION 313 (TITLE III SUPERFUND AMENDMENT AND REAUTHORIZATION ACT):
This product does not contain any chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

GOLDEN BEAR OIL SPECIALTIES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: COHEREX® P

COMMENTS - SECTION X

This product contains petroleum oils similar to ones categorized by the International Agency for R Cancer (IARC) as causing skin cancer in mice after prolonged and repeated contact. Any potentia can be minimized by using recommended protective equipment to avoid skin contact and by wash thoroughly after handling.

PREPARED BY: J. L. Davis.
TITLE: Laboratory Director.
ORIGINAL DATE: 07/16/97.
REVISION DATE: 07/16/97.
SUPERSEDES:

We believe the statements, technical information and recommendations contained herein are reli they are given without warranty or guarantee of any kind, express or implied, and we assum responsibility for any loss, damage, or expense, direct or consequential, arising out of their

PENNZSUPPRESS
MSDS

MATERIAL SAFETY DATA SHEET

PENNZOIL PRODUCTS COMPANY

I PRODUCT IDENTIFICATION

Manufacturer's Name	PENNZOIL COMPANY	CAS Number: MIXTURE MSDS Code: 008549	
Address	P.O. BOX 2967 HOUSTON, TX 77252-2967	NFPA Hazard Identification Degree of Hazard	Hazard Ratings
		Health: 1 Fire: 0 Reactivity: 0	0 - Least 1 - Slight 2 - Moderate 3 - High 4 - Extreme
Emergency Telephone No.	(800) 546-6040		
Trade Name	PENNZSUPPRESS® D		
Synonyms			

II INGREDIENTS

COMPONENT NAME CAS NUMBER	HAZARDOUS IN BLEND	PERCENTAGE MIN		MAX	COMPONENT EXPOSURE LIMIT	UNITS
PETROLEUM RESINS 64742-16-1	NO	30	TO	60	OSHA PEL ACGIH TLV	NO LIMIT NO LIMIT
WATER 7732-18-5	NO	20	TO	40	OSHA PEL ACGIH TLV	NO LIMIT NO LIMIT
EMULSIFIERS MIXTURE	NO	15	TO	35	OSHA PEL ACGIH TLV	NO LIMIT NO LIMIT
SURFACTANTS MIXTURE	NO	1	TO	5	OSHA PEL ACGIH TLV	NO LIMIT NO LIMIT
VACUUM RESIDUUM 64741-56-6	NO	5	TO	15	OSHA PEL ACGIH TLV	NO LIMIT NO LIMIT

BY - ENVIRONMENTAL, SAFETY & HEALTH
(800) 546-6227

EFFECTIVE DATE: MARCH 01, 1996
SUPERSEDES DATE: JUNE 17, 1994

DISCLAIMER OF WARRANTY:

THE INFORMATION CONTAINED HEREIN IS BASED UPON DATA AVAILABLE TO US, AND REFLECTS OUR BEST PROFESSIONAL JUDGEMENT. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY USE, OR ANY OTHER WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF SUCH DATA, THE RESULTS TO BE OBTAINED FROM THE USE THEREOF, OR THAT ANY SUCH USE DOES NOT INFRINGE ANY PATENT. SINCE THE INFORMATION CONTAINED HEREIN MAY BE APPLIED UNDER CONDITIONS OF USE BEYOND OUR CONTROL AND WITH WHICH WE MAY BE UNFAMILIAR, WE DO NOT ASSUME ANY RESPONSIBILITY FOR THE RESULTS OF SUCH APPLICATION. THIS INFORMATION IS FURNISHED UPON THE CONDITION THAT THE PERSON RECEIVING IT SHALL MAKE HIS OWN DETERMINATION OF THE SUITABILITY OF THE MATERIAL FOR HIS PARTICULAR PURPOSE.

III HEALTH EFFECT INFORMATION

EYE CONTACT	AVOID EYE CONTACT. THIS PRODUCT IS MINIMALLY IRRITATING TO THE EYES UPON DIRECT CONTACT. BASED ON TESTING OF THIS PRODUCT. THIS PRODUCT HAS A LOW VAPOR PRESSURE AND IS NOT EXPECTED TO PRESENT A HAZARD TO THE EYES AT AMBIENT CONDITIONS. SEE HEALTH DATA SECTION BELOW.
SKIN CONTACT	AVOID SKIN CONTACT. THIS PRODUCT MAY CAUSE SLIGHT SKIN IRRITATION UPON DIRECT CONTACT. PROLONGED OR REPEATED CONTACT MAY RESULT IN SLIGHT SKIN IRRITATION. PROLONGED OR REPEATED CONTACT MAY RESULT IN OIL ACNE WHICH IS CHARACTERIZED BY BLACKHEADS WITH POSSIBLE SECONDARY INFECTION. SEE HEALTH DATA SECTION BELOW.
INHALATION	AVOID PROLONGED INHALATION OF MIST OR VAPORS. THIS PRODUCT HAS A LOW VAPOR PRESSURE AND IS NOT EXPECTED TO PRESENT AN INHALATION HAZARD AT AMBIENT CONDITIONS. OIL MIST, IF GENERATED, IS CONSIDERED HAZARDOUS ACCORDING TO THE OSHA HAZARD COMMUNICATION STANDARD. THE PERMISSABLE EXPOSURE LIMIT (PEL) AND THRESHOLD LIMIT VALUE (TLV) FOR THIS PRODUCT AS OIL MIST IS 5 MG/M3. THE SHORT-TERM EXPOSURE LIMIT FOR THIS PRODUCT AS AN OIL MIST IS 10 MG/M3. ACUTE AND CHRONIC OVEREXPOSURES MAY BE IRRITATING TO THE RESPIRATORY TRACT. SEE HEALTH DATA SECTION BELOW.
INGESTION	DO NOT INGEST. THIS PRODUCT IS RELATIVELY NON-TOXIC BY INGESTION. THIS PRODUCT HAS LAXATIVE PROPERTIES AND MAY RESULT IN ABDOMINAL CRAMPS AND DIARRHEA. SEE HEALTH DATA SECTION BELOW.
HEALTH DATA	THIS PRODUCT WAS MINIMALLY IRRITATING TO THE EYES OF RABBITS. THIS CONCENTRATE WILL BE DILUTED FURTHER PRIOR TO USE AS A DUST SUPPRESSANT. AT END USE DILUTIONS, THIS PRODUCT IS EXPECTED TO BE PRACTICALLY NON-IRRITATING TO THE EYES. THIS PRODUCT IS NOT CARCINOGENIC ACCORDING TO THE OSHA HAZARD COMMUNICATION STANDARD.

EMERGENCY & FIRST AID PROCEDURES

ONTACT	IMMEDIATELY FLUSH EYES WITH LARGE AMOUNTS OF WATER AND CONTINUE FLUSHING FOR 15 MINUTES UNTIL IRRITATION SUBSIDES. IF MATERIAL IS HOT, TREAT FOR THERMAL BURNS AND TAKE VICTIM TO HOSPITAL IMMEDIATELY.
CONTACT	WASH CONTAMINATED AREA THOROUGHLY WITH SOAP AND WATER. IF REDNESS OR IRRITATION OCCURS, SEEK MEDICAL ATTENTION. IF MATERIAL IS HOT, SUBMERGE INJURED AREA IN COLD WATER. IF VICTIM IS SEVERELY BURNED, REMOVE TO A HOSPITAL IMMEDIATELY.
AL TION	IF EXPOSURE LEVELS EXCEED THE LIMITS LISTED IN SECTIONS II, III, OR IX, REMOVE VICTIM FROM EXPOSURE.
GESTION	IF PERSON IS CONSCIOUS, GIVE LARGE QUANTITIES OF WATER IMMEDIATELY. DO NOT INDUCE VOMITING. IF VOMITING OCCURS LOWER HEAD BELOW KNEES TO AVOID ASPIRATION. SEEK IMMEDIATE MEDICAL ATTENTION.

V PERSONAL HEALTH PROTECTION INFORMATION

EYE PROTECTION	WEAR PLASTIC FACE SHIELD OR SPLASH-PROOF SAFETY GOGGLES.
SKIN PROTECTION	NO SKIN PROTECTION IS REQUIRED FOR SINGLE, SHORT DURATION FOR PROLONGED OR REPEATED EXPOSURES, USE IMPERVIOUS CLOTHING (BOOTS, GLOVES, APRONS, ETC.) OVER PARTS OF THE BODY SUBJECT TO EXPOSURE. IF HANDLING HOT MATERIAL, USE INSULATED PROTECTIVE CLOTHING (BOOTS, GLOVES, APRONS, ETC.). LAUNDER SOILED CLOTHES. PROPERLY DISPOSE OF CONTAMINATED LEATHER ARTICLES INCLUDING SHOES, WHICH CANNOT BE DECONTAMINATED.
RESPIRATORY PROTECTION	RESPIRATORY PROTECTION IS NOT REQUIRED UNDER CONDITIONS OF NORMAL USE. IF VAPOR OR MIST IS GENERATED WHEN THE MATERIAL IS HEATED OR HANDLED, USE AN ORGANIC VAPOR RESPIRATOR WITH A DUST AND MIST FILTER. ALL RESPIRATORS MUST BE NIOSH CERTIFIED. DO NOT USE COMPRESSED OXYGEN IN HYDROCARBON ATMOSPHERES.
VENTILATION	IF VAPOR OR MIST IS GENERATED WHEN THE MATERIAL IS HEATED OR HANDLED, ADEQUATE VENTILATION IN ACCORDANCE WITH GOOD ENGINEERING PRACTICE MUST BE PROVIDED TO MAINTAIN CONCENTRATIONS BELOW THE SPECIFIED EXPOSURE OR FLAMMABLE LIMITS.
OTHER	CONSUMPTION OF FOOD AND BEVERAGE SHOULD BE AVOIDED IN WORK AREAS WHERE HYDROCARBONS ARE PRESENT. ALWAYS WASH HANDS AND FACE WITH SOAP AND WATER BEFORE EATING, DRINKING, OR SMOKING.

VI FIRE PROTECTION INFORMATION

FLASH POINT NONE TEST METHOD CONTAINS WATER

AUTOIGNITION TEMPERATURE NO DATA TEST METHOD NO DATA

FLAMMABLE LIMITS IN AIR % BY VOL. LOWER NO DATA UPPER NO DATA

EXTINGUISHING MEDIA: USE DRY CHEMICAL, FOAM, OR CARBON DIOXIDE.

SPECIAL FIRE FIGHTING PROCEDURES: WATER MAY BE INEFFECTIVE BUT CAN BE USED TO COOL CONTAINERS EXPOSED TO HEAT OR FLAME. CAUTION SHOULD BE EXERCISED WHEN USING WATER OR FOAM AS FROTHING MAY OCCUR, ESPECIALLY IF SPRAYED INTO CONTAINERS OF HOT, BURNING LIQUID.

UNUSUAL FIRE AND EXPLOSIVE CONDITIONS: DENSE SMOKE MAY BE GENERATED WHILE BURNING. CARBON MONOXIDE, CARBON DIOXIDE, AND OTHER OXIDES MAY BE GENERATED AS PRODUCTS OF COMBUSTION.

VII REACTIVITY DATA

STABILITY (THERMAL, LIGHT, ETC.)	STABLE	CONDITIONS TO AVOID	NONE
HAZARDOUS POLYMERIZATION	WILL NOT OCCUR	CONDITIONS TO AVOID	NONE
INCOMPATIBILITY MATERIALS TO AVOID	NONE KNOWN		
HAZARDOUS DECOMPOSITION PRODUCTS	NONE KNOWN		

MSDS CODE: 008549 PRODUCT: PENNZSUPPRESS® D

VIII ENVIRONMENTAL PRECAUTIONS

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

CONSULT HEALTH EFFECT INFORMATION IN SECTION III, PERSONAL HEALTH PROTECTION INFORMATION IN SECTION V, FIRE PROTECTION INFORMATION IN SECTION VI, AND REACTIVITY DATA IN SECTION VII. NOTIFY APPROPRIATE AUTHORITIES OF SPILL. CONTAIN SPILL IMMEDIATELY. DO NOT ALLOW SPILL TO ENTER SEWERS OR WATERCOURSES. REMOVE ALL SOURCES OF IGNITION. ABSORB WITH APPROPRIATE INERT MATERIAL SUCH AS SAND, CLAY, ETC. LARGE SPILLS MAY BE PICKED UP USING VACUUM PUMPS, SHOVELS, BUCKETS, OR OTHER MEANS AND PLACED IN DRUMS OR OTHER SUITABLE CONTAINERS.

WASTE DISPOSAL METHOD

THE DISPOSAL OF THIS MATERIAL MUST COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS. THE MATERIAL, IF DISPOSED, IS NOT REGULATED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY (USEPA) AS A HAZARDOUS WASTE. CAUTION! IF SOLVENTS ARE USED TO CLEAN UP SPILLED MATERIAL, THE RESULTING WASTE MIXTURE MAY BE REGULATED BY THE USEPA AS A HAZARDOUS WASTE AND MAY BE REGULATED BY THE U.S. DEPARTMENT OF TRANSPORTATION WHEN TRANSPORTED. REFER TO STATE AND LOCAL REGULATIONS FOR ADDITIONAL DISPOSAL REQUIREMENTS. THE DISCARDED MATERIAL SHOULD BE RECYCLED IF POSSIBLE.

IX MISCELLANEOUS

HANDLING AND STORAGE REQUIREMENTS

DO NOT TRANSFER TO UNMARKED CONTAINERS. THIS PRODUCT IS NOT CLASSIFIED AS HAZARDOUS UNDER DOT REGULATIONS. STORE IN CLOSED CONTAINERS.

ADDITIONAL INFORMATION

THIS MIXTURE MAY BE FORMULATED IN PART WITH COMPONENTS PURCHASED FROM OTHER COMPANIES. MANY INSTANCES, ESPECIALLY WHEN PROPRIETARY OR TRADE SECRET MATERIALS ARE USED, PENNZOIL COMPANY MUST RELY UPON THE HAZARD EVALUATION OF SUCH COMPONENTS SUBMITTED TO PENNZOIL BY THAT PRODUCT'S MANUFACTURER OR IMPORTER.

THIS PRODUCT IS NOT KNOWN TO CONTAIN ANY SARA TITLE III, SECTION 313 REPORTABLE CHEMICAL AT OR GREATER THAN 1.0% (0.1% FOR CARCINOGENS).

ALL INGREDIENTS OF THIS PRODUCT ARE LISTED ON THE TOXIC SUBSTANCES CONTROL ACT (TSCA) INVENTORY.

X PHYSICAL PROPERTIES

BOILING POINT	212 F	PERCENT VOLATILE	NO DATA
MELTING POINT	FREEZES AT 40 F	VAPOR DENSITY (AIR=1)	> 1
APPEARANCE	THICK MILKY DARK-BROWN LIQUID	EVAPORATION RATE (EE=1)	< 1
ODOR	LIGNOSULFONATE/RESIN ODOR	SPECIFIC GRAVITY	1.0254
VAPOR PRESSURE	NO DATA	MOLECULAR WEIGHT	NO DATA
SOLUBILITY	SOLUBLE IN WATER		

PRODUCT INFORMATION | DESCRIPTION

PRODUCT DESCRIPTION

PENNZSUPPRESS® D is a specially formulated, very effective dust control agent for the treatment of road aggregate. In concentrate form, it is intended for dilution with water for application to roads and other environments where airborne dust is undesirable. PennzSupress D is typically applied in a 4:1 dilution (80% water, 20% Pennzsuppress D concentrate). In addition to suppressing the irritating effects of airborne dust itself, PENNZSUPPRESS D is effective stabilizing road base aggregate materials, reducing soil erosion and protecting vegetation from blowing dust and sand.

PENNZSUPPRESS D contains effective binding agents to hold soil particles together and prevent them from being dispersed into the air. It is further formulated with an optimum blend of wetting agents, emulsifiers and dispersants to allow for ready penetration of the binding agents into the soil, easy emulsification with water and increased spreading power of the diluted mixture. PENNZSUPPRESS D readily emulsifies with all types of water and remains highly stable in its dilute form.

Formulated from a water emulsified resin base, PENNZSUPPRESS D contains no asphalt or solvent, as is commonly found in other road dust suppressants. The binding agents in PENNZSUPPRESS D are non-volatile, offering a lasting effect, unlike results obtained on roads treated with water alone. Concerns over the corrosive effects of road salts to vehicle underbodies are eliminated with the use of PENNZSUPPRESS D, as it is non-corrosive to metal. Because this product contains water, it is non-flammable and safe during use. PENNZSUPPRESS D is classified as "non-hazardous", "non-toxic", and "non-carcinogenic" according to Federal guidelines. It is also considered to be non-toxic to aquatic life.

PENNZOIL

Another Quality Product Of Pennzoil Products Company

Excerpts from EPA Documents

EPA-450/3-88-008

CONTROL OF OPEN FUGITIVE DUST SOURCES

FINAL REPORT

by

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EPA Contract No. 68-02-4395
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William L. Elmore, Project Officer
Emission Standards Division

Office of Air Quality Planning and Standards
U. S. Environmental Protection Agency
Research Triangle Park, North Carolina

September 1988

3.0 UNPAVED ROADS

As is the case for paved roads, particulate emissions occur whenever a vehicle travels over an unpaved surface. Unlike paved roads, however, the road itself is the source of the emissions rather than any "surface loading." Within the various categories of open dust sources in industrial settings, unpaved travel surfaces have historically accounted for the greatest share of particulate emissions in industrial settings. For example, unpaved sources were estimated to account for roughly 70 percent of open dust sources in the iron and steel industry during the 1970's. Recognition of the importance of unpaved roads led naturally to an interest in their control. As a result of these control programs, the portion of total open source dust emissions due to unpaved travel surfaces has decreased dramatically over the past 5 to 10 years. Nevertheless, the need for continued control of these sources is apparent.

This section presents a discussion of the various types of unpaved sources, available emission factors, viable control measures, and methods to determine compliance of controlled sources.

Travel surfaces may be unpaved for a variety of reasons. Possibly the most common type of unpaved road is that found in rural regions throughout the country; these roads may experience only sporadic traffic which, taken with the often considerable road length involved, makes paving impractical.

Other important travel surfaces are found in industrial settings. During the 1980's, industry has paved many previously unpaved roads as part of emissions control programs. Some industrial roads are, by their nature, not suitable for paving. These roads may be used by very heavy vehicles or may be subject to considerable spillage from haul trucks. Other roads may have poorly constructed bases which make paving impractical. Because of the additional maintenance costs associated with a paved road under these service environments, emissions from these roads are usually controlled by regular applications of water or chemical dust suppressants.

In addition to roadways, many industries often contain important unpaved travel <u>areas</u>. Examples include scraper traffic patterns related

to stockpile/reclaim activities in coal yards, compactor traffic in areas proximate to lifts at landfills, and travel related to open storage of finished products (such as coil at steel plants). These areas may often account for a substantial fraction of traffic-generated emissions from individual plants. In addition, these areas tend to be much more difficult to control than stretches of roadway (e.g., changing traffic patterns make semipermanent controls impractical, increased shear forces from cornering vehicles rapidly deteriorate chemically controlled surfaces, chemical suppressants may damage raw materials or finished products, etc.).

3.1 ESTIMATION OF EMISSIONS FROM UNPAVED ROADS

As was the case for paved roads, unpaved roads may be divided into the two classes of public and industrial. However, for the purpose of estimating emissions, there is no need to distinguish between the two, because the AP-42 emission factor equation takes source characteristics (such as average vehicle weight and road surface texture) into consideration:[1]

$$E = 0.61 \left(\frac{s}{12}\right) \left(\frac{S}{48}\right) \left(\frac{W}{2.7}\right)^{0.7} \left(\frac{w}{4}\right)^{0.5} \frac{(365-p)}{365} \text{ (kg/VKT)}$$

$$E = 2.1 \left(\frac{s}{12}\right) \left(\frac{S}{30}\right) \left(\frac{W}{3}\right)^{0.7} \left(\frac{w}{4}\right)^{0.5} \frac{(365-p)}{365} \text{ (lb/VMT)} \qquad (3\text{-}1)$$

where: E = PM_{10} emission factor in units stated

s = silt content of road surface material, percent

S = mean vehicle speed, km/h (mil/h)

W = mean vehicle weight, Mg (ton)

w = mean number of wheels (dimensionless)

p = number of days with $\geq$0.254 mm (0.01 in.) of precipitation per year

Using the scheme given in Appendix A, the above equation is rated "A" in AP-42. Measured silt values are given in Table 3-1. As is the case with all AP-42 emission factors, <u>the use of site-specific data is strongly encouraged</u>.

TABLE 3-1. TYPICAL SILT CONTENT VALUES OF SURFACE MATERIAL ON INDUSTRIAL AND RURAL UNPAVED ROADS[a]

Industry	Road use or surface material	Plant sites	Test samples	Silt, weight percent Range	Mean
Copper smelting	Plant road	1	3	15.9-19.1	17.0
Iron and steel production	Plant road	9	20	4.0-16.0	8.0
Sand and gravel processing	Plant road	1	3	4.1-6.0	4.8
Stone quarrying and processing	Plant road	1	5	10.5-15.6	14.1
Taconite mining and processing	Haul road	1	12	3.7-9.7	5.8
	Service road	1	8	2.4-7.1	4.3
Western surface coal mining	Access road	2	2	4.9-5.3	5.1
	Haul road	3	21	2.8-18	8.4
	Scraper road	3	10	7.2-25	17
	Haul road (freshly graded)	2	5	18-29	24
Rural roads	Gravel	1	1	NA	5.0
	Dirt	2	5	5.8-68	28.5
	Crushed limestone	2	8	7.7-13	9.6

Note: NA = Not applicable
[a]Reference 1 (AP-42).

The number of wet days per year, p, for the geographical area of interest should be determined from local climatic data. Figure 3-1 gives the geographical distribution of the mean annual number of wet days per year in the United States. Maps giving similar data on a monthly basis are available from the U.S. Department of Commerce.[2]

It is important to note that for the purpose of estimating annual or seasonal controlled emissions from unpaved roads, average control efficiency values based on worst case (i.e., dry, p = 0 in Equation (3-1)) uncontrolled emission levels are required. This is true simply because the AP-42 predictive emission factor equation for unpaved roads, which is routinely used for inventorying purposes, is based on source tests conducted under dry conditions.[1] Extrapolation to annual average uncontrolled (including natural mitigation) emissions estimates is accomplished by assuming that emissions are occurring at the estimated rate on days without measurable precipitation, and conversely are absent on days with measurable precipitation. This assumption has never been verified in a rigorous manner; however, MRI's experience with hundreds of field tests indicate that it is a reasonable assumption if the source operates on a fairly "continuous" basis.

The uncontrolled emission factor for a specific unpaved road will increase substantially after a precipitation event as the surface dries. However, in the absence of data sufficient to describe this growth as a function of traffic parameters, amount of precipitation, time of day, season, cloud cover, and other variables, uncontrolled emissions are estimated using the simple assumption given above. Prior MRI testing has suggested that for unpaved travel areas, surface moisture levels approximately twice that for dry conditions afford control of roughly 75 to 90 percent.[3] Between the dry, uncontrolled moisture level (typically <2 percent) and approximately 3 to 4 percent, a small increase in moisture content may result in a large increase in control efficiency. Beyond this point, control efficiency grows slowly with increased moisture content. These relationships are discussed in greater detail in the following section.

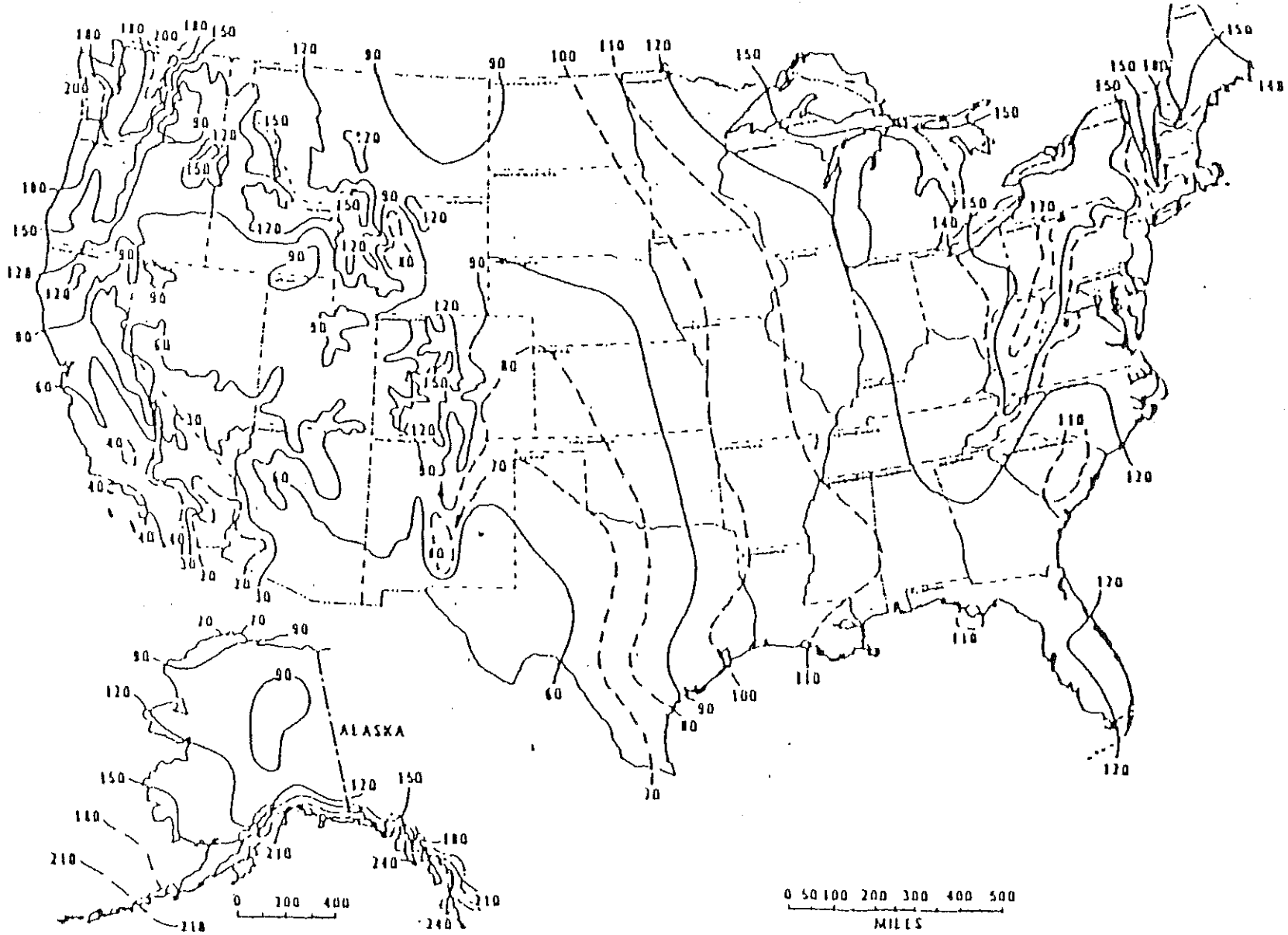

Figure 3-1. Mean annual number of days with at least 0.01 in of precipitation.[4]

3.2 DEMONSTRATED CONTROL TECHNIQUES FOR UNPAVED ROADS

There are numerous control options for unpaved travel surfaces, as shown in Table 3-2. Note that the controls fall into the three general categories of source extent reductions, surface improvements, and surface treatment. Each of these is discussed in greater detail in the following sections.

Source extent reductions. These controls either limit the amount of traffic on a road to reduce the PM_{10} emission rate or lower speeds to reduce the emission factor value given by Equation (3-1). Examples could include industrial plant bussing programs for employees, restriction of roads to only certain vehicle types, or strict enforcement of speed limits. In any instance, the control afforded by these measures is readily obtained by the application of the equation.

Surface improvements. These controls alter the road surface. Unlike surface treatments (discussed below), these improvements are largely "one-shot" control methods; that is, periodic retreatments are not normally required.

The most obvious surface improvement is, of course, paving an unpaved road. This option is expensive and is probably most applicable to high volume (more than a few hundred passes per day) public roads and industrial plant roads that are not subject to very heavy vehicles (e.g., slag pot carriers, haul trucks, etc.) or spillage of material in transport. Clearly, control efficiency estimates can be obtained by applying the information of Section 2.0 of this manual; this is discussed in greater detail in Section 3.3.

Other improvement methods cover the road surface material with another material of lower silt content (e.g., covering a dirt road with gravel or slag, or using a "road carpet" under ballast). Because Equation (3-1) shows a linear relationship between the emission factor and the silt content of the road surface, any reduction in the silt value is accompanied by an equivalent reduction in emissions. This type of improvement is initially much less expensive than paving; however, the reader is cautioned that maintenance (such as grading and spot reapplication of the cover material) may be required.

TABLE 3-2. CONTROL TECHNIQUES FOR UNPAVED TRAVEL SURFACES[a]

Source extent reduction:	Speed reduction Traffic reduction
Source improvement:	Paving Gravel surface
Surface treatment:	Watering Chemical stabilization[b] - Asphalt emulsions - Petroleum resins - Acrylic cements - Other

[a]Table entries reflect EPA draft guidance on urban fugitive dust control.
[b]See Table 3-3.

Finally, vegetative cover has been proposed as a surface improvement for low traffic volume roads. Note, however, that because vehicle related emissions would be quite low, this method is probably intended to control wind erosion of the road surface. As such, this technique is discussed in Section 5.0 of this manual.

Surface treatments. Surface treatment refers to those control techniques which require periodic reapplications. Treatments fall into the two main categories of (1) wet suppression (i.e., watering, possibly with surfactants or other additives), which keeps the surface wet to control emissions, and (2) chemical stabilization, which attempts to change the physical (and, hence, the emissions) characteristics of the roadway. Necessary reapplication frequencies may range from several minutes for plain water under hot, summertime conditions to several weeks (or months) for chemicals.

Water is usually applied to unpaved roads using a truck with a gravity or pressure feed. This is only a temporary measure, and periodic reapplications are necessary to achieve any substantial level of control efficiency. Some increase in overall control efficiency is afforded by wetting agents which reduce surface tension.

Chemical dust suppressants (Table 3-3), on the other hand, have much less frequent reapplication requirements. These suppressants are designed to alter the roadway, such as cementing loose material into a fairly impervious surface (thus simulating a paved surface) or forming a surface which attracts and retains moisture (thus simulating wet suppression).

Chemical dust suppressants are generally applied to the road surface as a water solution of the agent. The degree of control achieved is a direct function of the application intensity (volume of solution per area), dilution ratio, and frequency (number of applications per unit time) of the chemical applied to the surface and also depends on the type and number of vehicles using the road. Chemical agents have also been proven to be effective as crusting agents for inactive storage piles and for the stabilization of exposed open areas and agricultural fields. In both cases, the chemical acts as a binder to reduce the wind erosion potential of the aggregate surface. The use of chemical agents to control these sources is discussed in other chapters of this manual.

TABLE 3-3. CHEMICAL STABILIZERS[a]

A. Type: Bitumens

Product	Manufacturer
AMS 2200, 2300®	Arco Mine Sciences
Coherex®	Witco Chemical
Docal 1002®	Douglas Oil Company
Peneprime®	Utah Emulsions
Petro Tac P®	Syntech Products Corporation
Resinex®	Neyra Industries, Inc.
Retain®	Dubois Chemical Company

B. Type: Salts

Product	Manufacturer
Calcium chloride	Allied Chemical Corporation
Dowflake, Liquid Dow®	Dow Chemical
DP-10®	Wen-Don Corporation
Dust Ban 8806®	Nalco Chemical Company
Dustgard®	G.S.L. Minerals and Chemicals Corporation
Sodium silicate	The PQ Corporation

C. Type: Adhesives

Product	Manufacturer
Acrylic DLR-MS®	Rohm and Haas Company
Bio Cat 300-1®	Applied Natural Systems, Inc.
CPB-12®	Wen-Don Corporation
Curasol AK®	American Hoechst Corporation
DCL-40A, 1801, 1803®	Calgon Corporation
DC-859, 875®	Betz Laboratories, Inc.
Dust Ban®	Nalco Chemical Company
Flambinder®	Flambeau Paper Company
Lignosite®	Georgia Pacific Corporation
Norlig A, 12®	Reed Lignin, Inc.
Orzan Series®	Crown Zellerbach Corporation
Soil Gard®	Walsh Chemical

[a]Source: Reference 4, as cited by Reference 5.

Finally, note that some chemical dust suppressants may contain a considerable fraction of hydrocarbons. While these mixtures are generally not very volatile, regulators in areas with ozone problems should balance the benefits of dust control with the cost of a potential VOC emission increase.

3.3 EVALUATION OF ALTERNATIVE CONTROL MEASURES

3.3.1 Source Extent Reductions

These control methods act to reduce the emission rate due to traffic on a road. As noted in Section 3.2, control efficiency values are easily obtained by use of Equation (3-1).

The reduction may be obtained by banning certain vehicles (such as employees' cars) or strictly enforcing speed limits. Some of these methods (e.g., employee bussing) will require capital and operating and maintenance (O&M) expenditures, while others (e.g., speed reductions) may only require indirect costs associated with increased travel times. Consequently, identification of cost elements and estimation of costs are highly dependent upon the option(s) selected to reduce source extent, and no attempt is made here to generalize costs.

3.3.2 Surface Improvements

3.3.2.1 Paving. Control efficiency estimates for paving previously unpaved roads may be based on the material presented in Section 2.0 of this manual. Inherent in this process is estimating the silt loading on the paved surface; it is recommended that the reader use Table 2-2 or 2-7 for public and industrial roads, respectively. Alternatively, for public roads, the reader may wish to employ Equation (2-2) to estimate silt loading as a function of the daily traffic volume. Note, however, that use of the equation implies that curbs will be installed after paving.

Cost elements identified for paving are as follows:

Capital: Operating equipment (graders, paving equipment), paving material (asphalt, concrete), and base material

O&M: Patching materials, labor for patching, and equipment maintenance

Reference 6 provides the following cost estimates (April 1985 dollars) for asphaltic paving:

Initial capital expense: $44,700-$80,200/mile

Annual O&M costs: $6,600-$11,900/mile

These estimates are based on resurfacing every 5 years and "15 percent opportunity costs." Reference 7 estimates a cost of $140,000/mile (1983 dollars) to paved industrial unpaved roads. Because of the variety of cost estimates, it is strongly recommended that the reader obtain quotes from local paving contractors.

3.3.2.2 Gravel/Slag Improvements. As noted earlier, these types of improvements replace the present road surface material with a lower silt content material. Note that this method may increase road maintenance costs as the new aggregate fractures. This cost may be avoided by installing a "road carpet." Because Equation (3-1) indicates a linear relationship between silt content and emission levels, control efficiency can be estimated by determining the reduction in silt content. For example, if a road with a 12 percent silt content is recovered with a gravel (with an equilibrium silt content of 5 percent; see Table 3-1), then a 58 percent control efficiency would be expected.

Identified cost elements for these improvements follow:

Capital: Material (including "road carpet," if applicable), application equipment, and labor

O&M: Periodic grading including equipment and labor

No cost estimates were found in the reference documents used as the basis for this document. Because of the differences in local availability of cover materials (and civil engineering fabrics) and the amount of surface preparation, compaction, and maintenance required for various road types, it is recommended that the reader obtain quotes from local contractors.

3.3.2.3 Vegetative Cover. As noted by Turner et al., ". . . vegetative covers are obviously impractical for roads and facilities with construction activity . . . vegetative covering may be a practical control option for many inactive sites, but it is likely to be impractical for areas of continuing activity and areas that will not support a relatively dense vegetative cover."[5]

Consequently, vegetation is probably a viable control option only for inactive area wind erosion and is discussed elsewhere in this manual.

3.3.3 Surface Treatments

3.3.3.1 Watering. The control efficiency of unpaved road watering depends upon (a) the amount of water applied per unit area of road surface, (b) the time between reapplications, (c) traffic volume during that period, and (d) prevailing meteorological conditions during the period. While several investigations have estimated or studied watering efficiencies, few have specified all the factors listed above.

An empirical model for the performance of watering as a control technique has been developed.[8] The supporting data base consists of 14 tests performed in four states during five different summer and fall months. The model is:

$$C = 100 - \frac{0.8\ p\ d\ t}{i} \qquad (3\text{-}2)$$

where: C = average control efficiency, percent

P = potential average hourly daytime evaporation rate, mm/h

d = average hourly daytime traffic rate, (h^{-1})

i = application intensity, L/m^2

t = time between applications, h

Estimates of the potential average hourly daytime evaporation rate may be obtained from

$$p = \begin{cases} 0.0049 \times \text{(value in Figure 3-2) for annual conditions} \\ 0.0065 \times \text{(value in Figure 3-2) for summer conditions} \end{cases}$$

An alternative approach (which is potentially suitable for a regulatory format) is shown as Figure 3-3. This figure is adapted from 11 field tests conducted at a coal-fired power plant. Measured control efficiencies did not correlate well with either time or vehicle passes after application. However, this is believed due to reduced evening evaporation (logistics delayed the start of testing until 3 p.m. and testing continued through the early evening). Surface moisture grab samples were taken throughout the testing period, and not surprisingly, these show a strong correlation with control efficiency.

Figure 3-3 shows that between the average uncontrolled moisture content and a value of twice that, a small increase in moisture content results in a large increase in control efficiency. Beyond this point, control efficiency grows slowly with increased moisture content. Although

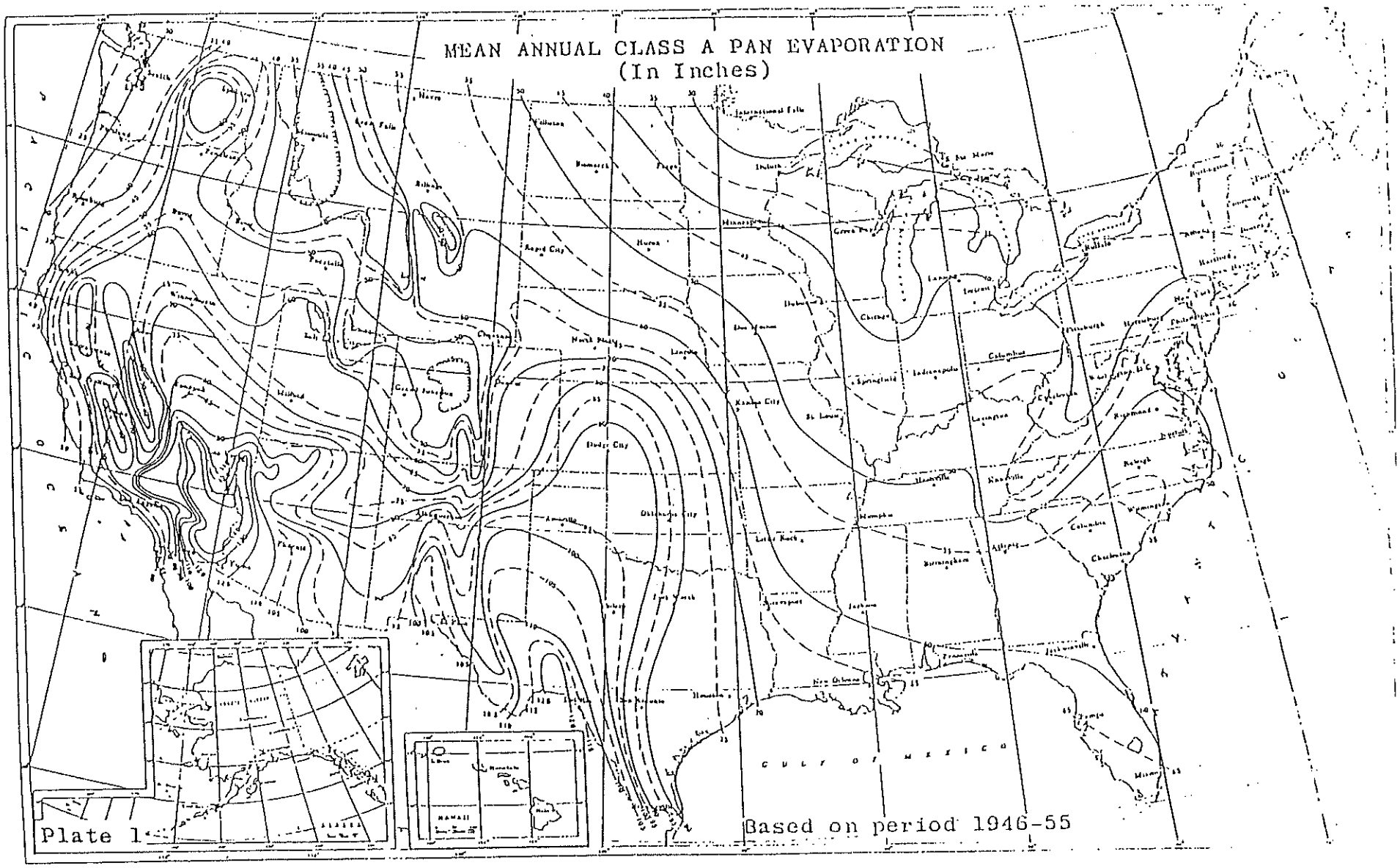

Figure 3-2. Annual evaporation data.

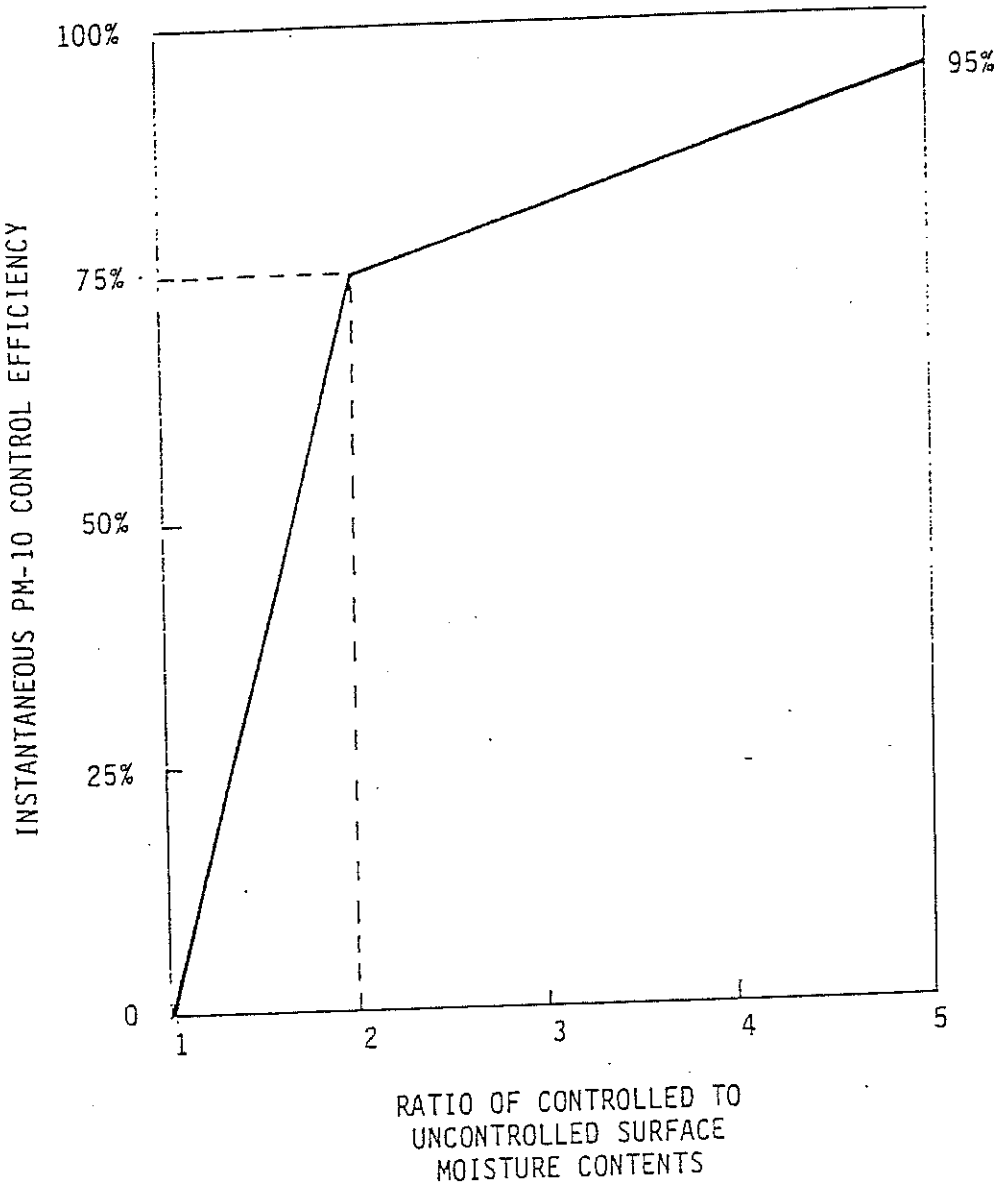

Figure 3-3. Watering control effectiveness for unpaved travel surfaces.

it is possible to fit hyperbolas to the data, the relatively simple bilinear relationship shown in the figure provides an adequate description. Furthermore, this relationship is applicable to all particle size ranges considered:

$$c = \begin{matrix} 75\ (M-1) & 1 \leq M \leq 2 \\ 62+6.7M & 2 \leq M \leq 5 \end{matrix} \qquad (3\text{-}3)$$

where: c = instantaneous control efficiency, percent

M = ratio of controlled to uncontrolled surface moisture contents

Costs for watering programs include the following elements:

Capital: Purchase of truck or other device

O&M: Fuel, water, truck maintenance, operator labor

Reference 6 estimates the following costs (1985 dollars):

Capital: $17,100/truck

O&M: $32,900/truck

The number of trucks required may be estimated by assuming that a single truck, applying water at 1 L/m², can treat roughly one mile of road every hour.

Enforcement of a watering program would ideally consist of two complementary approaches. The first facet would require the owner to maintain adequate records that would document to agency personnel's satisfaction that a regular program is in place. (See Appendix C for a suggested recordkeeping format.) The second approach would involve agency spot checks of controlled roads by taking either traffic counts or material grab samples (Appendices D and E) from the road. For example, the moisture or silt content of the traveled portion of the roadway could be measured and compared against a minimum acceptable value. As noted earlier, estimates of the PM_{10} control efficiency could then be obtained from Equations (3-2) and (3-3), respectively.

Records must be kept that document the frequency of water applied to unpaved surfaces. Pertinent parameters to be specified in a control plan and to be regularly recorded include:

General Information to be Specified in the Plan

1. All road segments and parking locations referenced on a map available to both the responsible party and the regulatory agency

2. Length of each road and area of each parking lot

3. Amount of water applied to each road/area and planned frequency of application (alternatively, a minimum moisture level could be specified)

4. Any provisions for weather (e.g., ¼ in of rainfall will be substituted for one treatment; program suspended during freezing periods; watering frequency as a function of temperature, cloud cover, etc.)

5. Source of water and tank capacity.

Specific Records for Each Road Segment/Parking Area Treatment

1. Date of treatment

2. Operator's initials (note that the operator may keep a separate log whose information is transferred to the environmental staff's data sheets)

3. Start and stop times on a particular segment/parking lot, average speed, number of passes

4. Start and stop times for tank filling.

General Records to be Kept

1. Equipment maintenance records

2. Meteorological log (to the extent that weather influences the control program, see above)

3. Any equipment malfunctions or downtime.

In addition to those items related to control applications, some of the regulatory formats suggested in Section 3.4 require that additional records be kept. These records may include surface material samples (following the sampling/analysis procedures given in Appendices D and E) or traffic counts. Traffic counts may be recorded either manually or using automatic devices.

3.3.3.2 Chemical Treatments. As noted in Section 3.2, some chemicals (most notably salts) simulate wet suppression by attracting and retaining moisture on the road surface. These methods are often supplemented by some watering. It is recommended that control efficiency estimates be obtained using Figure 3-3 and enforcement be based on grab sample moisture contents (see Appendices D and E).

The more common chemical dust suppressants form a hard cemented surface. It is this type of suppressant that is considered below.

Besides water, petroleum resins (such as Coherex[8]) have historically been the products most widely used in the iron and steel industry. However, considerable interest has been shown at both the plant and corporate level in alternative chemical dust suppressants. As a result of this continued interest, several new dust suppressants have been introduced recently. These have included asphalt emulsions, acrylics, and adhesives. In addition, the generic petroleum resin formulations developed at the Mellon Institute with funding from the American Iron and Steel Institute (AISI) have gained considerable attention. These generic suppressants were designed to be produced onsite at iron and steel plants.[9] Onsite production of this type of suppressant in quantities commonly used at iron and steel plants has been estimated to reduce chemical costs by approximately 50 percent.[9]

In an earlier test report, average performance curves were generated for four chemical dust suppressants: (a) a commercially available petroleum resin, (b) a generic petroleum resin for onsite production at an industrial facility, (c) an acrylic cement, and (d) an asphalt emulsion.[10] (Note that at the time of the testing program, these suppressant types accounted for roughly 85 percent of the market share in the iron and steel industry.) The results of this program were combined with other test results to develop a model to estimate <u>time-averaged</u> PM_{10} control performance. This model is illustrated as Figure 3-4. Several items are to be noted:

- The term "ground inventory" is a measure of residual effects from previous applications. Ground inventory is found by adding together the total volume (per unit area) of concentrate (<u>not solution</u>) since the start of the dust control season. An example is provided below.
- Note that no credit for control is assigned until the ground inventory exceeds 0.05 gal/yd^2.
- Because suppressants must be periodically reapplied to unpaved roads, use of the time-averaged values given in the figure are appropriate. Recommended minimum reapplication frequencies (as well as alternatives) are discussed later in this section.
- Figure 3-4 represents an <u>average</u> of the four suppressants given above. The basis of the methodology lies in a similar model for petroleum

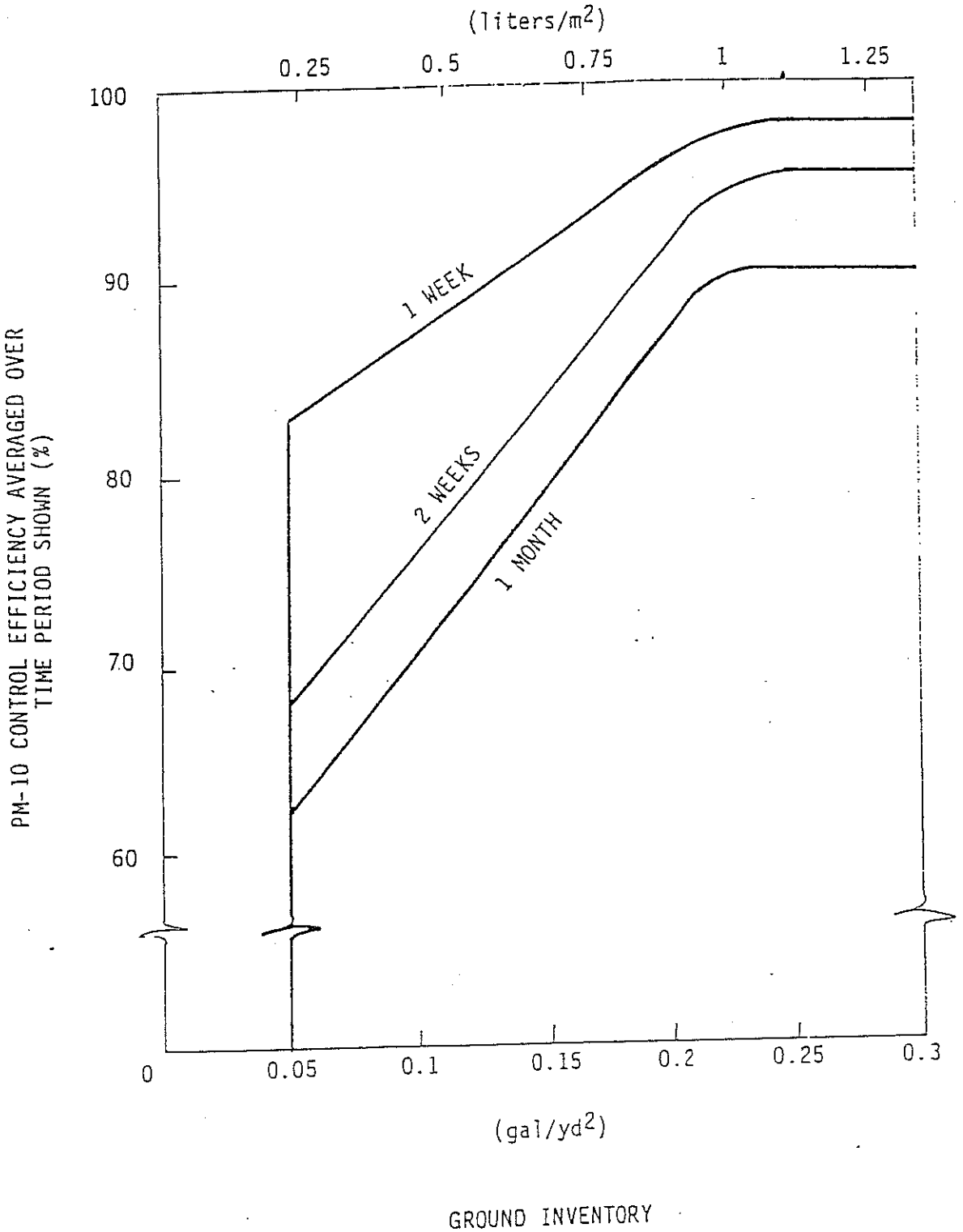

Figure 3-4. Average PM_{10} control efficiency for chemical suppressants.

resins only.[10] However, agreement between the control efficiency estimates given by Figure 3-4 and available field measurements is reasonably good.

As an example of the use of Figure 3-4, suppose that Equation (3-1) has been used to estimate a PM_{10} emission factor of 2.0 kg/VKT. Further, suppose that starting on May 1, the road is treated with 0.25 gal/yd² of a (1 part chemical to 5 parts water) solution on the first of each month until October. In this instance, the following average controlled emission factors are found:

Period	Ground inventory, gal/yd²	Average control efficiency, percent[a]	Average controlled emission factor, kg/VKT
May	0.042	0	2.0
June	0.083	68	0.64
July	0.12	75	0.50
August	0.17	82	0.36
September	0.21	88	0.24

[a]From Figure 3-3; zero efficiency assigned if ground inventory is less than 0.05 gal/yd².

A form which could be used as part of a recordkeeping format is presented in Section 3.4.

In formulating dust control plans for chemical dust suppressants, additional topics must be considered. These are briefly discussed below.

Use of paved road controls on chemically treated unpaved roads. Repeated use of chemical dust suppressants tend, over time, to form fairly impervious surfaces on unpaved roads. The resulting surface may admit the use of paved road cleaning techniques (such as flushing, sweeping, etc.) to reduce aggregate loading due to spillage and track-on. A field program conducted tests on surfaces that had been flushed and vacuumed 3 days earlier.[10] (The surfaces themselves had last been chemically treated 70 days before.) Control efficiency values of 90 percent or more (based on the uncontrolled emission factor of the unpaved roads) were found for each particulate size fraction considered.

The use of paved road techniques for "housekeeping" purposes would appear to have the benefits of both high control (referenced to an uncontrolled unpaved road) and potentially relatively low cost (compared to followup chemical applications). Generally, it is recommended that these methods not be employed until the ground inventory exceeds approximately 0.2 gal/yd^2 (0.9 L/m^2). Plant personnel should, of course, first examine the use of paved road techniques on chemically treated surfaces in limited areas prior to implementing a full-scale program.

Minimum reapplication frequency. Because unpaved roads in industry are often used for the movement of materials and are often surrounded by additional unpaved travel areas, spillage and carryout onto the chemically treated road require periodic "housekeeping" activities. In addition, gradual abrasion of the treated surface by traffic will result in loose material on the surface which should be controlled.

It is recommended that at least dilute reapplications be employed every month to control loose surface material unless paved road control techniques are used (as described above). More frequent reapplications would be required if spillage and track-on pose particular problems for a road.

Weather considerations. Roads generally have higher moisture contents during cooler periods due to decreased evaporation. Small increases in surface moisture may result in large increases in control efficiency (as referenced to the dry summertime conditions inherent in the AP-42 unpaved road predictive equation).[11] In addition, application of chemical dust suppressants during cooler periods of the year may be inadvisable for traffic safety reasons.

Weather-related application schedules should be considered prior to implementing any control program. Responsible parties and regulatory agency personnel should work closely in making this joint determination.

Compared to the other open dust sources discussed in this manual, there is a wealth of cost information available for chemical dust suppressants on unpaved roads. Note that many salt products are delivered and applied by the same truck. For those products, costs are easily obtained by contacting a local distributor.

For other chemicals, identified cost elements include:

Capital: Distributor truck, tanks, pumps, piping

O&M: Chemical suppressants, water, fuel, replacement parts, labor

Many plants contract out application and thus have minimal capital expenditures.

Because each plant faces a unique set of needs, no attempt has been made here to include all possible costs involved in a dust control program. For example, some facilities may be forced to install new storage tanks while others may only need to refurbish unused tanks in the plant. Still others may find it more efficient to retain an outside contractor to store and apply the suppressants. Extensive discussions, comparing rental and capital expenses, have been prepared; one is shown in Appendix B.

In order to provide preliminary estimates of costs associated with chemical dust suppressants, the reader may employ the following average costs:

	Chemical suppressant cost, 1985 $/gal	
	Small lot	Bulk
Salts	0.70[a]	0.46[a]
Other	2.60[b]	1.48[c]

[a]Cost includes delivery and application.
[b]FOB costs for 55-gal drums.
[c]FOB; note that at the time this manual was prepared, bulk costs of suppressants are slightly lower than that stated.

Delivery and contracted application costs may be estimated by increasing bulk costs by 10 and 15 percent, respectively.

At application intensities and dilution ratios common in the iron and steel industry, an adequate estimate of applied unit costs for chemical suppressants is $3,000 per treatment per mile of unpaved road.[10] For treatments at the higher intensities recommended by the chemical supplier, the corresponding unit cost is approximately $5,000 per treatment per mile.[11] Note that in the iron and steel industry, lighter application

intensities have been found to be more cost-effective over typical time intervals between treatments.[10]

Enforcement of a chemical dust control program would ideally consist of two complementary approaches. The first facet would require the owner to maintain adequate records that would document to agency personnel's satisfaction that a regular program is in place. (See Appendix C for a suggested recordkeeping format.) The second approach would involve agency spot checks of controlled roads by taking a material sample from the road. The latter approach is discussed in Section 3.4. The sampling method should be essentially the same as that used in the development of the current AP-42 predictive equations.

Records must be kept that document the frequency of chemicals applied to unpaved surfaces. Pertinent parameters to be specified in a control plan and to be regularly recorded include the following.

General Information to be Specified in the Plan

1. All road segments and parking locations referenced on a map available to both the responsible party and the regulatory agency
2. Length of each road and area of each parking lot
3. Type of chemical applied to each road/area, dilution ratio, application intensity, and planned frequency of application
4. Provisions for weather.

Specific Records for Each Road Segment/Parking Area Treatment

1. Date of treatment
2. Operator's initials (note that the operator may keep a separate log of whose information is transferred to the environmental staff's data sheets)
3. Start and stop times on a particular segment/parking lot, average speed, number of passes, amount of solution applied
4. Qualitative description of road surface condition.

General Records to be Kept

1. Equipment maintenance records
2. Meteorological log (to the extent that weather influences the control program--see above)
3. Any equipment malfunctions or downtime.

In addition to those items related to control applications, some of the regulatory formats suggested in Section 3.4 require that additional records be kept. These records may include surface material samples (following the sampling/analysis procedures given in Appendices D and E) or traffic counts. Traffic counts may be recorded either manually or using automatic devices.

3.4 EXAMPLE DUST CONTROL PLAN

As an illustration of the use of material given earlier, this section considers an example dust control plan. In this example, it is assumed that a minimum of 75 percent average control is required on an uncontrolled unpaved road. Traffic and meteorological parameters for the road are given below:

Hours of operation:	9 h/day, 250 days/yr
Traffic volume:	25 vehicle passes/h
Average daylight evaporation rate:	0.2 mm/h

3.4.1 Example Water Program

If the above assumptions are substituted, Equation (3-2) may be used to estimate the necessary hourly watering requirements:

$$75 \leq 100 - \frac{0.8(0.2)(25)t}{i}$$

or,

$$\frac{i}{t} \geq 0.16 \text{ L/m}^2\text{/h}$$

Thus, any watering program that applies at least 0.16 L/m² of water for every hour between applications would result in an estimated average control of at least 75 percent. Some example programs are presented below.

- 0.48 L/m² (0.11 gal/yd²) every 3 h
- 0.40 L/m² (0.088 gal/yd²) every 2 1/2 h
- 0.72 L/m² (0.16 gal/yd²) every 4 1/2 h

3.4.2 Example Chemical Dust Suppressant Program

Figure 3-3 may be used to design a chemical suppressant program resulting in a minimum of 75 percent average control. The figure

indicates that 75 percent average control is achieved over 2 weeks with a ground inventory of 0.41 L/m² (0.09 gal/yd²) and over 1 month with a 0.56 L/m² (0.125 gal/yd²) ground inventory. Thus, any of the following programs would result in a minimum of 75 percent average control:

- 0.45 gal/yd² of 4 parts water to 1 part chemical applied with any reapplication every 2 weeks, monthly reapplications after ground inventory is at least 0.125 gal/yd²
- 0.88 gal/yd² of a 6:1 solution applied initially, token reapplications every following month
- 1.0 gal/yd² of 10:1 solution applied initially, 0.38 of 10:1 solution 2 weeks later, token reapplications every following 30 days

Note that many other plans meeting the 75 percent minimum could also be formulated.

3.5 POTENTIAL REGULATORY FORMATS

There are numerous regulatory formats possible for unpaved roads. For example, some state rules have been developed using opacity readings to determine compliance. The Tennessee and Ohio visible emission methods are discussed in detail in Appendix C. Michigan and Illinois formulated rules based on opacity, and both resulted in considerable debates of merit.

It is important to note that opacity has yet to be related to emission levels from roads. (As discussed in Appendix C, Indiana has a current program which will attempt to correlate mass emission levels with opacity readings.) One often-raised question deals with prevailing wind speeds during opacity readings; ambient air concentrations (and hence, opacity levels) tend to be greater under lower wind speeds. Consequently, for a road with even a constant emission rate, opacity readings would vary indirectly with wind speed.

Recordkeeping offers another compliance tool for unpaved road dust controls. The level of detail needed varies with the control option employed. Table 3-4 summarizes the level of detail required for the various controls discussed in Section 3.3.

Recordkeeping, together with traffic records as required, will allow the regulator to estimate control performance for a variety of control programs. For example, use of the watering model presented as

TABLE 3-4. RECORDKEEPING REQUIREMENTS FOR UNPAVED ROADS

Control	Level of detail	Comments
Paving	Minimal level, starting date of paving, type, etc.	Additional records required if paved road controls employed (see Section 2.0)
Graveling	Minimal level, starting date of graveling, gravel specifications grading/reapplication dates	Before and after measurements of silt content recommended
Vegetation	See comment	Not generally applicable for traffic sources
Watering	Extensive, covering each day/ time of application, meteorological conditions, amount of water applied, traffic records	Collection of grab samples for moisture recommended
Chemicals (salts)	Fairly extensive, dates of applications and subsequent waterings	Collection of grab samples for moisture recommended
Chemicals	Moderate, dates and operating parameters for each application	Field samples recommended to bound control efficiency (see text)

Equation (3-2), together with traffic, application, and meteorological records, would allow one to estimate average control efficiency. Moreover, use of Figure 3-4, together with the form shown as Figure 3-5, allows estimation of chemical suppressant efficiency between applications. Figure 3-6 shows a completed form corresponding to the example in Section 3.3.3.2.

While recordkeeping affords a convenient method of assessing long-term control performance, it is important that regulatory personnel have "spot-check" compliance tools at their disposal. One such tool was mentioned earlier in connection with Figure 3-3. Rules could be written specifying a minimum surface moisture content (thus, corresponding to a minimum control efficiency) to be maintained on an unpaved surface which is watered or treated with salts. Inspection personnel would then collect grab samples for moisture analysis to determine compliance following the procedures in Appendices D and E.

For chemically (other than salts) controlled surfaces, it has been found that Equation (2-3) tends to <u>overestimate</u> the controlled emission factor (and thus, <u>underestimate</u> instantaneous control efficiency).[10] In this way, an inspector could collect an unpaved sample with a whisk broom and dustpan, and after laboratory analysis for silt content, have a conservatively low estimate of control efficiency due to the chemical treatment. If a rule is written to maintain a certain level of efficiency, the inspector could then instruct the responsible party to reapply the chemical or use paved road controls (if feasible).

WORKSHEET FOR DETERMINING UNPAVED ROAD CONTROL EFFICIENCY

No.	Date	Application Intensity (gal/yd²)	Dilution Ratio (water:chem)	Ground Inventory (gal/yd²)	Period (days)	Average PM-10 Control (%)
				DO NOT USE THIS SPACE		

Figure 3-5. Example chemical suppressant application log.

WORKSHEET FOR DETERMINING UNPAVED ROAD CONTROL EFFICIENCY

No.	Date	Application Intensity (gal/yd²)	Dilution Ratio (water:chem)	Ground Inventory (g/yd²)	Period (days)	Average PM-10 Control (%)
				DO NOT USE THIS SPACE		
1	5/1	0.25	5:1	0.042	31	0
2	6/1	0.25	5:1	0.083	30	68
3	7/1	0.25	5:1	0.125	31	75
4	8/1	0.25	5:1	0.167	31	82
5	9/1	0.25	5:1	0.208	30	88

3.4 REFERENCES FOR SECTION 3

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MRI Report and Summary
"Field Evaluation of PennzSuppress D"

MRI REPORT

Field Evaluation of PennzSuppress D

Revised Final Report

For Pennzoil Products Company

MRI Project No. 4599

February 11, 1998

MIDWEST RESEARCH INSTITUTE 425 Volker Boulevard, Kansas City, MO 64110-2299 • (816) 753-7600

MRI REPORT

Field Evaluation of PennzSuppress D

Revised Final Report

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Preface

This report was prepared by Midwest Research Institute (MRI) for the Pennzoil Products Company. Mr. Michael Hopfe of Pennzoil served as Pennzoil's project manager. Dr. Chatten Cowherd served as MRI Project Leader for this work. Dr. Gregory Muleski and Dr. Cowherd are the principal authors of this report. Other MRI staff who contributed to this project included Mr. Gary Garman, Mr. Mike Raile, and Mr. James Mulik.

Sincerely,

MIDWEST RESEARCH INSTITUTE

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Approved:

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February 11, 1998

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1. Introduction

A recently updated national PM-10 (particulate matter no greater than 10 microns in aerodynamic diameter) emission inventory[1] shows that dust emissions from unpaved roads are a major source category, accounting for 28% of nationwide emissions. Besides industrial unpaved roads, which typically dominate PM-10 emissions from heavy industries such as surface mining operations, public unpaved roads mostly in rural settings contribute most to the PM-10 emission total.

Probably no single generic particulate emission category spans a broader range of source conditions than vehicular travel over unpaved surfaces. Included are not only the public unpaved roads common throughout rural parts of the country, but also those roads traveled by very large trucks used in heavy industry such as surface mining operations. Some roads—such as those at landfills, mines, and construction sites—may exist for only a short period of time.

Despite the broad range of conditions, all these sources share the same basic features. When a vehicle travels over the surface, the wheels pulverize of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

Chemical stabilization has been recognized as a viable measure for controlling unpaved road dust emission. Chemical dust suppressants have also been shown to be effective in controlling the regulated component consisting of particles less than or equal to 10 micrometers in aerodynamic diameter (PM-10). During the period that testing took place, new National Ambient Air Quality Standards referencing PM-2.5 (i.e., particulate matter no greater than 2.5 μm in aerodynamic diameter) were promulgated. Although the main emphasis in this program was characterization of the PM-10 control performance, a limited effort was devoted to definition of PM-2.5 control efficiency.

Chemical road dust suppressants reduce emissions from unpaved roads by changing the physical characteristics of the existing road surface material. Most road dust suppressants form a hardened surface that binds particles together. After several applications, a treated road often resembles a paved road except that the surface is not uniformly smooth. Because the treated surface is more efficient in grinding of residual dust into small particles, the silt content (that is, the mass fraction of material passing a 200 mesh screen upon dry sieving) of loose material on a highly controlled surface may be substantially higher than when the surface was uncontrolled. However, this effect is more than offset by the much lower total loading of loose material found on the treated surface as compared to its uncontrolled state.

During the 1980s, the Environmental Protection Agency (EPA) conducted a series of field test programs to determine the efficiency of a variety of commercially available dust

suppressants for unpaved roads. These included petroleum resins, asphalt emulsions, acrylics, lignin sulfonates, and salts. As part of the testing programs, an appropriate test methodology was defined.

This report presents the results from a field test program to assess the effectiveness of PennzSuppress D in controlling particulate emissions from a variety of unpaved roads. PennzSuppress D is a new product which appeared well after EPA testing concluded. Therefore, a major objective of the program described in this report was to demonstrate the effectiveness of PennzSuppress D relative to dust suppressants evaluated in the EPA tests. To that end, the methods described in this report are analogous to those used in the EPA test programs.

The remainder of this report is structured as follows. Section 2 describes the test sites used in the field program as well as the control treatments applied to the test roads. Section 2 also presents the general test methodology used in the field exercise and describes how data were reduced. Section 3 presents the test results obtained and discusses the results in the context of past studies of chemical unpaved road dust suppressants. Section 4 lists the references.

2. Description of Test Sites, Control Measures, and Test Methodology

This section describes the test sites and control applications considered in this study. In addition, the test methodology employed to characterize both controlled and uncontrolled emission levels is described.

2.1 Test Sites

A total of three test sites were considered for use in the field program. Pennzoil Products Company (PPC) arranged for the test sites. MRI personnel inspected the Cyprus Sierrita Mine (located near Green Valley, Arizona) and the Cyprus Bagdad Mine (located in Bagdad, Arizona) on December 4 and 5, 1996, respectively. (Note that these are now known as Cyprus Amax mines.) A test road was selected at each mine based on information provided by the mine about: prevailing wind directions, typical traffic patterns, and other logistical issues.

At Sierrita, the road leading from the Sierrita mine to the Twin Buttes area was chosen. Because the road had been constructed to accommodate haul trucks, it was wide enough to permit both topical application and stabilization test sections. (Note that the Sierrita site involved left-hand traffic.) Because the prevailing wind direction was said to be southeasterly, a gently curving section of the road was selected to permit testing under a variety of wind directions from the south to southeast. As shown in Figure 2-1, the Sierrita test site gently curved from a SW-NE to a W-E orientation. During the December site visit, mine personnel characterized traffic as consisting of both large over-the-road (i.e., 18 wheel) trucks carrying acid or concentrated ores and miscellaneous plant (i.e., pick-up) traffic. Traffic volume was estimated at roughly 40 to 50 vehicle passes per day.

At Bagdad, the "causeway" road was selected for field evaluation for a topical application of PennzSuppress D. Because of concerns expressed by mine personnel, only a limited length (approximately 400 ft) of roadway could be dedicated for either the controlled or the untreated section of road (see Figure 2-2). Traffic at the Bagdad road consisted of both 18-wheel trucks carrying concentrated ore and miscellaneous plant traffic. In contrast to the Sierrita test site, traffic volume averaged approximately 200 to 300 passes per day.

Besides the short length of road available, two other drawbacks were present at the Bagdad site. First, the causeway road had a considerable (approximately 5% to 10%) grade along its length. Furthermore, an infrequently used haul road paralleled the causeway immediately upwind of the test section. Because baseline emission factors for

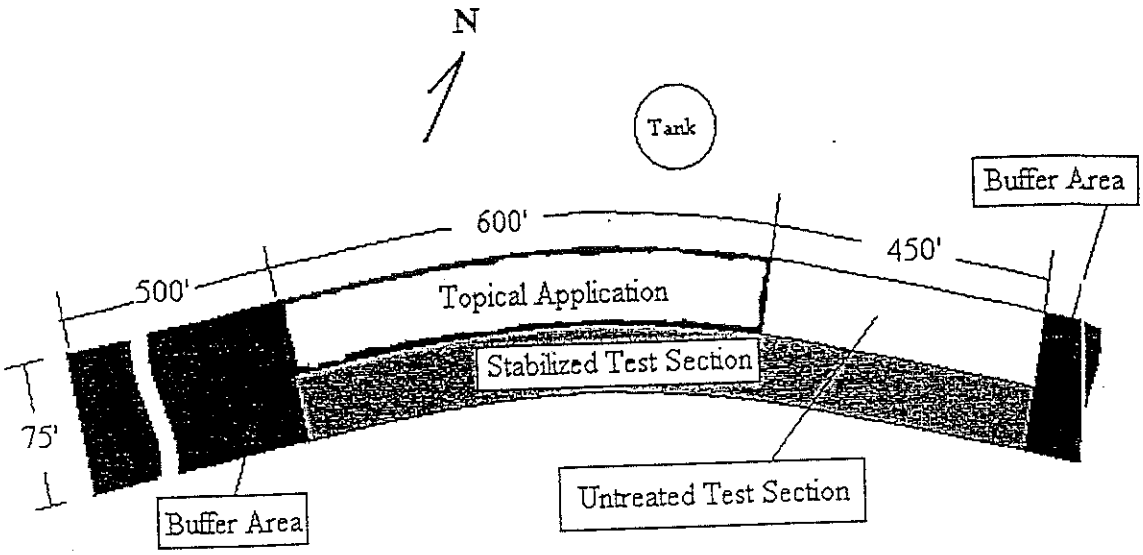


Figure 2-1. Sierrita Test Site

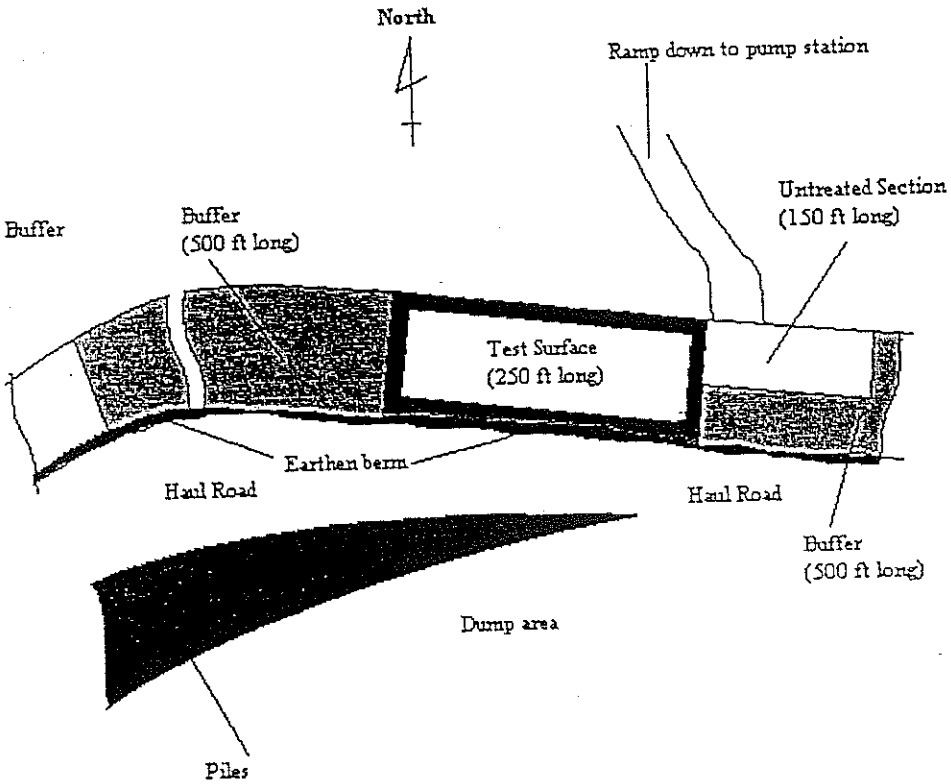
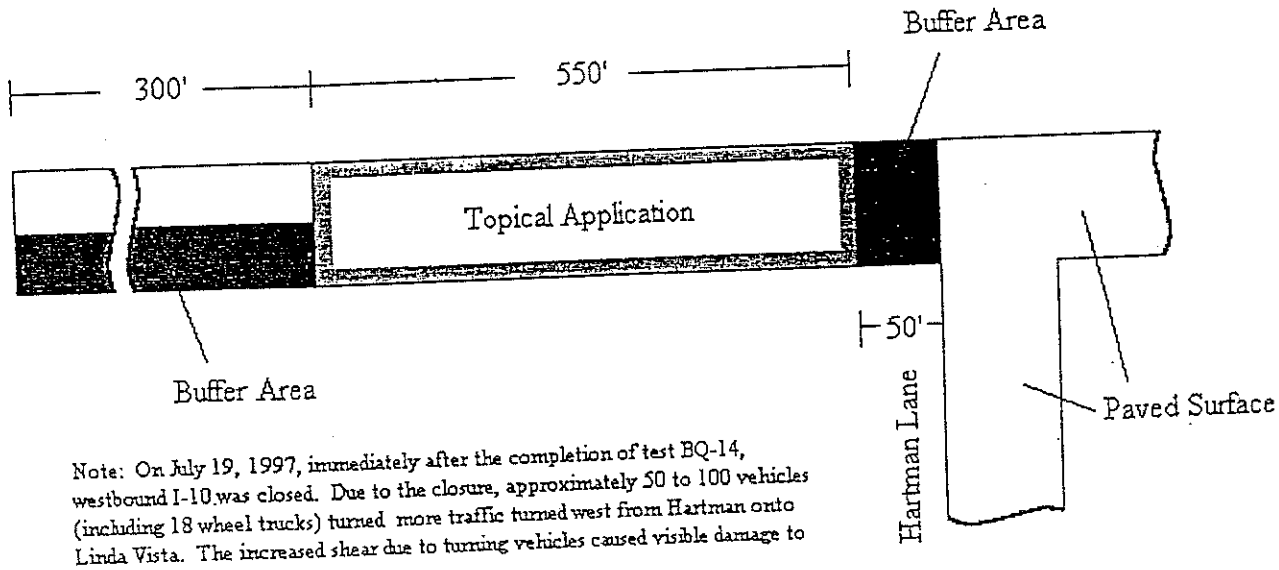


Figure 2-2. Bagdad Test Site

haul trucks are one to two orders of magnitude greater than the emission factors that would be developed for the test section, testing would be restricted to days when that haul road was not in use in order to isolate the source contribution.

A series of difficulties hampered testing activities at Bagdad. At the time field crew and test equipment arrived in May 1997, the parallel haul road was in active use. Mine personnel stated that haulage would continue for approximately one month. In addition, a substantial portion of the test section was badly damaged by a bulldozer traveling over a berm and then along the test section. This raised concerns about whether the test section might be compromised during the field exercise.

Because of the problems at the second mine, a third road was selected to replace the Bagdad site. Linda Vista (Figure 2-3) is a public unpaved road in the northwestern Tucson metropolitan area which experiences substantial traffic during the morning and evening commutes. (Note that because the road is heavily traveled, Pima County plans to pave Linda Vista within the next year.)



Note: On July 19, 1997, immediately after the completion of test BQ-14, westbound I-10 was closed. Due to the closure, approximately 50 to 100 vehicles (including 18 wheel trucks) turned more traffic turned west from Hartman onto Linda Vista. The increased shear due to turning vehicles caused visible damage to the eastern buffer area.

Figure 2-3. Linda Vista Test Site

2.2 Control Applications of PennzSuppress D

Cactus Transport, Inc. of Phoenix arranged all applications of PennzSuppress® D. Figures 2-1 and 2-3 show that buffered strips were used to control track-on of material from uncontrolled areas onto the test sections. Buffers were retreated each time that Cactus visited the site to perform a maintenance application.

As noted above, the Sierrita test road was wide enough to accommodate two treated test sections. Both sections were graded prior to treatment. The northern test section was topically treated on April 1 and April 7. A maintenance application was performed on May 8, 1997, and brought the total application of PennzSuppress D concentrate to 0.225 gal/yd^2. The southern section was stabilized on April 1, 1997, through a series of applications followed by blade mixing and compaction. The total application of PennzSuppress D concentrate was 0.30 gal/yd^2.

Initial treatments were monitored by MRI personnel who used tared sampling pans to determine the amount of PennzSuppress D 1:9 solution applied per unit area. After Cactus Transport had made two passes each at a nominal application rate of 0.25 gal/yd^2, the sampling pans were reweighed. This led to a mean measured application rate of 0.46 $\pm$ 0.033 gal/yd^2, as compared to the metered value of 0.50 gal/yd^2. This exercise demonstrated that not only did Cactus Transport's equipment accurately meter the application intensity but also that the application pattern was uniform (i.e., did not vary in intensity along the road).

The Linda Vista site was topically treated on July 2 and July 7, 1997. Note that Linda Vista was not graded prior to treatment. The total amount of PennzSuppress D concentrate applied was 0.15 gal/yd^2.

Table 2-1 summarizes the application history of the two sites evaluated in the field exercise.

2.3 Traffic Characterization at Test Sites

Traffic volumes were measured using pneumatic tube counters deployed at each site. The Sierrita road experienced a moderate level of traffic related to mine maintenance operations, with a daily total of approximately 70 plant vehicle passes. Because, however, two treated sections were used at Sierrita, each section experienced only approximately 35 vehicle passes per day. In contrast to what was expected, almost no 18-wheel trucks were observed to travel the Sierrita test road, and the traffic was almost exclusively light- to medium-duty (e.g., 6-wheel fuel trucks, etc.) vehicles.

Table 2-1. Application History for the Sierrita and Linda Vista Test Sites

Site	Date	Application description
Cyprus Sierrita		
Topical Application	4/1/97	Road bladed and then sprayed in 3 passes. Each pass consisted of 0.25 gal/yd^2 of 1:9 (1 part concentrate to 9 parts water) solution. Total ground inventory[a] of 0.075 gal/yd^2 .
	4/7/97	Second application applied in 3 passes each of 0.25 gal/yd^2 of 1:9 solution. Total ground inventory of 0.15 gal/yd^2.
	5/8/97	Maintenance application applied in 3 passes each of 0.25 gal/yd^2 of 1:9 solution. Total ground inventory of 0.225 gal/yd^2.
Stabilization Section	4/1/97	Road bladed and then sprayed with 0.5 gal/yd^2 of 1:4 solution. Road surface mix-bladed. Second spray of 0.5 gal/yd^2 of 1:4 solution, followed by mix blading[b] Road surface static rolled, followed by vibratory rolling. Final topical application of 0.5 gal/yd^2 of 1:4 solution.
Linda Vista		
Topical Application	7/2/97	Road sprayed in 3 passes. Each pass consisted of 0.25 gal/yd^2 of 1 part concentrate to 9 parts water solution. Total ground inventory[a] of 0.075 gal/yd^2 .
	7/7/97	Follow-up application in 3 passes, each of 0.025 gal/yd^2 of 1:9 solution. Total ground inventory of 0.15 gal/yd^2.

[a] Cumulative volume of concentrated product applied per unit road surface area.
[b] Total depth of blade mix stabilization approximately 3 in.

As noted earlier, Linda Vista experienced substantial traffic during the morning and evening commutes, with a total of approximately 200 vehicle passes per day. In addition, deliveries to a dam construction project to the west of the immediate test area resulted in approximately 5 passes per day by relatively heavy over-the-road vehicles (e.g., cement mixers).

In order to complete testing, both test sites relied on "captive" traffic. That is to say, during periods of air sampling (as described in the next section), MRI supplied light-duty traffic on each test road not only to complete testing in a reasonable period of time but also to assure control of mean vehicle characteristics (e.g., speed).

At Linda Vista, the captive traffic was recorded by the pneumatic counter. However, at the Sierrita test site, the pneumatic counter recorded only "natural" traffic. As a result, the captive vehicle passes were added to the total recorded by the counter to determine the total number of vehicle passes over the test section.

2.4 Overview of Test Methodology

In order to assess control performance, one must determine the source emission strength of a test road both with and without emission control in place. This section describes how the source emission factor is measured in both the controlled and uncontrolled conditions.

Emission testing employed the exposure profiling method to quantify the mass emissions from the test road in either controlled or uncontrolled condition. Exposure profiling uses a direct mass-balance calculation scheme similar to stack testing methods rather than relying on an uncalibrated dispersion model to indirectly backcalculate an emission rate.

Figure 2-4 illustrates the basic measurement scheme used to test a line source such as traffic on an unpaved road. The method relies on simultaneous measurement of particulate concentrations and wind speeds at various points over the effective height of the plume. Background concentrations were monitored upwind of the test road. The sampling time was long enough to provide sufficient particulate mass and to average over several cycles of the fluctuation in the emission rate (e.g., vehicle passes on the road).

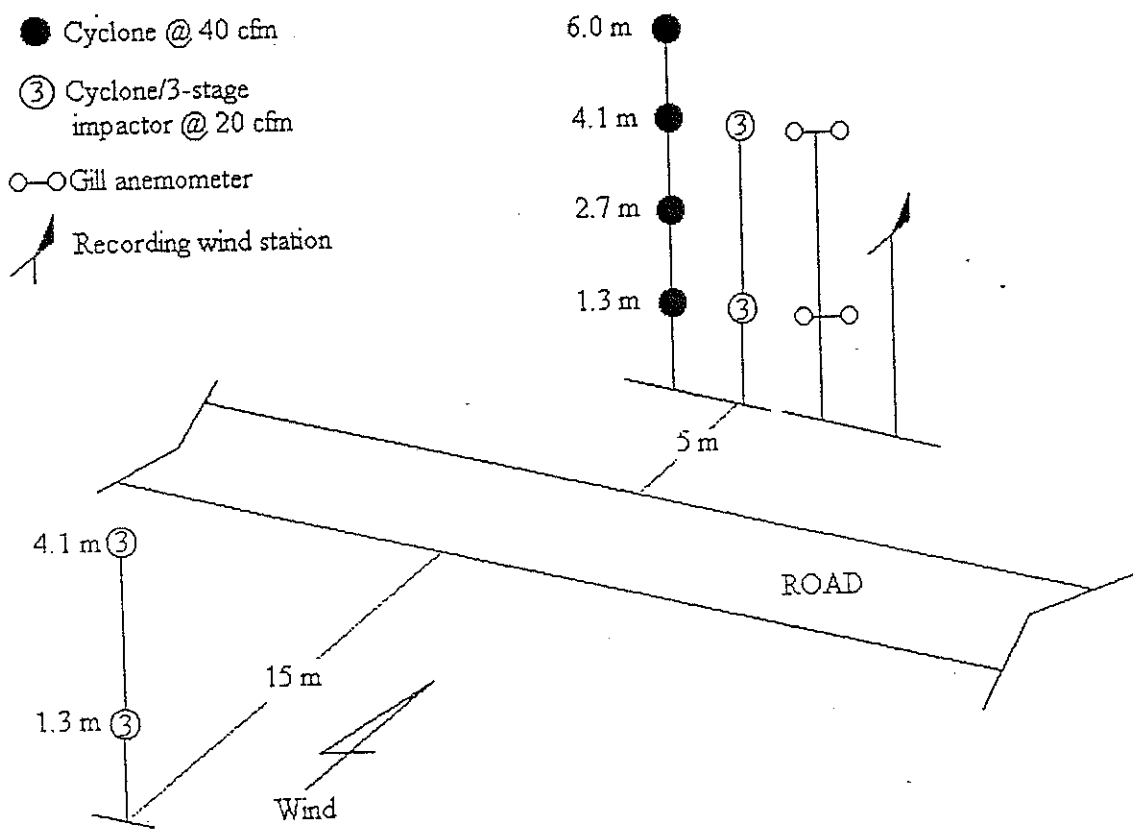


Figure 2-4. Equipment Deployment

The primary sampling device used in the case study was the high-volume air sampler fitted with a cyclone preseparator. Samplers were used in two basic configurations. The preseparator, when operated at 40 acfm, exhibits a D_{50} cutpoint of approximately 10 μmA (microns in aerodynamic diameter).[5,6] Thus, the particulate sample collected on the 8- by 10-in glass fiber backup filter represents PM-10 (see Figure 2-5). This sampling configuration was used to define the downwind road dust plume profile.

The second configuration allowed definition of the particle size distribution by operating the preseparator at 20 acfm over a 3-stage cascade impactor. At that flow rate, the cyclone and 3 stages exhibit D_{50} cutpoints of 15, 10.2, 4.2, and 2.1 μmA. Particulate was collected on 4- by 5-in glass fiber impactor substrates and the 8- by 10-in glass fiber backup filter (see Figure 2-6). To reduce particle "bounce" through the impactor, the substrates were sprayed with a grease solution that improved the adhesion of the impacted particles.[6] The PM-2.1 size fraction collected on the 8 x 10 back-up filler was used as a surrogate for PM-2.5, which is the reference for the new PM NAAQSs.

To determine the emission factor for the road, a conservation of mass approach was used. The passage of airborne particulate (i.e., the quantity of emissions per unit of source activity) was obtained by spatial integration of distributed measurements of exposure (mass/area) over the effective cross section of the plume. Exposure is the point value of the flux (mass/area-time) of airborne particulate integrated over the time of measurement, or equivalently, the net particulate mass passing through a unit area normal to the mean wind direction during the test.

2.5 Specific Test Procedures and Data Reduction

The sampling and analysis procedures followed in this field testing program were subject to certain QA guidelines. These guidelines are discussed in conjunction with the activities to which they apply. These procedures meet or exceed the requirements specified in the reports entitled "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II—Ambient Air Specific Methods" (EPA 600/4-77-027a) and "Ambient Monitoring Guidelines for Prevention of Significant Deterioration" (EPA 450/2-78-019).[7,8]

As part of the QA program for this study, routine audits of sampling and analysis procedures were performed. The purpose of the audits was to demonstrate that measurements were made within acceptable control conditions for particulate source sampling and to assess the source testing data for precision and accuracy. Examples of items audited included gravimetric analysis of filters, flow rate calibration, field and laboratory data processing, and emission factor calculation. The mandatory use of specially designed reporting forms for sampling and analysis data obtained in the field and laboratory aided in the auditing procedure. Further details on specific sampling and analysis procedures are provided in the following sections.

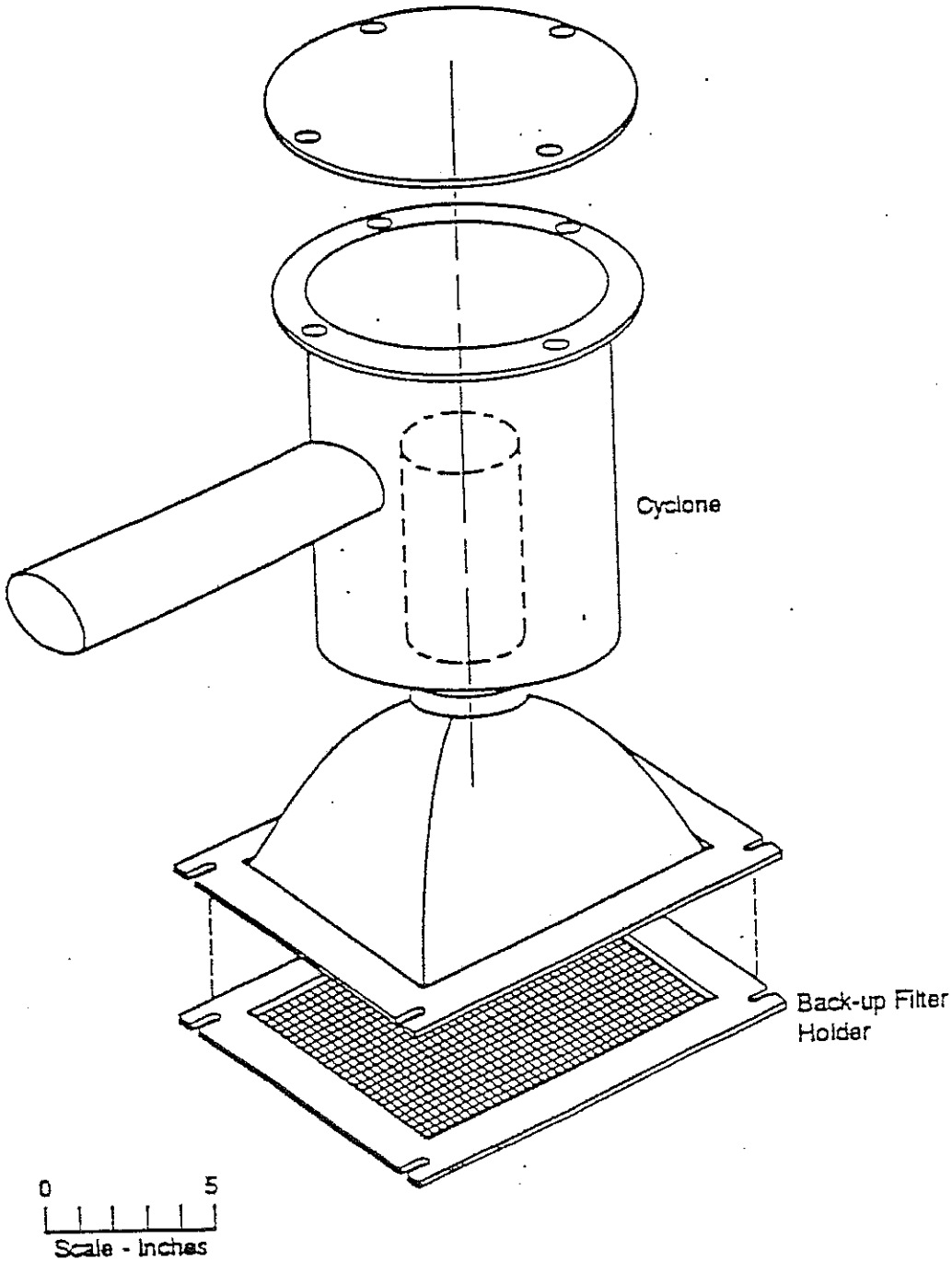


Figure 2-5. Cyclone Preseparator

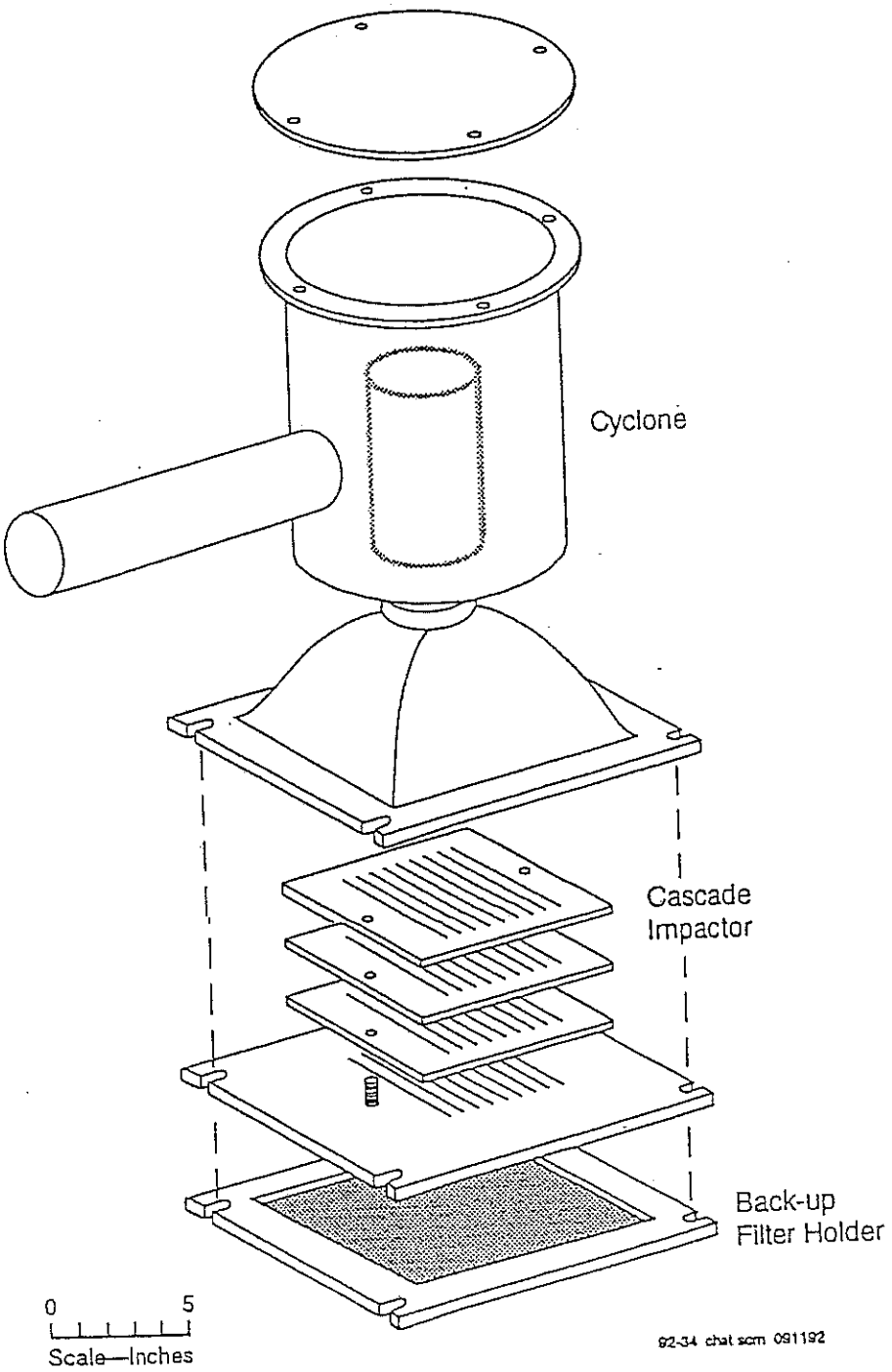


Figure 2-6. Cyclone/Cascade Impactor Combination

Particulate Sample Handling—Particulate samples were collected on Whatman EPM-2000 glass fiber filters (8 in by 10 in). Prior to the initial weighing, the filter media were equilibrated for 24 h at constant temperature and humidity in a special weighing room. During weighing, the balance was checked at frequent intervals with standard (Class S) weights to ensure accuracy. The filters remained in the same controlled environment for another 24 h, after which a second analyst reweighed them as a precision check.

A minimum of ten percent (10%) of the filters used in the field served as blanks to account for the effects of handling. These filters were inserted into and then removed from the sampling devices without drawing any air through the samplers. The QA guidelines pertaining to preparation of sample collection media and equipment operation are presented in Tables 2-2 and 2-3, respectively.

Once they had been used, exposed filters were placed in individual glassine envelopes and then into numbered file folders. When exposed filters and the associated blanks were returned to the laboratory, they were equilibrated under the same conditions as the initial weighing. After reweighing, 10% of the filters were audited to check weighing accuracy.

The interior surface of each cyclone preseparator was washed with distilled water into separate sample jars which were then capped and taped shut. To determine the sample weight of particulate collected on the interior surface, the entire wash solution was passed through a Büchner-type funnel holding an 47-mm glass fiber filter under suction. This ensured collection of all suspended material on the filter.

All wash filters were weighed with a 100% audit of tared filters and a minimum of 10% audit of exposed filters. Blank values were determined by washing "clean" (unexposed) cyclone preseparators in the field and following the above procedures.

Data Reduction—To calculate emission rates from exposure profiling test data, a conservation of mass approach was used. The passage of airborne particulate (i.e., the quantity of emissions per unit of source activity) was obtained by spatial integration of distributed measurements of exposure (mass/area) over the effective cross-section of the plume. Exposure is the point value of the flux (mass/area-time) of airborne particulate integrated over the time of measurement, or equivalently, the net particulate mass passing through a unit area normal to the mean wind direction during the test. Exposure was calculated by:

Table 2-2. Quality Assurance Procedures for Sampling Media

Activity	QA check/requirement
Preparation	Inspect and imprint glass fiber media with identification numbers.
Conditioning	Equilibrate media for 24 h in clean controlled room with relative humidity of 45% (variation of less than ±5% RH) and with temperature of 23°C (variation of less than ±1°C).
Weighing	Weigh hi-vol filters to nearest 0.05 mg.
Auditing of weights	Independently verify final weights of 10% of filters (at least four from each batch). Reweigh batch if weights of any hi-vol filters deviate by more than ±2.0 mg. For tare weights, conduct a 100% audit. Reweigh tare weight of any filters that deviate by more than ±1.0 mg. Follow same procedures for impactor substrates used for sizing tests. Audit limits for impactor substrates are 1.0 and 0.5 mg for final and tare weights, respectively.
Correction for handling effects	Weigh and handle at least one blank for each 1 to 10 filters of each type used to test.
Calibration of balance	Balance to be calibrated once per year by certified manufacturer's representative. Check prior to each use with laboratory Class S weights.

Table 2-3. Quality Assurance Procedures for Sampling Equipment

Activity	QA check/requirement[a]
Maintenance • All samplers	Check motors, gaskets, timers, and flow measuring devices at each plant prior to testing.
Operation • Timing	Start and stop all downwind samplers during time span not exceeding 1 min.
• Isokinetic sampling (cyclones)	Adjust sampling intake orientation whenever mean wind direction dictates.
	Change the cyclone intake nozzle whenever the mean wind speed approaching the sampler falls outside of the suggested bounds for that nozzle. This technique allocates no nozzle for wind speeds ranging from 0 to 10 mph, and unique nozzles for four wind speed ranges above 10 mph.
• Prevention of static mode deposition	Cover sampler inlets prior to and immediately after sampling.

[a] "Mean" denotes a 3- to 15-min average.

$$E = (C - C_b)\,U\,T$$

where: E = net particulate matter exposure
C = downwind concentration
C_b = background concentration
U = approach wind speed
T = duration of sampling

Exposure varies with height over the extent of the plume.

When exposure values were integrated over the effective cross-section of the plume, the quantity obtained represented the total passage of airborne particulate matter due to the road

$$A = \int_0^H E\,dh$$

where: A = integrated exposure
E = particulate exposure
h = height

and the integration extended from 0 to the effective height H of the plume.

Because exposures were measured at discrete heights of the plume, a numerical integration was necessary to determine A1. The exposure must equal to zero at the vertical extremes of the profile (i.e., at the ground where the wind velocity equaled zero and at the effective height of the plume where the net concentration equaled zero). However, the maximum exposure usually occurred below a height of 1 m, so that there was a sharp decay in exposure near the ground. To account for this sharp decay, the value of exposure at the ground level was set equal to the value at the lowest sampling height. The integration was then performed the trapezoidal rule.

The emission factor was then found by dividing the integrated exposure by the number of vehicle passes during sampling:

$$e = A/N$$

where: e = particulate emission factor in terms of mass per vehicle-distance-traveled
A = integrated exposure
N = number of vehicle passes during sampling

Ancillary Sample Collection and Analysis—In addition to the airborne samples, each test was associated with a material sample collected from the road surface. The samples were analyzed for surface moisture content (by determining weight loss upon drying) and for silt content (by dry sieving the sample to determine the sub-200 mesh fraction). Tables 2-4 and 2-5 present the procedures to determine moisture and silt contents, respectively.

Table 2-4. Moisture Content Determination

1. Preheat the oven to approximately 110°C (230°F). Record oven temperature.
2. Record the make, capacity, and smallest division of the scale.
3. Weigh the empty laboratory sample containers which will be placed in the oven to determine their tare weight.
4. Weigh containers with the lids on if they have lids. Record the tare weight(s). Check zero before each weighing.
5. Weigh the laboratory sample(s) in the container(s). For materials with high moisture content, ensure that any standing moisture is included in the laboratory sample container. Record the combined weight(s). Check zero before each weighing.
6. Place sample in oven and dry overnight. Materials composed of hydrated minerals or organic material like coal and certain soils should be dried for only 1-1/2 h.
7. Remove sample container from oven and (a) weigh immediately if uncovered, being careful of the hot container; or (b) place the tight-fitting lid on the container and let cool before weighing. Record the combined sample and container weight(s). Check zero reading on the balance before weighing.

   Calculate the moisture as the initial weight of the sample and container minus the oven-dried weight of the sample and container divided by the initial weight of the sample alone. Record the value.

Table 2-5. Silt Content Determination

1. Select the appropriate 20 cm (8-in) diameter, 5 cm (2-in) deep sieve sizes. Recommended U.S. Standard Series sizes are: 3/8 in, No. 4, No. 20, No. 40, No. 100, No. 140, No. 200, and a pan. Comparable Tyler Series sizes can also be utilized. The No. 20 and the No. 200 are mandatory. The others can be varied if the recommended sieves are not available or if buildup on one particulate sieve during sieving indicates that an intermediate sieve should be inserted.
2. Obtain a mechanical sieving device such as vibratory shaker or a Roto-Tap without the tapping function.
3. Clean the sieves with compressed air and/or a soft brush. Material lodged in the sieve openings or adhering to the sides of the sieve should be removed (if possible) without handling the screen roughly.
4. Obtain a scale (capacity of at least 1,600 g or 10 lb) and record make, capacity, smallest division, date of last calibration, and accuracy.
5. Weigh the sieves and pan to determine tare weights. Check the zero before every weighing. Record weights on the form.
6. After nesting the sieves in decreasing order with pan at the bottom, dump dried laboratory sample (preferably immediately after moisture analysis) into the top sieve. The sample should weigh between ~ 400 and 1,600 g (0.9 to 3.5 lb). This amount will vary for finely textured materials; 100 to 300 g may be sufficient with 90 percent of the sample passes a No. 8 (2.36 mm) sieve. Brush fine material adhering to the sides of the container into the top sieve and cover the top sieve with a special lid normally purchased with the pan.
7. Place nested sieves into the mechanical sieving device and sieve for 10 min. Remove pan containing minus No. 200 and weigh. Repeat the sieving in 10-min intervals until the difference between two successive pan sample weighings (where the tare weight of the pan has been subtracted) is less than 3.0 percent. Do not sieve longer than 40 min.
8. Weigh each sieve and its contents and record the weight on the form. Check the zero reading on the balance before every weighing.
9. Collect the laboratory sample and place the sample in a separate container if further analysis is expected.
10. Calculate the percent of mass less than the 200 mesh screen (75 mm). This is the silt content.

3. Test Results and Discussion

This section discusses the results obtained from the field evaluation of PennzSuppress D at the Arizona test sites.

The control efficiency measured during any individual test represents the **"instantaneous"** control efficiency (that is, at a particular time after application). Another important measure of control performance is **"average"** control efficiency, defined by

$$C(T) = \frac{1}{T} \int_0^T c(t)\, dt$$

where: $C(T)$ = average control efficiency during a period ending T days after application

$c(t)$ = instantaneous control efficiency as a function time "t"

The average control efficiency is of greater interest when estimating emissions.

3.1 Field Test Results

The following tests were performed at the two test sites:

Sierrita

5 tests of emissions from the uncontrolled unpaved road surface
6 tests of emissions from the surface stabilized with PennzSuppress D
5 tests of emissions from the surface topically treated with PennzSuppress D

Linda Vista

2 tests of emissions from the uncontrolled unpaved road surface
5 tests of emissions from the surface topically treated with PennzSuppress D

Site parameters associated with the tests are given in Table 3-1.

Of special note was the extensive amount of localized rainfall that fell at Sierrita on July 21, 1997. On that day, MRI transferred equipment from the Linda Vista site to Sierrita. Upon arrival, it was found that the water running along the south side of the road had freed the traffic counter from its anchors. Although this marked the only rainfall recorded at the site, the heavy rain removed loose material from the test surfaces. For example, the post-rain silt loading on the uncontrolled surface was roughly one tenth the pre-storm value. Consequently, the first set of uncontrolled tests (i.e., BQ-1 and -2) were used to determine control efficiency values at the Sierrita site. Some loose material on the controlled surfaces was also removed, although probably not to the same extent as the uncontrolled test surface.

Table 3-1. Test Site Parameters

Run	Date	Location	Treatment[a]	Start time	Duration (min)	Vehicle passes	Air temperature (°F)	Baro. pressure (inHg)
BQ-1	05/06/97	Sierrita	U	15:32	111	110	98	26.33
BQ-2	05/07/97	Sierrita	U	13:40	76	71	95	26.33
BQ-3	05/07/97	Sierrita	U	15:06	111	54	97	26.30
BQ-5	07/01/97	Sierrita	S	14:59	156	310	106	26.32
BQ-6	07/02/97	Sierrita	S	13:53	207	316	106	26.29
BQ-7	07/03/97	Sierrita	T	14:35	183	308	106	26.28
BQ-8	07/04/97	Sierrita	T	15:11	184	304	102	26.31
BQ-9	07/05/97	Sierrita	S	13:44	175	303	104	26.36
BQ-10	07/07/97	Sierrita	S	15:32	84	82	96	26.31
BQ-12	07/16-17/97	Linda Vista	T	10:27[b]	689	228	102	27.55
BQ-13	07/18/97	Linda Vista	T	05:24[b]	264	439	90	27.54
BQ-14	07/19/97	Linda Vista	T	05:38[b]	280	392	82	27.52
BQ-15	07/21/97	Linda Vista	U	07:24	44	63	78	27.64
BQ-16	07/21/97	Linda Vista	U	08:30	38	51	79	27.66
BQ-17	07/22-23/97	Sierrita	S	13:52	345	603	94	26.42
BQ-18	07/24-25/97	Sierrita	S	10:49	374	592	99	26.37
BQ-19	07/26/97	Sierrita	T	10:19	245	506	91	26.40
BQ-20	07/27-28/97	Sierrita	T	11:55	306	652	94	26.41
BQ-21	07/29-30/97	Sierrita	U	10:41	115	168	94	26.46
BQ-22	07/31/97	Sierrita	U	11:13	115	309	97	26.51
BQ-23	08/01-02/97	Linda Vista	T	12:40	222	429	102	27.58
BQ-24	08/04/97	Linda Vista	T	09:30	204	434	100	27.63
BQ-26	08/07-08/97	Sierrita	T	09:40	271	409	95	26.41

[a] U = uncontrolled, T = topical, S = stabilized

[b] Run BQ-12 was conducted over 2 days under marginal wind conditions. Runs BQ-13 and -14, on the other hand, were conducted during early morning hours under much better wind conditions. Because of greater confidence in the results from runs BQ-13 and -14, no emission factor was calculated for run BQ-12.

The Linda Vista site also experienced an unanticipated condition. On July 19, 1997, westbound Interstate 10 was closed for four hours. This occurred immediately after the completion of test BQ-14. During the closure, approximately 100 vehicles (roughly one-fourth of which was 18-wheel trucks) detoured around the closure by traveling across the Linda Vista test site. The detouring vehicles traveled north on Hartman Lane, and when turning west onto Linda Vista, caused some damage to the buffer area. This increased the rate at which control efficiency decayed at Linda Vista.

Table 3-2 compares, for each run, the raw PM-10 concentration values obtained both upwind and downwind of the test road. Direct comparison between PM-10 concentrations measured by the high-volume cyclone and those from the cyclone/impactor combination is not possible for the cases when the latter units were operated for two runs in

Table 3-2. Representative PM-10 Concentrations ($\mu g/m^3$)

Run	1.3 m upwind cascade impactor	2.7m upwind cascade impactor	4.1m upwind cascade impactor	1.3 m downwind cyclone	1.3 m downwind cascade impactor	4.1 m downwind cyclone	4.1 m downwind cascade impactor
BQ1	15		8.7	512	470	36	35
BQ2	7.9		7.3	545	380	72	61
BQ3	"[a]		"	324	"	50	"
BQ5	16		11	33	35	15	12
BQ6	"		"	30	"	6.3	"
BQ7	11		–[b]	14	12	8.7	11
BQ8	"		–[b]	13	"	6.9	"
BQ9		17[b]		25	21	13	19
BQ10		"		21	"	10	"
BQ12		20		36	34	26	21
BQ13		"		36	"	14	"
BQ14		12		52	45	21	28
BQ15		40		2370	1900	592	690
BQ16		"		3030	"	837	"
BQ17		8.0		100	42	20	8.7
BQ18		7.6		108	64	24	13
BQ19		14		27	20	5.0	17
BQ20		17		73	54	20	17
BQ21		12		157	140	26	11
BQ22		49		645	640	126	140
BQ23		6.3		242	150	24	28
BQ24		1.4		417	310	81	87
BQ26		31		75	79	27	-

[a] The significance of ditto marks is discussed in the test.

[b] The 4.1 m upwind sampler was blown over during a gust of wind during Run BQ-8. Because of damage to the preseparator, only one upwind sampler could be deployed thereafter.

order to obtain adequate sample mass on the impactor substrates. Those instances are noted in Table 3-2 by the use of "ditto" marks.

Individual point values of exposure (net mass per unit area) within in the open source dust plume are presented in Table 3-3. These values, when integrated over the effective area of the plume, yield the emission factors.

Table 3-4 presents the emission factors obtained for both PM-10 and for total particulate matter (PM) sampled by the high-volume cyclone (i.e., the cyclone catch plus the back-up filter catch). In addition, the table presents PM-2.5 emission factors, which

Table 3-3. Plume Sampling Data

Run	Sampling height	Mean wind speed (mph)[a]	Net PM-10 exposure (mg/cm^2)	Net PM exposure (mg/cm^2)
BQ-1	1.3m	3.5	0.521	2.537
	2.7m	4.2	0.116	6.450
	4.1m	4.5	0.033	0.120
	6.0m	4.9	0.004	0.000
BQ-2	1.3m	3.1	0.337	1.100[b]
	2.7m	3.8	0.117	0.342[b]
	4.1m	4.2	0.051	0.182[b]
	6.0m	4.6	0.012	0.049[b]
BQ-3	1.3m	2.9	0.269	1.100[b]
	2.7m	3.6	0.100	0.342[b]
	4.1m	4.0	0.046	0.182[b]
	6.0m	4.4	0.007	0.049[b]
BQ-5	1.3m	3.6	0.031	0.358
	2.7m	5.5	0.012	0.181
	4.1m	6.6	0.007	0.049
	6.0m	7.6	0.000	0.000
BQ-6	1.3m	3.7	0.036	0.512
	2.7m	6.1	0.000	0.382
	4.1m	7.5	0.000	0.002
	6.0m	8.7	0.000	0.000
BQ-7	1.3m	3.2	0.003	0.053
	2.7m	5.0	0.000	0.000
	4.1m	6.1	0.000	0.000
	6.0m	7.0	0.000	0.000
BQ-8	1.3m	3.0	0.001	0.301
	2.7m	4.5	0.000	0.010
	4.1m	5.5	0.000	0.000
	6.0m	6.3	0.000	0.000
BQ-9	1.3m	3.4	0.020	0.121
	2.7m	4.9	0.001	0.069
	4.1m	5.7	0.003	0.000
	6.0m	6.5	0.000	0.000
BQ-10	1.3m	2.6	0.005	0.000
	2.7m	4.1	0.005	0.000
	4.1m	4.9	0.000	0.000
	6.0m	5.7	0.000	0.000
BQ-12	1.3m	c		
	2.7m	c		
	4.1m	c		
	6.0m	c		

Table 3-3 (Continued)

Run	Sampling height	Mean wind speed (mph)[a]	Net PM-10 exposure (mg/cm^2)	Net PM exposure (mg/cm^2)
BQ-13	1.3m	3.7	0.062	0.935
	2.7m	4.4	0.020	0.298
	4.1m	4.7	0.008	0.151
	6.0m	5.1	0.017	0.057
BQ-14	1.3m	2.7	0.082	1.235
	2.7m	3.1	0.033	0.070
	4.1m	3.3	0.023	0.396
	6.0m	3.5	0.021	0.199
BQ-15	1.3m	1.2	0.330	1.384[b]
	2.7m	1.7	0.140	0.942[b]
	4.1m	2.0	0.130	0.935[b]
	6.0m	2.3	0.062	0.469[b]
BQ-16	1.3m	1.7	0.517	1.384[b]
	2.7m	2.2	0.181	0.942[b]
	4.1m	2.5	0.203	0.935[b]
	6.0m	2.8	0.150	0.469[b]
BQ-17	1.3m	1.9	0.155	1.294
	2.7m	2.9	0.038	0.786
	4.1m	3.5	0.026	0.313
	6.0m	4.1	0.000	0.149
BQ-18	1.3m	1.8	0.174	1.273
	2.7m	3.3	0.067	1.075
	4.1m	4.1	0.051	0.430
	6.0m	4.9	0.002	0.157
BQ-19	1.3m	4.2	0.036	0.733
	2.7m	5.0	0.000	0.216
	4.1m	5.5	0.000	0.081
	6.0m	6.0	0.000	0.000
BQ-20	1.3m	2.4	0.119	0.861
	2.7m	3.1	0.042	0.401
	4.1m	3.4	0.021	0.169
	6.0m	3.8	0.020	0.079
BQ-21	1.3m	2.6	0.116	0.543
	2.7m	3.8	0.040	0.325
	4.1m	4.5	0.019	0.150
	6.0m	5.2	0.000	0.013
BQ-22	1.3m	2.3	0.423	1.673
	2.7m	3.8	0.235	1.326
	4.1m	4.6	0.110	0.601
	6.0m	5.4	0.000	0.209

Table 3-3 (Continued)

Run	Sampling height	Mean wind speed (mph)[a]	Net PM-10 exposure (mg/cm^2)	Net PM exposure (mg/cm^2)
BQ-23	1.3m	3.0	0.411	3.657
	2.7m	4.0	0.114	1.598
	4.1m	4.6	0.033	0.561
	6.0m	5.2	0.000	0.177
BQ-24	1.3m	2.4	0.531	3.173
	2.7m	3.1	0.219	1.926
	4.1m	3.5	0.132	1.280
	6.0m	3.9	0.060	0.490
BQ-26	1.3m	1.3	0.042	0.644
	2.7m	2.0	0.011	0.298
	4.1m	2.3	0.000	0.064
	6.0m	2.7	0.000	0.000

[a] Mean wind speed during periods with captive traffic.
[b] The cyclone catches for Runs BQ-2 and -3 and Runs BQ-15 and -16 were combined.
[c] As noted earlier in connection with Table 3-1, Run BQ-12 was conducted under poor wind conditions.

Table 3-4. Road Surface Parameters and Emission Factors

Run	Silt content (%)	Silt loading (g/m^2)	Moisture content (%)	PM-10 emission factor (g/VMT)	PM emission factor (g/VMT)	PM-2.5 emission factor (g/VMT)
BQ1	3	110	0.46	184	901	89
BQ2	4.4	140	0.39	210	387	72
BQ3	2.4	51	0.48	225	387	130
BQ5	1.4	9	0.22	4.72	57	1.4
BQ6	1.1	9.6	0.17	3.67	79	1.8
BQ7	0.95	0.79	0.27	0.313	5.5	0.33
BQ8	0.54	0.34	0.18	0.148	3.3	0.32
BQ9	0.33	0.19	0.49	2.44	18	1.5
BQ10	0.29	0.58	0.24	3.27	–	2.0
BQ13	2.29	1.4	0.33	6.58	94	2.8
BQ14	0.59	4.4	0.26	10.8	174	5.4
BQ15	2	63	0.72	285	798	110
BQ16	3.7	100	0.72	549	798	160
BQ17	1.1	5.7	0.96	10.7	115	3.9
BQ18	1.6	9.3	0.21	14.2	132	3.3
BQ19	0.86	2.6	0.25	2.3	60	3.5[a]
BQ20	1.5	2.3	0.29	8.57	65	2.6
BQ21	1.1	10	0.32	30.5	171	8.9
BQ22	2.5	33	0.29	70.3	330	22
BQ23	3.3	51	0.24	38.7	397	15
BQ24	3.4	55	0.39	60.3	426	23
BQ26	2.1	18	0.27	3.91	71	3.9[a]

[a] Due to the need for approximation in the PM-2.5 calculation scheme, these PM-2.5 values occasionally are found to be equal to or slightly greater than the PM-10 emission factors reported. In these cases, the PM-2.5 emission factors are not considered reliable.

are based on the net concentration determined from the particulate masses collected on the last stages of the cascade impactors. Because these concentrations were measured only at 2 downwind heights, the point values of PM-2.5 exposure were found by inter/extrapolation of the values measured at 1.3 m and 4.1 m heights. The remainder of the integration and emission factor calculation procedures were identical to those discussed earlier for PM-10 and PM.

3.2 Control Efficiency Values

Control efficiency was determined by calculating the percent reduction in emission factor from the average uncontrolled value determined for each test road. The average uncontrolled factors are shown below:

	Mean Uncontrolled Emission Factor (g/VMT)		
	PM-10	PM	PM-2.5
Sierrita	206	644	96
Linda Vista	420	798	140

The control efficiency values are summarized in Table 3-5. These values reflect the performance of PennzSuppress D under the tested source environments and a well managed application sequence.

Table 3-5. Control Efficiency Values

Run	Julian day	Test location	Treatment[a]	Days after treatment	Vehicle passes after treatment[b]	PM-10 control efficiency (%)	PM control efficiency (%)	PM-2.5 control efficiency (%)
BQ5	182	Sierrita	S	91	3431	98	91	98
BQ6	183	Sierrita	S	92	3780	98	88	98
BQ9	186	Sierrita	S	95	4198	99	97	98
BQ10	188	Sierrita	S	97	4462	98	–	98
BQ17	204	Sierrita	S	113	5404	95	82	96
BQ18	206	Sierrita	S	115	6002	93	80	97
BQ7	184	Sierrita	T	56	2170	100	99	100
BQ8	185	Sierrita	T	57	2512	100	99	100
BQ19	207	Sierrita	T	79	3769	99	91	96
BQ20	209	Sierrita	T	81	4444	96	90	97
BQ26	220	Sierrita	T	92	5503	98	89	96
BQ13	199	Linda Vista	T	11	2750	98	88	98
BQ14	200	Linda Vista	T	12	3000	97	78	96
BQ23	214	Linda Vista	T	26	6500	91	50	89
BQ24	216	Linda Vista	T	28	7000	86	47	83

[a] T = topical, S = Stabilized

[b] Includes all captive traffic prior to test and half the captive traffic during test at Sierrita. Traffic rates based on 250 vehicles/day at Linda Vista and 36/48 natural vehicles/day Sierrita before/after Julian day 202 (July 21, 1997).

Plots showing the decay in control efficiency at PennzSuppress D against cumulative vehicle passes are provided in Figures 3-1 through 3-4. Cumulative vehicle passes represent an appropriate measure of the road surface stress forces that contribute to the decay in the effectiveness of a chemical road dust suppressant.

Figures 3-1 and 3-2 present the PM-10 and PM control efficiency decay trends, respectively, for the stabilized and topical applications at Sierrita. Figures 3-3 and 3-4 compare the control efficiency decay for PM-10 and PM, respectively, observed for the two sets of topical applications (i.e., at Sierrita and Linda Vista). The figures track the performance of PennzSuppress D up to a cumulative traffic volume in the range of 6,000 to 7,000 vehicle passes.

Both sets of plots show that the control efficiency is greater for PM-10 than it is for the coarser size range. This is in keeping with past field evaluations [2,3,4] in which it was found that PM-10 tends to remain more highly controlled, because of the greater agglomerating tendency of fine particles. This tendency is particularly noticeable for the Linda Vista site. It is presumed that the greater decay for PM at Linda Vista was due to the detouring traffic. Table 3-5 shows that, in general, the PM-2.5 control efficiency is nearly the same as that for PM-10. Although the PM-2.5 values tend to be slightly lower (1 to 2 percentage points) than the PM-10 values, one can readily approximate PM-2.5 efficiency with the PM-10 effectiveness. Figure 3-3 shows that the PM-10 and PM-2.5 values are within 4% of each other in all cases.

Direct comparison of results for the stabilized section with those for the topical application should strictly account for the facts that (a) the stabilized was exposed for 30 days longer than the topical and (b) the stabilized section had had approximately 20% more suppressant applied. Assuming that the effects from (a) and (b) largely cancel, Figures 3-1 and 3-2 suggest that stabilization and topical application result in very comparable control efficiencies, with instantaneous control of roughly 90% and 80%, for PM-10 and PM, even after 3 to 4 months.

The effect of different service environments can be seen in Figures 3-4 and 3-5. Those figures compare the control efficiency decay for the topical applications at Linda Vista and Sierrita. Again, direct comparison must account for different exposure periods and different amounts of PennzSuppress D that had been applied. However, Linda Vista and Sierrita may be viewed as representing extremes of the service environments, for the reasons summarized below:

Item	Linda Vista	Sierrita
Surface preparation	No preparation prior to spraying	Graded before first topical application
Amount of PennzSuppress D applied	0.15 gal/yd^2	50% more suppressant applied (0.225 gal/yd^2)
Traffic volume	300% higher traffic volume (250 passes/day)	60 vehicles/day (natural and captive)
Other factors	Surface damaged by vehicles bypassing I-10 on July 19	Surface cleaned by heavy rain on July 21

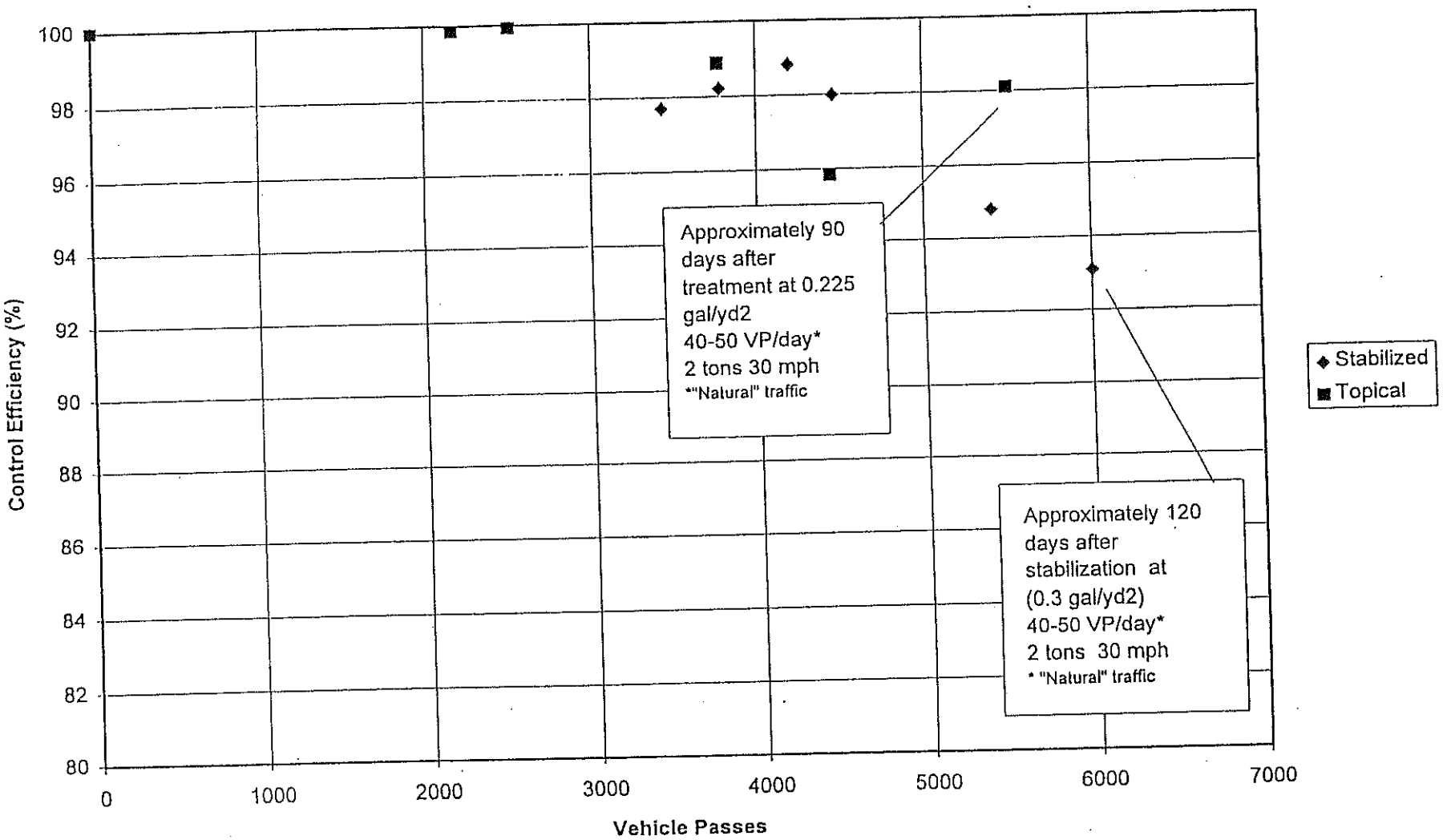


Figure 3-1. PM-10 Control Efficiency Results for Sierrita

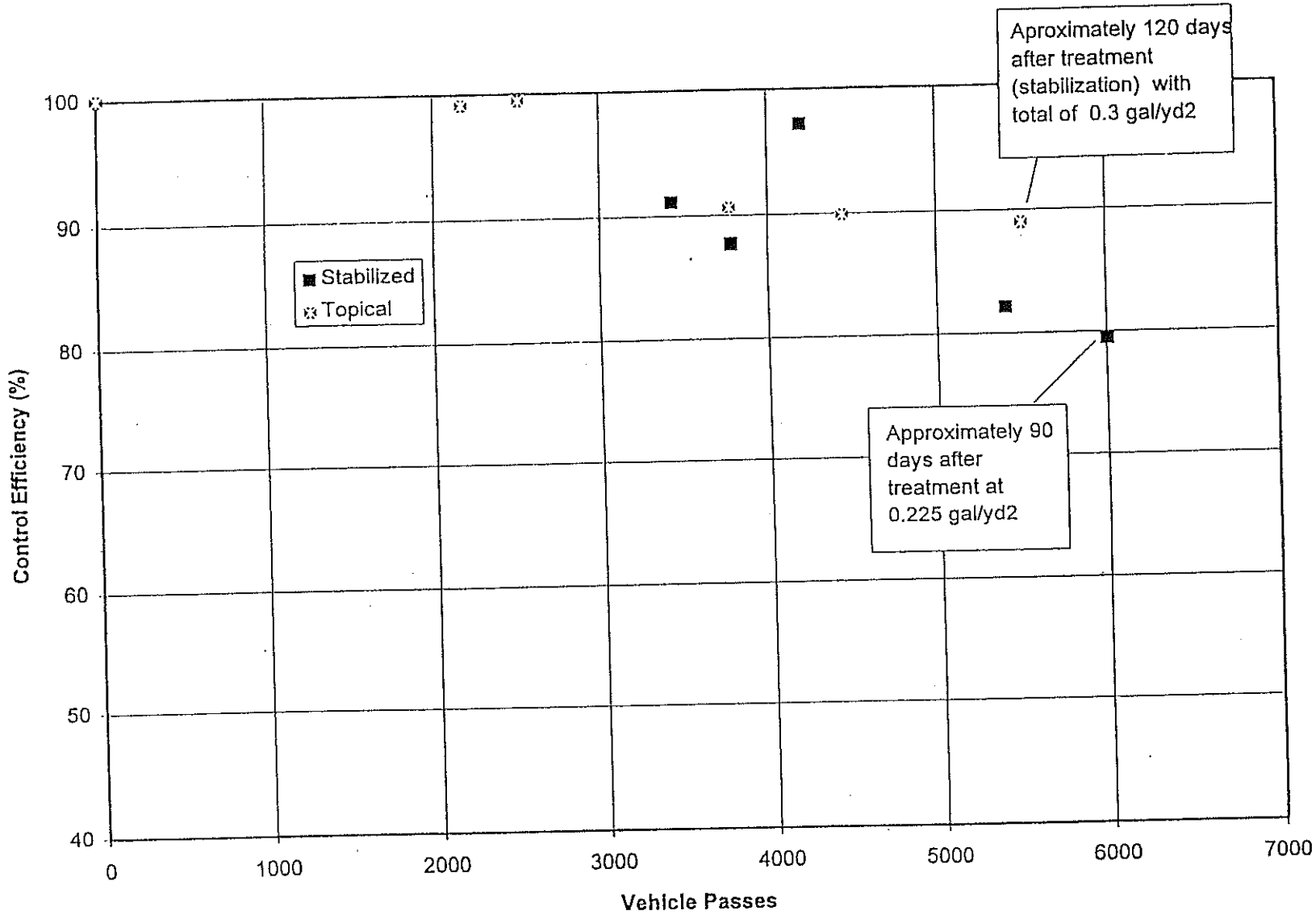


Figure 3-2. PM Control Efficiency Results for Sierrita

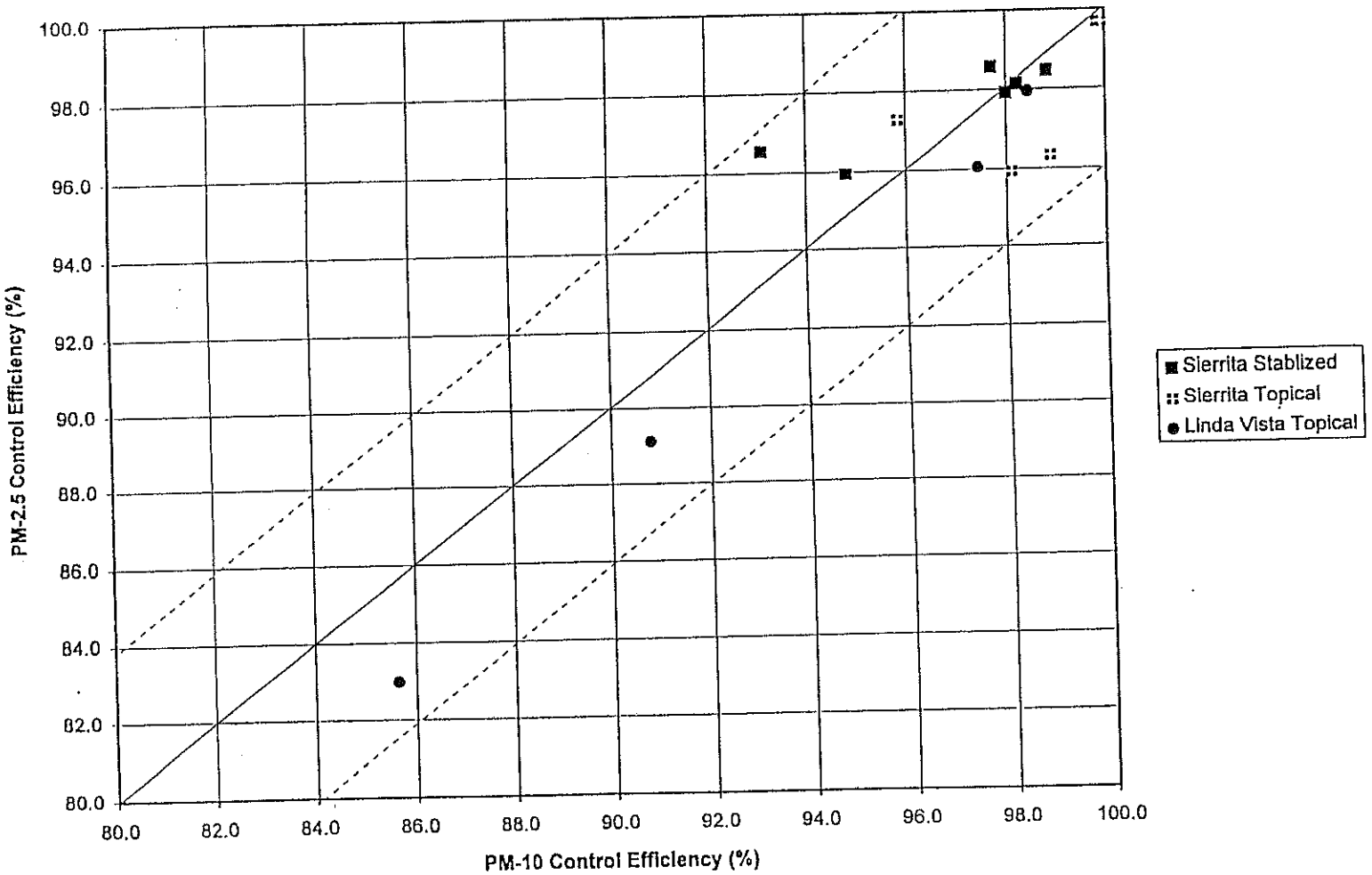


Figure 3-3. Comparison of PM-10 and PM-2.5 Control Efficiency Values

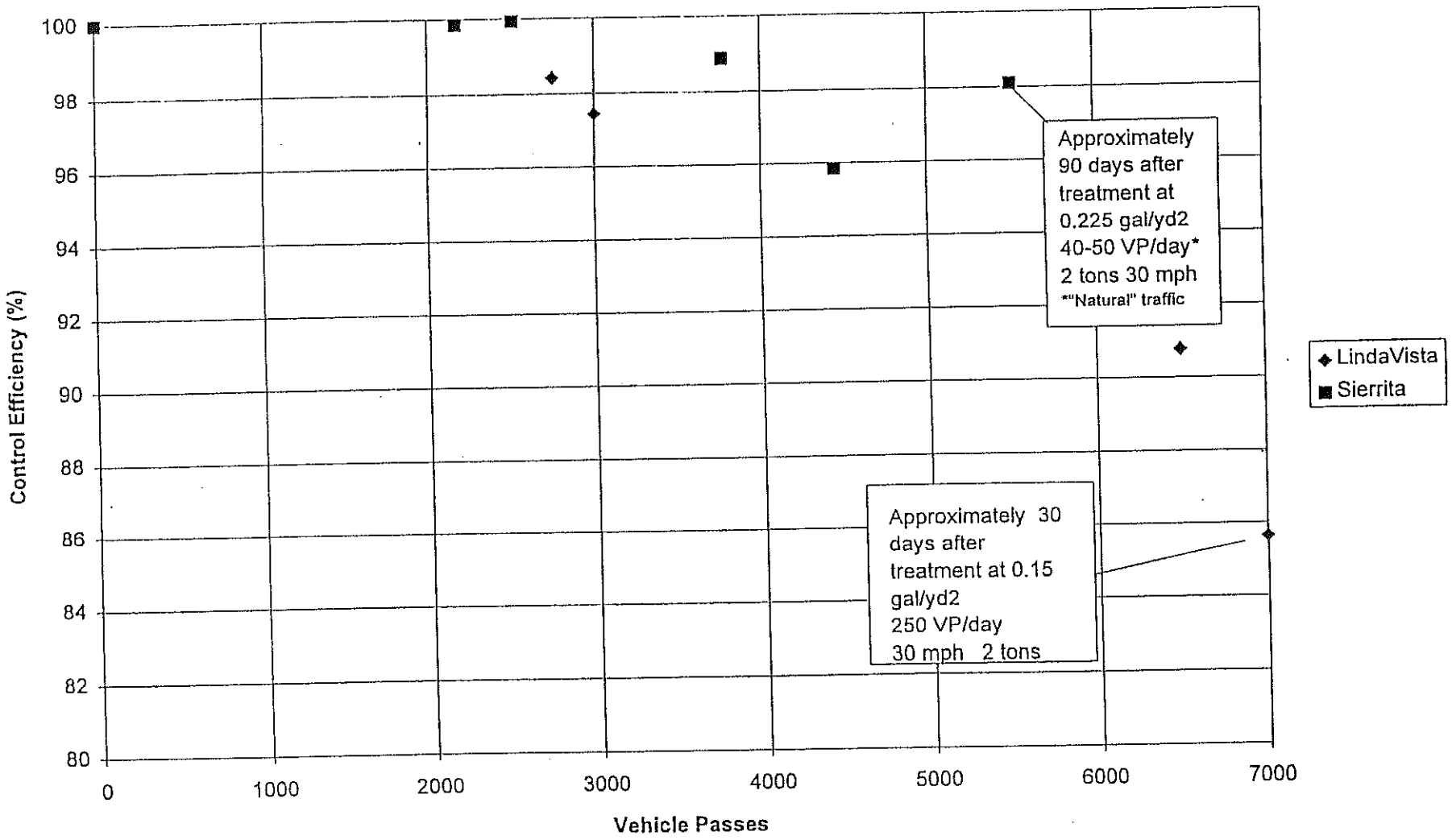


Figure 3-4. PM-10 Control Efficiency Results for Topical Applications at Linda Vista and Sierrita

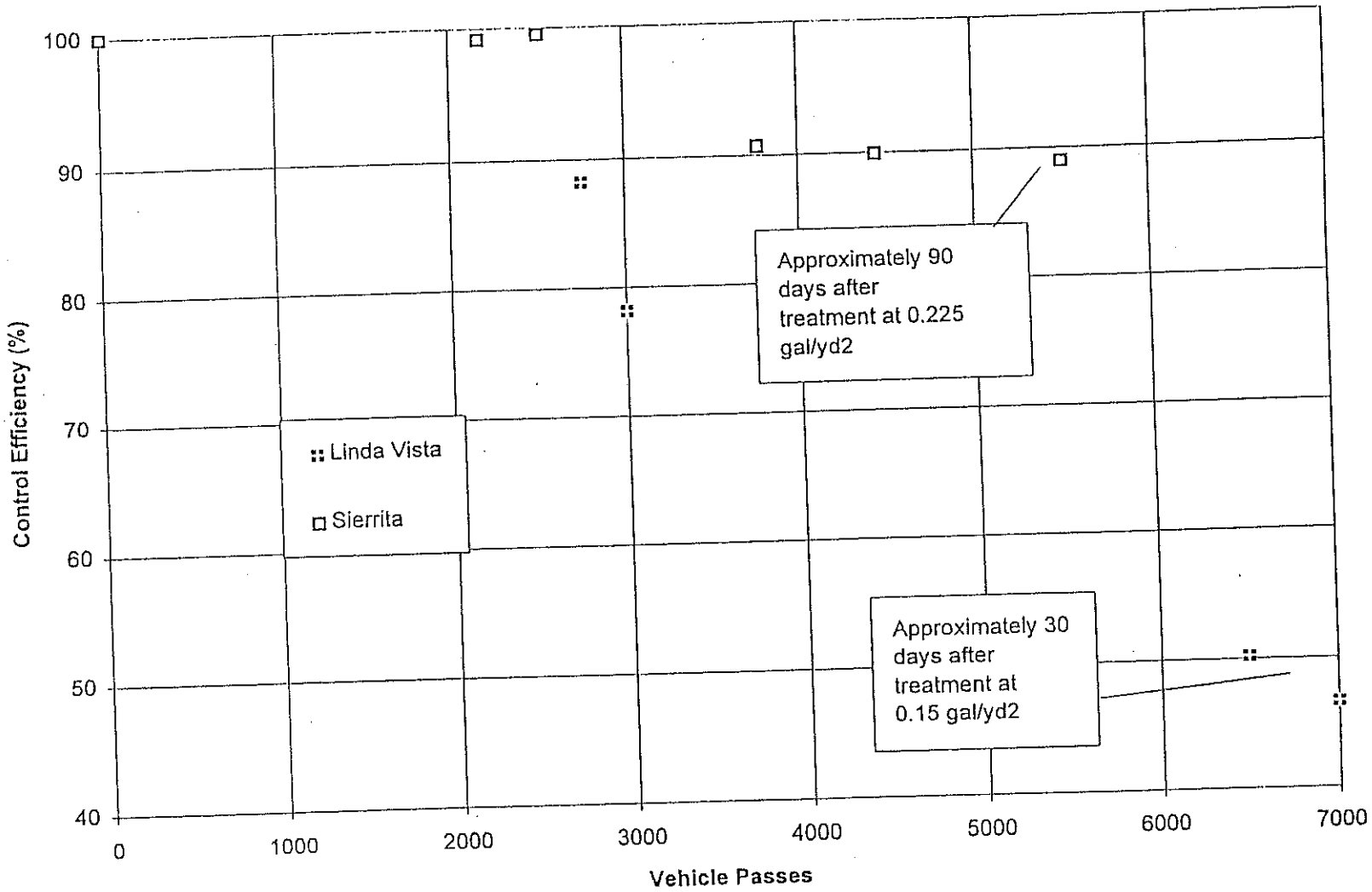


Figure 3-5. PM Control Efficiency Results for Topical Applications at Linda Vista and Sierrita

Thus, the Linda Vista site can be expected to experience substantially greater decay in control efficiency than the Sierrita site. That was seen in Figures 3-3 and 3-4.

Nevertheless, the results from Linda Vista still indicate that PennzSuppress D provides a very high level of control, even under the more severe service environment. After approximately one month and 7000 vehicle passes, the topical application still provided instantaneous control of approximately 85% and 50%, respectively, for PM-10 and PM. When the Linda Vista data are fitted to a second degree polynomial, the average control over the 7000 vehicle period is estimated as 96% and 77% for PM-10 and PM, respectively (see Figure 3-6).

3.3 Comparison with Past Studies

As noted in the introduction, the US EPA conducted a number of field studies on chemical unpaved road dust suppressants in the early 1980s.[2,3,4] Most of these evaluations took place on roads at iron and steel plants. The last major EPA field evaluation was completed in 1985.[4] During that study, four chemical dust suppressants were compared in side-by-side tests (the "AQ" test series) conducted at a remote area of a steel plant in Kansas City. Traffic on the road was supplied by a captive vehicle. Mean vehicle parameters were: 220 equivalent vehicle passes per day, average vehicle speed of 15 mph, a weight of 10 tons, and 6 wheels per vehicle.

Direct comparisons between the results obtained in this study and those from the AQ test series for the U.S. EPA are somewhat limited because of different averaging times, vehicle characteristics, and ground inventory values. However, under the assumption that the higher travel speed (i.e., 30 mph) in the present study compensates for the heavier vehicles in the AQ test series, one may reasonably compare past results from tests AQ9S through AQ11S with results obtained from Linda Vista. Both of these tests reference a ground inventory of 0.15 gal/yd^2.

Figure 3-7 compares the results obtained at Linda Vista with the AQ test results for PM-10. As can be seen from the figure, PennzSuppress compares well with the test results obtained in past studies.

3.4 Conclusions

Testing at the two Arizona sites has shown that a two-step application of PennzSuppress D retains a high level of effectiveness as an unpaved road dust suppressant when used in an appropriate surface conditioning and maintenance program. The Linda Vista public road test site represented a more severe service environment than the Sierrita mine road test site, which had less traffic than projected by mine personnel.

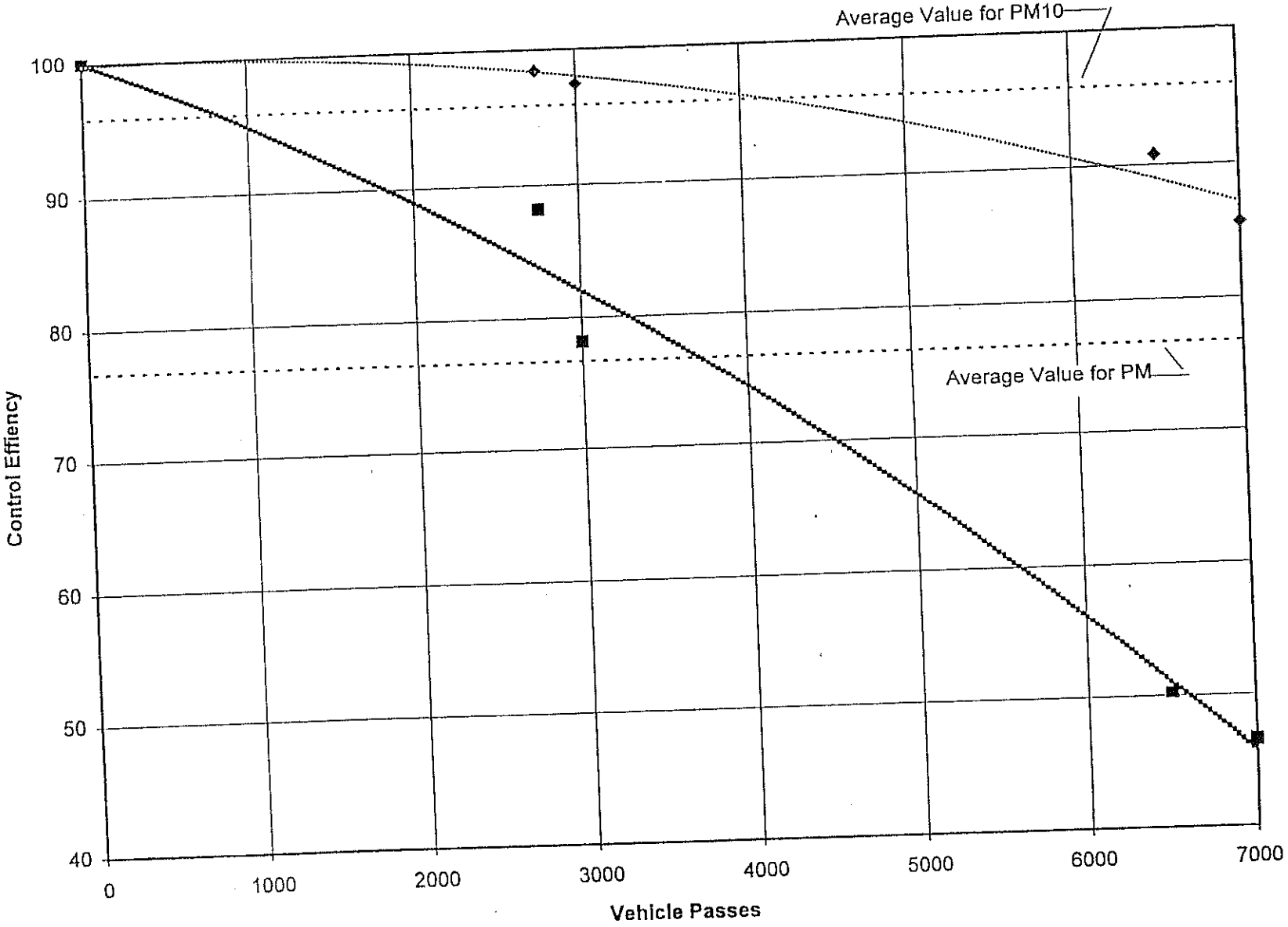


Figure 3-6. Polynomial Fits and Average Control Efficiency for Topical Application at Linda Vista

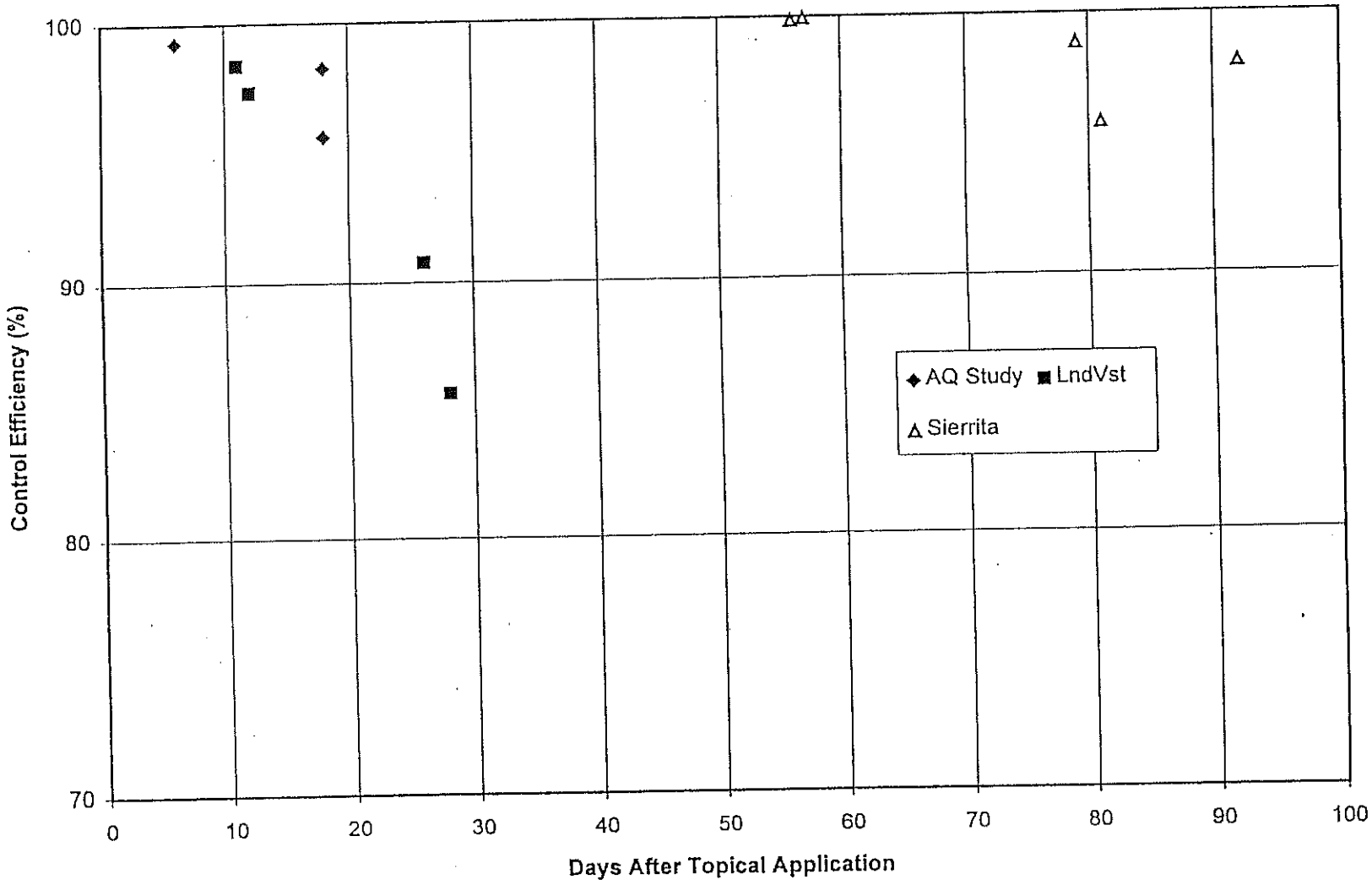


Figure 3-7. Comparison of PM-10 Control Efficiency Decay for Topical Applications @ 0.15 gal/yd

At the Sierrita test site, two methods of surface application of PennzSuppress D were evaluated—stabilization and topical application. Both methods showed similar results. After 3 to 4 months (approximately 6,000 vehicle passes of mostly light-duty vehicles), control efficiencies of about 90% and 80% for PM-10 and PM were still in effect. Average control efficiencies over that period were even higher. At the Linda Vista site, instantaneous control efficiencies after 7,000 vehicle passes were considerably lower, but average efficiencies were 96% and 77% for PM-10 and PM, respectively. The control efficiency values for PM, although not of interest relative to the National Ambient Air Quality Standards, were developed in this study to provide a full characterization of control effectiveness of PennzSuppress D.

The **average** control efficiencies of PennzSuppress D are of greatest interest from a control strategy development standpoint, because they determine the emission reductions achievable with this product. This study shows that PennzSuppress D as an unpaved road dust control product compares very well with products previously tested by the U.S. EPA.

The levels of effectiveness obtained in this study can be expected with regular applications of PennzSuppress D to roads with similar traffic characteristics. As with other unpaved road dust suppressants, control efficiencies will be reduced by the effects of spillage or mud/dirt trackout from adjacent areas. The reapplication frequency at a particular site will depend on the traffic levels encountered and the target value for average PM-10 control efficiency.

4. References

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FIELD TESTING SHOWS PENNZSUPPRESS® D IS A HIGHLY EFFECTIVE DUST SUPPRESSANT

Recent field testing of PennzSuppress® D proves the product to be highly effective for controlling dust from unpaved roads. Dust caused by vehicles traveling on unpaved roads has been identified by United States Environmental Protection Agency (US EPA) as a health and environmental concern.

According to recent US EPA survey data, unpaved roads account for 28% of the nationwide dust emissions formally known as PM-10 (dust particles 10 microns or less). Recent US EPA National Ambient Air Quality Standards have redefined particulate emissions using a PM-2.5 standard (dust particles 2.5 microns or less). PennzSuppress® D has been field tested by the independent Midwest Research Institute (MRI) and found to be very effective at reducing PM-2.5 and PM-10 dust emissions from unpaved roadways.

Known for its success in developing numerical emission models and field-particulate measurement methods for the U.S. Environmental Protection Agency, the not-for-profit MRI began its PennzSuppress® D testing in April, 1997. Institute researchers chose an open-pit copper mine and a county road near Tucson Arizona as test sites. Cactus Transport, Inc., the PennzSuppress® D distributor for Arizona, prepared the road sites for testing by both stabilizing and topically applying the product to test sections.

THE SCOPE OF WORK

The purpose of the field testing was to determine the long-term, average control efficiency expected through regular use of PennzSuppress® D on the road surfaces treated. The test program captured the following information at each site tested:

Vehicle Parameters

- mean vehicle speed
- mean vehicle weight
- average traffic rate

Dust Palliative Application Parameters

- intensity of applied product (volume of diluted product per unit of road surface area)
- dilution ratio of product
- frequency of product reapplications (number of applications per unit time)
- application method

Road Surface Parameters

- materials of construction for the road surface and subgrade
- crowning, curves and other physical layout variables

Environmental Factors

- precipitation
- wind speed, direction
- temperature
- barometric pressure

Emission Measurement Technique

The emission testing used the exposure profiling method to quantify mass emissions from the test roads in both controlled and uncontrolled conditions. Exposure profiling uses a direct mass-balance calculation scheme similar to stack testing methods rather than relying on an uncalibrated dispersion model to indirectly back-calculate an emission rate.

The method required simultaneous measurement of particulate concentrations and wind speed at various points over the effective height of the plume of suspended particulate matter. Background concentrations are measured upwind of the test road.

Sampling Equipment

Sampling equipment consisted of a high-volume cyclone operated at 40 cubic feet per minute (cfm) staged downwind of the test area at heights of 1.3, 2.7, 4.1, 6.0 meters. Additionally, a high-volume cyclone followed by a 3-stage cascade impactors were operated at 20 cfm and staged upwind and downwind of the test area at heights of 1.3 and 4.1 meters. This equipment is consistent with that used to develop the particle size multipliers used in EPA's AP-42 predictive emissions factor equations for paved and unpaved roads. The aerodynamic particle sizes measured by this equipment included 15, 10.2, 4.2, and 2.1 microns.

Test Sites

Two application methods were evaluated on PennzSuppress® D treated roads on three unpaved roadways. Detailed information on application methods for each test site is provided below.

Topically Treated Unpaved County Road

- Week 1 - One 0.25 gal/yd2 application of a 9:1 dilution of PennzSuppress® D (nine parts water to one part PennzSuppress® D concentrate).
- Week 2 - One 0.25 gal/yd2 application of a 9:1 dilution of PennzSuppress® D.
- Total ground inventory of PennzSuppress® D concentrate after treatment was 0.15 gal/yd2.

Topically Treated Mine Haul Road

- Week 1 - Three 0.25 gal/yd2 applications of a 9:1 dilution of PennzSuppress® D.
- Week 2 - Three 0.25 gal/yd2 applications of a 9:1 dilution of PennzSuppress® D.
- Week 7 - Maintenance application of three 0.25 gal/yd2 applications of a 9:1 dilution of PennzSuppress® D.
- Total ground inventory of PennzSuppress® D concentrate after treatment was 0.225 gal/yd2.

Stabilized Mine Haul Road

- Road was bladed and sprayed with 0.5 gal/yd2 of a 4:1 dilution of PennzSuppress® D then blade-mixed.
- Second spray of 0.5 gal/yd2 of a 4:1 dilution of PennzSuppress® D then blade-mixed.
- Road surface was static rolled followed by vibratory rolling.
- Final topical application of a 0.5 gal/yd2 of a 4:1 dilution of PennzSuppress® D.
- Total ground inventory of PennzSuppress® D after treatment was 0.3 gal/yd2.

TEST RESULTS

Field testing spanned a period of approximately 120 days with traffic counts ranging from 35 to 200 vehicles per day and with cumulative vehicle traffic totaling up to 7,000 passes. Airborne PM-10 and PM-2.5 dust particles generated by vehicle traffic on treated and untreated road surfaces were sampled. The control efficiency was calculated by comparing dust emission measurements from the PennzSuppress® D treated roads to the untreated roads.

Control efficiency results are illustrated in the Figures 1 through 3. At the end of 5,500 to 7,000 vehicle passes, PennzSuppress® D still controlled PM-10 emissions in the range of 86% to 98% and controlled PM-2.5 emissions in the range of 83% to 97%. The field data indicated that PM-2.5 control efficiency was typically within 4% ± of the PM-10 control efficiency.

The control efficiency data from the field testing was compared to past studies on dust palliatives. According to MRI:

The average control efficiencies of PennzSuppress® D are of greatest interest from a control strategy development standpoint, because they determine the emission reductions achievable with this product.

MRI has confirmed what many PennzSuppress® D users have already experienced. PennzSuppress® D is highly effective in reducing dust caused by vehicle traffic on unpaved road surfaces.

Figure 1

Topically Treated Mine Haul Road

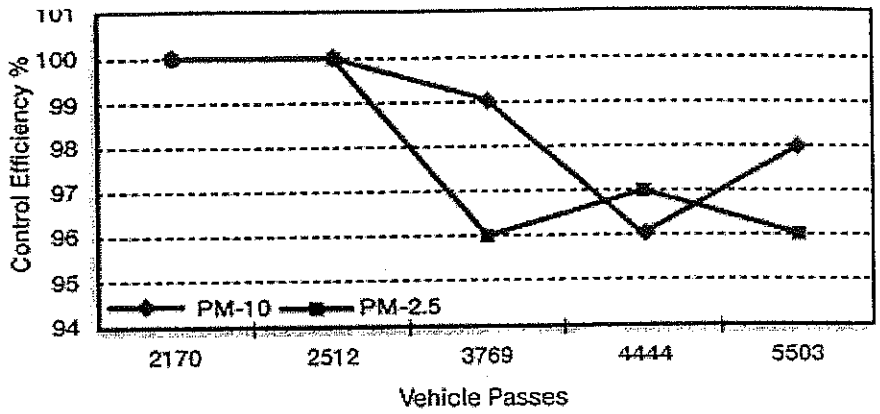


Figure 2

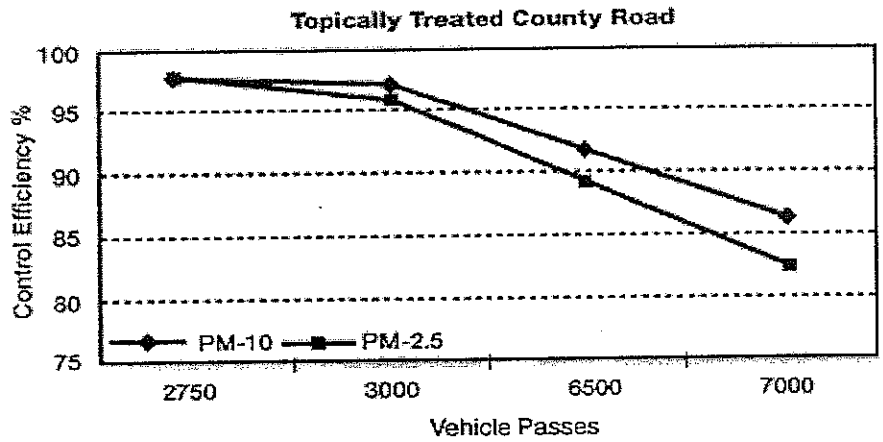
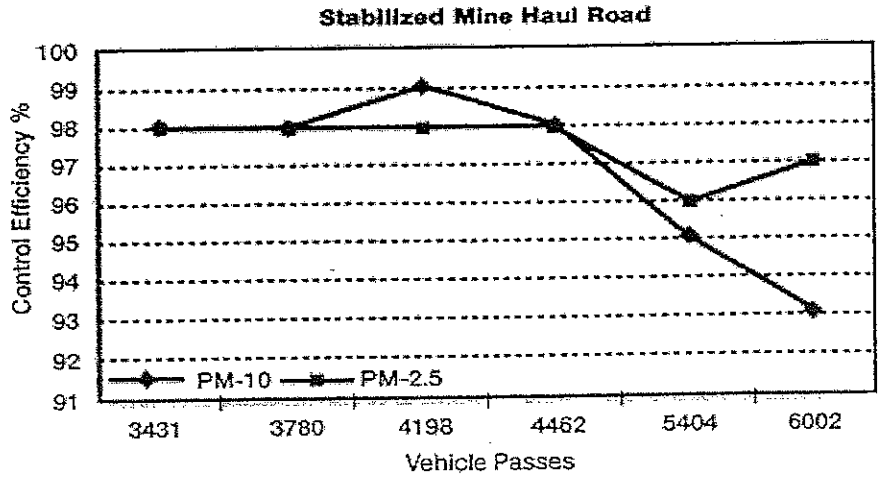


Figure 3



Another Quality Product Of Pennzoil Products Company

California ARB Precertification

Winston H. Hickox
Agency Secretary

Air Resources Board

Alan C. Lloyd, Ph.D.
Chairman
2020 L Street • P.O. Box 2815 • Sacramento, California 95812 • www.arb.ca.gov

Gray Davis
Governor

August 29, 2000

Dear Air Pollution Control Officer:

I am pleased to enclose a copy of an Executive Order that has been issued to Pennzoil-Quaker State Company for its PennzSuppress® D. The Executive Order was issued as part of the Air Resources Board's (ARB's) Equipment and Process Precertification (Precertification) Program, a voluntary fee-based statewide program for manufacturers of commonly-used equipment or processes. Specifically, the Executive Order documents our verification of the air quality-related claims for PennzSuppress® D when it is applied according to manufacturer's specifications.

Under the Precertification Program, manufacturers request that the ARB conduct an independent third-party verification of performance claims which focus on the air quality benefits of their equipment or process. If the claim is verified, the manufacturer is free to refer to the results of the ARB staff's evaluation in its marketing literature. Upon successful completion of the verification process, the ARB staff notifies the air pollution control and air quality management districts of the ARB's determination.

PennzSuppress® D is a paraffinic petroleum resin that is diluted with water and applied to dusty surfaces using a liquid application truck with a pressurized spray bar. PennzSuppress® D is used to reduce PM_{10} emissions from unpaved roads, parking lots, parks, fields, offhighway motor vehicle parks, and race tracks.

The enclosed evaluation report discusses the process used by Pennzoil-Quaker State Company in the manufacture of its PennzSuppress® D, the performance claim verified by the ARB, the emissions estimation techniques and results, and the findings and recommendations of the ARB staff concerning PennzSuppress® D.

Our staff has evaluated the air quality-related performance of this technology, and has verified the following claim:

> "When topically applied as a dust suppressant in accordance with the manufacturer's instructions, including a target rate of 0.15 gallons of concentrate per square yard of treated surface, PennzSuppress D® reduced PM_{10} emissions by approximately 85 percent after 7,000 vehicle (predominantly light-duty) passes on an engineered unpaved road consisting of a well-graded aggregate."

We believe that the type of technology discussed in this letter presents an opportunity to control PM_{10} emissions from unpaved roads. If you have any questions about the enclosed Executive Order, Evaluation Report, or the Precertification Program, please contact Mr. Richard Corey at (916) 323-1079 or myself at (916) 322-6026.

Sincerely,

Raymond E. Menebroker, Chief
Project Assessment Branch

Enclosures

cc: Mr. Richard Corey, ARB

bcc: Bob Barham, SSD (w/enclosures)
Dan Donohoue, SSD (w/enclosures)
Dean Saito, PTSD (w/enclosures)
Vicky Davis, EO (w/enclosures)
John Moore, RD (w/enclosures)
Patrick Gaffney, PTSD (w/enclosures)
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Block Environmental Services
2451 Estand Way
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Mr. Mike Laybourn (w/enclosures)
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Mr. Larry Biland (w/enclosures)
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Midwest Research Institute
425 Volker Boulevard
Kansas City, Missouri 64110

State of California
AIR RESOURCES BOARD
Executive Order G-096-029-031
Equipment Precertification of
Pennzoil-Quaker State Company
PennzSuppress® D

WHEREAS, the Air Resources Board (ARB) has established a statewide Equipment and Process Precertification (Precertification) Program to assist air pollution control and air quality management districts in meeting the requirements of the Air Pollution Permit Streamlining Act (California Health and Safety Code section 42320-42323);

WHEREAS, the ARB has been given the authority under California Health and Safety Code section 39620 to develop and implement the Precertification Program which consists of a preliminary engineering evaluation of equipment or processes and provides recommended operating conditions;

WHEREAS, this Precertification does not constitute an air pollution permit or eliminate the responsibility of the end user to comply with all federal, state, and local laws, rules, and regulations;

WHEREAS, Pennzoil-Quaker State Company has requested a Precertification of PennzSuppress® D, a dust suppressant for unpaved roads;

WHEREAS, Pennzoil-Quaker State Company identified the following Precertification standard regarding the emissions performance of PennzSuppress® D: when topically applied as a dust suppressant in accordance with the manufacturer's instructions, including a target concentration of 0.15 gallons of concentrate per square yard of treated surface, PennzSuppress® D reduced PM_{10} emissions by approximately 85 percent after 7,000 vehicle (predominantly light-duty) passes on an engineered unpaved road consisting of a well-graded aggregate;

WHEREAS, this Precertification is valid only when PennzSuppress® D is manufactured, transported, sold, stored, applied, and disposed of in accordance with the recommended practices contained in Exhibit A;

WHEREAS, this Precertification applies only to the use of PennzSuppress® D for air pollution/air quality control purposes, and should be represented in a manner consistent with this Executive Order;

WHEREAS, this Precertification is valid only when a copy of the recommended practices contained in Exhibit A is provided to each distributor, applicator, and user of PennzSuppress® D prior to its application on an unpaved road;

WHEREAS, I find that the Applicant, Pennzoil-Quaker State Company, has met the requirements specified in Title 17 California Code of Regulations section 91400 which incorporates the ARB's Criteria for Equipment Precertification (Adopted June 14, 1996) and has satisfactorily demonstrated through independent testing that the dust suppressant described in the application meets the identified Precertification standards;

WHEREAS, this performance Precertification is subject to all conditions and requirements of the ARB's Criteria for Equipment Precertification, including the provisions relating to suspension and revocation;

WHEREAS, marketing of this device using an identification other than that shown in this Executive Order shall be prohibited unless prior approval is obtained from the ARB. Any oral or written references to this Executive Order or its content by Pennzoil-Quaker State Company, its principals, agents, employees, distributors, dealers, or other representatives must include the disclaimer that this Executive Order is not an endorsement or approval of PennzSuppress® D. No claim shall be made, such as "Approved by the Air Resources Board," with respect to any advertising or other oral or written communication. It is only a finding that PennzSuppress® D meets the identified Precertification standard, as specified in the evaluation report for application number 09059701;

WHEREAS, this performance Precertification shall expire three years from the date of this Executive Order, unless renewed;

NOW THEREFORE, IT IS HEREBY ORDERED, that the performance Precertification, Executive Order G-096-029-031, executed at Sacramento, California this 15th day of August, 2000, is hereby granted.

Michael P. Kenny
Executive Officer

By: Peter D. Venturini, Chief
Stationary Source Division

State of California
AIR RESOURCES BOARD
Executive Order G-096-029-031
EXHIBIT A

RECOMMENDED PRACTICES FOR REDUCING THE GENERATION OF AIRBORNE PARTICULATE EMISSIONS FROM UNPAVED ROADS

Purpose: To reduce the generation of airborne particulate matter by treating unpaved roads with PennzSuppress® D.

Evaluate the unpaved road closely to determine the condition of the road and to determine the appropriate application of PennzSuppress® D. Specific consideration should be given to:

- Road imperfections such as potholes, wash-boarding, aggregate loss, rutting, etc.;
- Type of material from which the road has been constructed, including the aggregate and particle size distribution (i.e. clay content, largest aggregate size, etc.);
- Slope and drainage of the road;
- Number of vehicle passes per day;
- Type of vehicles using the road; and
- Local climate, including annual rainfall amounts, relative atmospheric humidity, temperature extremes, and seasonal climatological fluctuations.

Repair the road as necessary by:

- Correcting road imperfections such as potholes, wash-boarding, rutting and a lack of road base aggregate material; and
- Correcting improper drainage by constructing a crown/slope on the road, cutting ditches along the length of the road and/or constructing drainage beneath the road surface.

Apply a dilution of PennzSuppress® D evenly on the road surface. The dilution will range from 4:1 to 9:1 parts water to PennzSuppress® D concentrate. The recommended application rate is 0.25 to 0.50 gallons per square yard (1.125 to 2.25 liters per square meter). The dilution and application rate may be adjusted, depending on:

- The compaction of the road surface; and
- The moisture content of the road material

Apply a second product treatment to effectively bind any loose road surface material, seven to 10 days after the initial application. This second application should be applied at a rate not to exceed 0.25 gallons per square yard (1.125 liters per square meter) to ensure the product dilution fully penetrates the road surface. As with the initial application, the dilution will depend on the road conditions at the time of the application. Regardless of the dilutions or application rates used, the quantity of PennzSuppress® D

concentrate used to treat each square yard of surface should total no less than 0.15 gallons (0.68 liters per square meter).

Plan follow-up treatment of the road according to the deterioration of the road surface over time. The effectiveness of PennzSuppress® D to suppress dust over time will be affected by those items detailed in item 1. It should be noted, however, that over time, with repeated PennzSuppress® D treatments, the amount of product required to achieve similar dust suppression efficiencies will likely decrease to a point.

Precautions:

1. PennzSuppress® D should not be introduced into storm drains or drainage ditches. Temporary berms should be used to prevent product from entering storm drains.
2. PennzSuppress® D should not be applied during or immediately prior to a rain event.
3. PennzSuppress® D should not be applied directly to a stream bank.
4. PennzSuppress® D should not be applied within 100 feet of a sinkhole or any direct conduit to ground water.
5. PennzSuppress® D should not be applied in a manner that may cause the reporting of an unauthorized discharge to be made to an environmental authority.

Appendix C

Screen Analysis

Fugitive Dust Sampling
Trafficway Areas

Chemetco - Copper Reclamation Facility

Sampling Date: 6/6/00
Sampling By: David L. Seidel, P.E.

Sample ID	Traffic Area Name	Sample Area (SF)	Cntr Wt (g)	Dust Wt (g)	Dust Wt (lb)	Pan Wt (g)	Silt Wt (g)	Silt (%)	Pb (%)	sL Value (g/m2)
FDPL	Parking Lot	24	40.7	14.4	0.032	379.3	0.2	1.39	0.864	0.09
FDTS	Truck Scale Drive	15	72.7	46.4	0.102	384.6	5.5	11.85	1.78	3.95
FDTL	Truck Lot	30	60.4	34.1	0.075	380.4	1.3	3.81	1.72	0.47
FDCL	West Chemetco Ln	25	116.4	90.1	0.199	381.0	1.9	2.11	1.5	0.82
FDZL	ZincO Access Rd	10	53.8	27.5	0.061	388.2	9.1	33.09	5.07	9.80
FDSY	Scrap Yards	4	137.6	111.3	0.245	421.5	42.4	38.10	4.87	114.10
FDGS	Gran.Slag Road	4	343.6	317.3	0.700	385.7	6.6	2.08	1.61	17.76
FDFB	Fines Bldg Entrance	6	170.7	144.4	0.318	398.5	19.4	13.43	4.92	34.80
FDKR	Kress Haul Rd	2	189.2	162.9	0.359	406.5	27.4	16.82	5.33	147.47
FDAF	AAF Area Drive	2	44.8	18.5	0.041	383.4	4.3	23.24	4.44	23.14

Cntr Tare Wt (g)= 26.3
Pan Tare Wt (g)= 379.1

Note: Lead analysis was performed on the silt fraction of the dust sample.

An Analytical Testing Laboratory

Prairie Analytical Systems, INCORPORATED

1265 Capital Airport Drive
Springfield, IL 62707-8490

Phone: 217-753-1148
FAX: 217-753-1152
E-Mail: IL100323@aol.com

21 June 2000

Ms. Heather Young
Chemetco
P.O. Box 187
Alton, IL 62002

RE: PAS Project Code **CSD-501**

Dear Ms. Young,

This report contains the analytical results for **Fugitive Dust Samples** samples received under chain of custody by Prairie Analytical Systems, Inc. on 15-Jun-00.

All applicable quality control procedures met method specific acceptance criteria

This report shall not be reproduced, except in full, without the prior written consent of Prairie Analytical Systems, Inc.

If you have any questions, please feel free to call me at (217) 753-1148.

Sincerely,

Stephen R. Johnson
Laboratory Director

CC: Project File

Chemetco
P.O. BOX 167 • ALTON, ILLINOIS 62002

CHAIN OF CUSTODY RECORD

TODAY'S DATE: 6/14/00

SAMPLES SENT TO: Prairie Anal

PROJECT NO. PROJECT NAME: Fugitive Dust Samples

SAMPLERS: (Signature) Dave Seidel

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	% Pb by weight	REMARKS
FDGS	6/6		X		6158077	1	X	Please Fax Results
FDAF					6158078			to H Young
FDKR					6158079			at 618/254-9492
FDSY					6158080			
FDZL					6158081			
FDCL					6158082			
FDFB					6158083			
FDTL					6158084			
FDTS					6158085			
FDPL					6158086			

CSO-501

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY:	RELINQUISHED BY: (Signature)	DATE	TIME	RECEVED BY:
[signature]	6/14/00		Candace Sumkus				
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY:	RELINQUISHED BY: (Signature)	DATE	TIME	RECEVED BY:
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY:	DATE	TIME	REMARKS	

DISTRIBUTION: Original to Lab, Copy 1 to Field Files, Copy 2 to Project Manager

Certificate of Analysis

Prairie Analytical Systems, INCORPORATED

Chemetco
P.O. Box 187
Alton, IL 62002

1265 Capital Airport Drive
Springfield, IL 62707-8490
Phone: 217-753-1148
Facsimile: 217-753-1152
E-Mail: IL100323@aol.com

Client Project: **Fugitive Dust Samples**
PAS Project Code: CSD-501

Sample Description:	FDGS	FDAF	FDKR	FDSY	FDZL
PAS Sample Number:	0006158077	0006158078	0006158079	0006158080	0006158081
Matrix:	Solid	Solid	Solid	Solid	Solid
Date Sampled:	6-Jun-00	6-Jun-00	6-Jun-00	6-Jun-00	6-Jun-00
Date Received	15-Jun-00	15-Jun-00	15-Jun-00	15-Jun-00	15-Jun-00
Date Analyzed:	21-Jun-00	21-Jun-00	21-Jun-00	21-Jun-00	21-Jun-00
Date Reported:	21-Jun-00	21-Jun-00	21-Jun-00	21-Jun-00	21-Jun-00

Element(s) Analysis

Parameter(s)	RL / Unit	Result	Result	Result	Result	Result	Method
Lead (^{208}Pb), Total	0.001 %	1.61	4.44	5.33	4.87	5.07	200.8(3)

Jun-21-00 12:02P Prairie Analytical System 12177531152 P.04

Certificate of Analysis

Prairie Analytical Systems, Incorporated

Chemetco
P.O. Box 187
Alton, IL 62002

1265 Capital Airport Drive
Springfield, IL 62707-8490
Phone: 217-753-1148
Facsimile: 217-753-1152
E-Mail: IL100323@aol.com

Client Project: **Fugitive Dust Samples**
PAS Project Code: CSD-501

Sample Description:	FDCL	FDFB	FDTL	FDTS	FDPL
PAS Sample Number:	0006158082	0006158083	0006158084	0006158085	0006158086
Matrix:	Solid	Solid	Solid	Solid	Solid
Date Sampled:	6-Jun-00	6-Jun-00	6-Jun-00	6-Jun-00	6-Jun-00
Date Received	15-Jun-00	15-Jun-00	15-Jun-00	15-Jun-00	15-Jun-00
Date Analyzed:	21-Jun-00	21-Jun-00	21-Jun-00	21-Jun-00	21-Jun-00
Date Reported:	21-Jun-00	21-Jun-00	21-Jun-00	21-Jun-00	21-Jun-00

Element(s) Analysis

Parameter(s)	RL / Unit	Result	Result	Result	Result	Result	Method
Lead (^{208}Pb), Total	0.001 %	1.50	4.92	1.72	1.78	0.864	200.8(3)

End of Report

(3) - Analysis performed using "Methods for Chemical Analysis of Water and Wastes"

Jun-21-00 12:02P Prairie Analytical System 12177531152 p.05
** TOTAL PAGE.005 **

Appendix D

Wind Speed Data

Chemetco Met Data
3/7/2000 - 8/1/2000

TYPE,DATE,Inside Temp.,Outside Temp.,Wind Chill,Pressure,Wind Dir,
Wind Speed,Avg. Wind Spd.,Peak Wind Spd.
MIN,02/29/2000,,,,,,,,
MAX,02/29/2000,,,,,,,,
MIN,03/01/2000,,,,,,,,
MAX,03/01/2000,,,,,,,,
MIN,03/02/2000,,,,,,,,
MAX,03/02/2000,,,,,,,,
MIN,03/03/2000,,,,,,,,
MAX,03/03/2000,,,,,,,,
MIN,03/04/2000,,,,,,,,
MAX,03/04/2000,,,,,,,,
MIN,03/05/2000,,,,,,,,
MAX,03/05/2000,,,,,,,,
MIN,03/06/2000,,,,,,,,
MAX,03/06/2000,,,,,,,,
MIN,03/07/2000,59.9,58.8,53.3,29.68,,0,,
MAX,03/07/2000,93.2,78.4,78.2,29.77,,21,16,21
MIN,03/08/2000,57.2,54.6,52.4,29.58,113,0,5,6
MAX,03/08/2000,95.0,87.6,87.6,29.79,113,24,18,24
MIN,03/09/2000,68.5,59.1,48.1,29.26,113,0,3,5
MAX,03/09/2000,90.5,86.1,85.5,29.60,113,39,24,39
MIN,03/10/2000,63.5,43.1,29.4,29.32,203,0,13,23
MAX,03/10/2000,84.3,70.8,70.8,29.74,203,33,22,33
MIN,03/11/2000,62.4,38.3,20.0,29.71,315,0,0,1
MAX,03/11/2000,73.4,57.7,57.7,29.83,315,23,12,23
MIN,03/12/2000,57.7,34.1,8.7,29.64,338,0,7,13
MAX,03/12/2000,83.4,51.9,51.9,29.84,338,28,17,28
MIN,03/13/2000,59.0,27.8,27.8,29.83,315,0,0,0
MAX,03/13/2000,86.9,60.8,60.8,29.95,315,18,14,18
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MIN,03/18/2000,61.8,35.2,16.1,29.88,338,0,4,8
MAX,03/18/2000,91.5,63.8,63.8,30.07,338,22,14,22
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MAX,04/10/2000,94.2,77.1,77.1,29.91,135,26,17,26
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MIN,04/12/2000,64.4,46.2,33.7,29.59,135,0,11,16
MAX,04/12/2000,80.9,66.7,66.5,30.04,135,24,15,24
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MAX,04/14/2000,75.0,64.9,64.9,29.98,338,17,12,17
MIN,04/15/2000,75.0,63.3,63.3,29.85,135,5,0,0
MAX,04/15/2000,75.0,63.3,63.3,29.85,135,5,0,0
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MAX,04/17/2000,88.1,73.5,73.2,29.64,135,30,21,30
MIN,04/18/2000,60.9,47.8,27.9,29.55,225,0,7,15
MAX,04/18/2000,70.8,58.4,58.4,29.71,225,26,13,26
MIN,04/19/2000,65.1,52.3,42.5,29.54,338,0,0,0
MAX,04/19/2000,97.5,76.6,76.6,29.73,338,24,14,24
MIN,04/20/2000,69.8,56.8,44.6,29.22,135,0,7,11
MAX,04/20/2000,95.3,87.8,87.6,29.59,135,40,27,40
MIN,04/21/2000,62.4,48.3,26.3,29.06,158,0,10,18
MAX,04/21/2000,77.0,77.3,77.3,29.45,158,45,24,45
MIN,04/22/2000,59.7,45.6,23.2,29.44,293,0,8,16
MAX,04/22/2000,92.8,73.9,73.9,29.62,293,32,15,32
MIN,04/23/2000,62.2,41.1,41.1,29.41,315,0,0,0
MAX,04/23/2000,102.2,83.3,83.3,29.62,315,14,8,14
MIN,04/24/2000,68.1,55.5,43.1,29.40,090,0,4,8
MAX,04/24/2000,75.9,66.0,66.0,29.45,090,17,11,17
MIN,04/25/2000,67.4,54.3,41.5,29.41,023,0,5,12
MAX,04/25/2000,90.6,70.7,70.7,29.58,023,25,15,25
MIN,04/26/2000,62.9,48.3,38.3,29.58,338,0,6,15
MAX,04/26/2000,95.3,79.5,79.5,29.71,338,26,13,26
MIN,04/27/2000,59.5,47.4,47.3,29.64,023,0,2,6
MAX,04/27/2000,102.5,82.9,82.9,29.78,023,14,7,14
MIN,04/28/2000,69.9,53.9,37.4,29.39,135,0,0,0
MAX,04/28/2000,93.2,70.8,70.8,29.65,135,35,17,35
MIN,04/29/2000,67.4,52.5,42.3,29.51,270,0,0,0
MAX,04/29/2000,92.4,85.8,85.8,29.59,270,35,15,35
MIN,04/30/2000,71.2,57.3,54.9,29.56,135,0,2,5
MAX,04/30/2000,98.6,82.9,82.9,29.77,135,16,10,16
MIN,05/01/2000,69.0,51.9,51.5,29.62,248,0,0,0
MAX,05/01/2000,99.1,84.9,84.7,29.86,248,23,16,23
MIN,05/02/2000,67.6,65.4,57.2,29.47,135,0,5,8
MAX,05/02/2000,87.2,84.0,84.0,29.64,135,23,14,23
MIN,05/03/2000,65.4,62.9,56.0,29.56,000,0,9,16
MAX,05/03/2000,97.8,86.9,86.9,29.72,000,26,14,26
MIN,05/04/2000,66.0,65.6,59.8,29.61,113,0,2,6
MAX,05/04/2000,88.8,85.4,85.4,29.67,113,26,16,26
MIN,05/05/2000,66.2,64.0,60.5,29.59,113,0,6,10
MAX,05/05/2000,93.5,86.5,86.3,29.68,113,30,19,30
MIN,05/06/2000,65.6,67.2,62.3,29.59,113,0,2,3
MAX,05/06/2000,93.3,87.0,86.8,29.72,113,28,19,28
MIN,05/07/2000,67.4,66.7,60.6,29.53,135,0,6,9
MAX,05/07/2000,84.9,83.4,83.0,29.66,135,33,22,33
MIN,05/08/2000,66.9,68.3,59.4,29.42,113,0,6,8
MAX,05/08/2000,81.3,80.4,80.2,29.54,113,20,14,20
MIN,05/09/2000,78.6,78.4,76.2,29.42,113,7,0,0
MAX,05/09/2000,78.6,78.4,76.2,29.42,113,7,0,0
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MIN,05/10/2000,63.1,57.9,44.4,29.23,113,0,0,0
MAX,05/10/2000,82.4,78.4,76.2,29.48,113,29,17,29
MIN,05/11/2000,61.3,53.4,46.0,29.42,203,0,4,6
MAX,05/11/2000,95.7,78.8,78.8,29.60,203,24,16,24
MIN,05/12/2000,64.2,63.6,54.1,29.16,135,0,7,10
MAX,05/12/2000,87.9,89.2,88.6,29.43,135,38,23,38
MIN,05/13/2000,68.5,68.5,60.3,29.15,135,0,14,21
MAX,05/13/2000,91.9,93.3,94.1,29.42,135,30,17,30
MIN,05/14/2000,60.2,56.8,48.7,29.37,293,0,1,5
MAX,05/14/2000,86.3,73.4,73.4,29.78,293,36,17,36
MIN,05/15/2000,59.9,48.0,48.0,29.78,315,0,0,2
MAX,05/15/2000,87.0,80.9,80.9,29.92,315,21,12,21
MIN,05/16/2000,85.8,76.6,76.6,29.81,203,3,0,0
MAX,05/16/2000,85.8,76.6,76.6,29.81,203,3,0,0
MIN,05/17/2000,85.8,76.6,76.6,29.81,203,3,0,0
MAX,05/17/2000,85.8,76.6,76.6,29.81,203,3,0,0
MIN,05/18/2000,79.3,76.6,73.0,29.29,203,3,0,0
MAX,05/18/2000,90.5,88.7,88.7,29.81,203,30,19,30
MIN,05/19/2000,78.2,74.4,68.7,29.30,158,0,8,12
MAX,05/19/2000,91.9,84.7,84.1,29.50,158,35,22,35
MIN,05/20/2000,72.1,58.2,49.9,29.49,203,0,4,6
MAX,05/20/2000,79.3,74.8,74.8,29.72,203,19,12,19
MIN,05/21/2000,68.9,53.0,49.5,29.61,000,0,4,6
MAX,05/21/2000,89.0,73.9,73.9,29.75,000,18,10,18
MIN,05/22/2000,71.9,57.3,57.3,29.64,113,0,0,0
MAX,05/22/2000,71.9,57.3,57.3,29.64,113,0,0,0
MIN,05/23/2000,71.9,57.3,57.3,29.64,113,0,0,0
MAX,05/23/2000,71.9,57.3,57.3,29.64,113,0,0,0
MIN,05/24/2000,77.9,74.8,74.8,29.16,,0,,
MAX,05/24/2000,90.6,94.6,95.1,29.22,,14,7,14
MIN,05/25/2000,74.3,66.3,66.3,29.19,113,0,0,0
MAX,05/25/2000,92.4,96.8,97.7,29.39,113,24,11,24
MIN,05/26/2000,77.3,68.1,60.2,29.34,225,0,0,0
MAX,05/26/2000,101.4,89.9,89.9,29.55,225,19,10,19
MIN,05/27/2000,76.6,63.3,51.1,29.33,090,0,4,8
MAX,05/27/2000,80.2,69.9,69.9,29.63,090,25,14,25
MIN,05/28/2000,71.4,66.3,59.1,29.29,,0,,
MAX,05/28/2000,86.7,82.9,82.9,29.42,,23,15,23
MIN,05/29/2000,75.9,64.2,51.3,29.37,248,0,1,5
MAX,05/29/2000,79.8,69.8,69.8,29.55,248,27,13,27
MIN,05/30/2000,76.6,62.2,55.8,29.53,338,0,1,5
MAX,05/30/2000,97.5,82.5,82.5,29.64,338,20,11,20
MIN,05/31/2000,75.5,64.9,56.7,29.52,135,0,7,10
MAX,05/31/2000,78.9,66.9,66.9,29.59,135,17,11,17
MIN,06/01/2000,78.9,65.4,65.4,29.59,113,0,0,0
MAX,06/01/2000,78.9,65.4,65.4,29.59,113,0,0,0
MIN,06/02/2000,78.9,65.4,65.4,29.59,113,0,0,0
MAX,06/02/2000,78.9,65.4,65.4,29.59,113,0,0,0
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MIN,06/03/2000,77.5,65.4,65.4,29.59,113,0,0,0
MAX,06/03/2000,91.2,88.3,88.3,29.83,113,22,13,22
MIN,06/04/2000,75.3,62.6,52.8,29.70,315,0,0,0
MAX,06/04/2000,101.1,87.0,87.0,29.87,315,20,12,20
MIN,06/05/2000,75.2,59.7,55.7,29.48,293,0,0,1
MAX,06/05/2000,91.9,87.9,87.9,29.74,293,30,18,30
MIN,06/06/2000,71.6,60.6,52.0,29.53,315,0,0,2
MAX,06/06/2000,82.4,72.1,72.1,29.79,315,24,12,24
MIN,06/07/2000,72.6,55.7,55.2,29.78,315,0,1,3
MAX,06/07/2000,102.2,86.1,86.1,29.92,315,19,12,19
MIN,06/08/2000,72.8,54.8,54.8,29.65,135,0,0,0
MAX,06/08/2000,100.2,86.9,86.9,29.88,135,21,15,21
MIN,06/09/2000,77.9,64.7,59.7,29.58,135,0,3,5
MAX,06/09/2000,101.8,94.2,94.9,29.70,135,21,12,21
MIN,06/10/2000,78.0,65.3,63.9,29.56,135,0,1,3
MAX,06/10/2000,98.7,95.1,96.2,29.69,135,23,14,23
MIN,06/11/2000,78.2,72.8,70.0,29.58,113,0,0,0
MAX,06/11/2000,90.1,93.0,93.5,29.64,113,26,18,26
MIN,06/12/2000,79.7,82.2,82.2,29.62,158,1,0,0
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MAX,06/13/2000,79.7,82.2,82.2,29.62,158,1,0,0
MIN,06/14/2000,79.7,82.2,82.2,29.62,158,1,0,0
MAX,06/14/2000,79.7,82.2,82.2,29.62,158,1,0,0
MIN,06/15/2000,79.7,82.2,82.2,29.62,158,1,0,0
MAX,06/15/2000,79.7,82.2,82.2,29.62,158,1,0,0
MIN,06/16/2000,77.7,69.2,64.8,29.25,158,0,0,0
MAX,06/16/2000,100.4,91.9,92.0,29.62,158,25,15,25
MIN,06/17/2000,77.9,66.3,59.7,29.25,135,0,6,10
MAX,06/17/2000,88.1,85.2,85.2,29.59,135,18,11,18
MIN,06/18/2000,71.9,65.1,56.8,29.57,225,0,0,0
MAX,06/18/2000,82.5,75.5,75.5,29.74,225,98,5,98
MIN,06/19/2000,76.2,65.1,58.6,29.67,338,0,0,0
MAX,06/19/2000,98.6,86.7,86.7,29.77,338,12,7,12
MIN,06/20/2000,74.6,64.7,62.6,29.62,113,0,0,0
MAX,06/20/2000,93.5,87.0,87.0,29.77,113,15,10,15
MIN,06/21/2000,77.7,71.0,62.6,29.35,135,0,5,8
MAX,06/21/2000,89.7,91.5,91.5,29.62,135,39,19,39
MIN,06/22/2000,79.1,70.3,70.3,29.39,180,0,1,3
MAX,06/22/2000,93.0,86.1,86.1,29.55,180,3,1,3
MIN,06/23/2000,77.9,67.1,67.1,29.51,180,0,0,0
MAX,06/23/2000,88.8,92.3,92.3,29.59,180,5,1,5
MIN,06/24/2000,87.8,91.5,91.5,29.56,225,0,0,0
MAX,06/24/2000,87.8,91.5,91.5,29.56,225,0,0,0
MIN,06/25/2000,76.4,74.1,74.1,29.36,225,0,0,0
MAX,06/25/2000,95.3,91.5,91.5,29.56,225,0,0,0
MIN,06/26/2000,76.1,71.4,71.4,29.49,180,0,0,0
MAX,06/26/2000,101.8,92.3,92.3,29.64,180,0,0,0
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MIN,06/27/2000,79.1,78.8,78.8,29.47,135,0,0,0
MAX,06/27/2000,80.9,79.5,79.5,29.51,135,0,0,0
MIN,06/28/2000,80.4,78.9,78.9,29.48,113,0,0,0
MAX,06/28/2000,80.4,78.9,78.9,29.48,113,0,0,0
MIN,06/29/2000,80.4,78.9,78.9,29.48,113,0,0,0
MAX,06/29/2000,80.4,78.9,78.9,29.48,113,0,0,0
MIN,06/30/2000,80.4,78.9,78.9,29.48,113,0,0,0
MAX,06/30/2000,80.4,78.9,78.9,29.48,113,0,0,0
MIN,07/01/2000,75.2,68.1,68.1,29.48,113,0,0,0
MAX,07/01/2000,84.0,79.5,79.5,29.66,113,2,0,2
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MIN,07/03/2000,76.4,68.1,68.1,29.64,135,0,0,0
MAX,07/03/2000,76.4,68.1,68.1,29.64,135,0,0,0
MIN,07/04/2000,76.4,68.1,68.1,29.64,135,0,0,0
MAX,07/04/2000,76.4,68.1,68.1,29.64,135,0,0,0
MIN,07/05/2000,76.4,68.1,68.1,29.64,135,0,0,0
MAX,07/05/2000,76.4,68.1,68.1,29.64,135,0,0,0
MIN,07/06/2000,76.4,68.1,68.1,29.64,135,0,0,0
MAX,07/06/2000,76.4,68.1,68.1,29.64,135,0,0,0
MIN,07/07/2000,76.4,68.1,68.1,29.64,135,0,0,0
MAX,07/07/2000,76.4,68.1,68.1,29.64,135,0,0,0
MIN,07/08/2000,0.0,0.0,0.0,.00,000,0,0,0
MAX,07/08/2000,0.0,0.0,0.0,.00,000,0,0,0
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MAX,07/13/2000,99.6,98.0,98.3,29.56,000,11,7,11
MIN,07/14/2000,80.2,75.2,74.7,29.54,090,0,0,0
MAX,07/14/2000,101.3,99.6,101.1,29.63,090,15,9,15
MIN,07/15/2000,79.7,75.7,75.7,29.47,090,0,0,0
MAX,07/15/2000,104.5,100.9,102.5,29.59,090,18,9,18
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MAX,07/19/2000,95.0,92.4,92.6,29.65,225,26,14,26
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MIN,07/20/2000,79.5,66.2,57.6,29.50,338,0,0,0
MAX,07/20/2000,90.5,87.4,87.4,29.68,338,18,11,18
MIN,07/21/2000,79.3,66.2,65.8,29.61,338,0,0,0
MAX,07/21/2000,85.8,75.5,75.5,29.67,338,8,4,8
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MAX,07/22/2000,84.5,75.3,75.3,29.64,135,3,0,0
MIN,07/23/2000,84.5,75.3,75.3,29.64,135,3,0,0
MAX,07/23/2000,84.5,75.3,75.3,29.64,135,3,0,0
MIN,07/24/2000,84.5,75.3,75.3,29.64,135,3,0,0
MAX,07/24/2000,84.5,75.3,75.3,29.64,135,3,0,0
MIN,07/25/2000,82.0,69.8,69.8,29.64,135,0,0,0
MAX,07/25/2000,103.1,94.1,94.6,29.75,135,16,10,16
MIN,07/26/2000,78.0,62.9,62.9,29.61,000,0,0,0
MAX,07/26/2000,102.0,90.5,90.5,29.72,000,15,11,15
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MAX,07/27/2000,101.3,94.6,94.8,29.73,090,18,13,18
MIN,07/28/2000,77.7,71.4,69.6,29.57,113,0,4,6
MAX,07/28/2000,98.6,95.7,96.6,29.63,113,18,11,18
MIN,07/29/2000,74.6,70.7,62.6,29.47,113,0,0,0
MAX,07/29/2000,86.7,79.7,79.7,29.61,113,24,15,24
MIN,07/30/2000,78.9,71.0,68.1,29.22,248,0,7,11
MAX,07/30/2000,90.6,82.7,82.7,29.53,248,12,9,12
MIN,07/31/2000,80.2,69.6,66.9,29.46,315,0,0,0
MAX,07/31/2000,100.2,91.9,92.0,29.53,315,13,7,13
MIN,08/01/2000,80.2,70.8,70.1,29.52,338,0,0,0
MAX,08/01/2000,99.6,85.6,85.6,29.62,338,16,11,16
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Appendix E

Slag Analysis

WORKSTATION 146 - USER HY - YOUNG, HEATHER YO

WORKSTATION 146 READY 10:06 AM TUESDAY AUGUST 1, 2000

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*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
*****************************************************************************************
*  *                                                                                  *  *
* 1*                                SLAG_ANALYSIS_REPORT                              * 1*
* 2*                                                                                  * 2*
* 3*    DATE   F HEAT FRM WEIGHT TEMP   CU    FE    PB    SN    ZN   SIO2   CAO  AL2O3  * 3*
* 4*   ------ - ---- --- ------ ---- ----- ----- ----- ----- ----- ----- ----- -----  * 4*
* 5*    73100 4  115 FB   80000 2061   .98 45.14   .12   .49  6.71 26.51  1.94  4.17  * 5*
* 6*    73100 1   72 FB   80000 2089   .14 34.49  3.05   .78  7.30 33.69  3.18  5.03  * 6*
* 7*    73100 4  116 GS  120000 2058       44.18   .43   .40  7.28 31.66  1.90  5.04  * 7*
* 8*    73100 4  117 GS   40000 2150   .48 38.96  1.25   .52 10.26 29.82  2.06  4.86  * 8*
* 9*    73100 4  117 JSY 100000 2093   .67 46.65   .34   .30  5.84 30.92  1.98  4.30  * 9*
*10*                                                                                  *10*
* 1*                                                                                  * 1*
* 2*                                                                                  * 2*
* 3*                                                                                  * 3*
* 4*                                                                                  * 4*
* 5*                                                                                  * 5*
* 6*                                                                                  * 6*
* 7*                                                                                  * 7*
* 8*                                                                                  * 8*
* 9*                                                                                  * 9*
*20*                                                                                  *20*
* 1*                                                                                  * 1*
* 2*                                                                                  * 2*
* 3*   WEIGHTED AVG     84775199        .24 37.22   .57   .36  6.65 30.14  2.23  4.15  * 3*
* 4*                                                                                  * 4*
*  *                                                                                  *  *
*****************************************************************************************
****          1         2         3         4         5         6         7         8 ****
**** 12345678901234567890123456789012345678901234567890123456789012345678901234567890 ****
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AUG 1 '00 09:36 FROM CHEMETCO-ACCOUNTING TO 15734450137

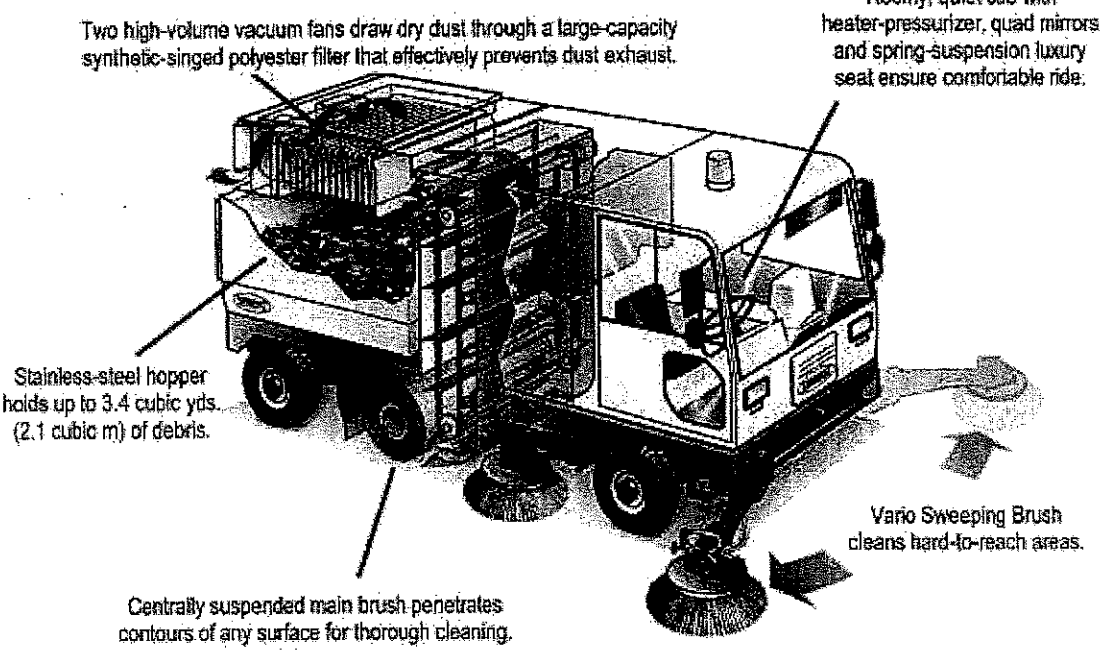
Appendix F

Tennant Sweeper Certification Information

APPENDIX F: TENNANT SWEEPER CERTIFICATION INFORMATION

The Tennant Model 830 II sweeper (which is the type of sweeper used at Chemetco) has been certified by the South Coast Air Quality Management District in California as meeting the Rule 1186 sweeper certification procedures and requirements for PM10-efficient sweepers. The purpose of Rule 1186 is to reduce the amount of particulate matter entrained in the ambient air as a result of vehicular traffic. One of the key points of this rule is the requirement that significant roads are swept with PM10 efficient sweepers. Appendix A of Rule 1186 establishes a standard testing procedure for determining the PM10 efficiency of street sweeping equipment. In order to be certified, the pick-up efficiency of the sweeping equipment must be greater than or equal to 80 percent. Information supporting the certification of the Tennant Model 830 II sweeper per Rule 1186 requirements is included in Appendix F.

Tennant Model 830 II



TENNANT

December 20, 2000

CHEMETCO INCORPORATED
3754 Chemetco Ln
Hartford, IL 62048

Dear Mr. Fock,

Per your request please consider this a document that states that the Tennant Model 830-II passed the method used for testing for the Air Quality Management District (AQMD) Rule 1136 certification process conducted in Sept. 1999.

Please let me know if there is anything more I can do to help you.

Sincerely,

Pete Thomson

PM10 – What It Is and How Can Tennant Products Help?

PM10-What Is It?

PM10 is a measurement of the size of small particles. It covers particles that are less than 10 microns in diameter. Compared to a PM10 particle, a strand of human hair is approximately 7 times larger. A good example of PM10 size is thick smoke. PM10 has recently come to be recognized as a layman term for small dust particles.

The Federal EPA determined that PM10 particles are not filtered out by the normal bodily filters and tend to imbed themselves into the surface of the lungs. In the early '70s the EPA used this information to establish National Ambient Air Quality Standards (NAAQS) which defines the maximum amounts of PM10 particles people could be exposed to before suffering long term adverse health affects.

These PM10 standards were implemented for municipalities across the US. Air quality monitors were installed in municipal areas to measure levels on a long-term basis. Municipalities that did not meet the required levels were placed in a "State of Non-Attainment". Their Federal funding was in jeopardy until they formulated a plan to correct the situation.

Sources of PM10

It was determined that dust originated from two general sources, Point Sources and Non-Point Sources. Many industrial and construction sites within municipalities were identified as "Point Sources" of PM10. They fell under the jurisdiction of the local EPA offices to reduce the amount of dust they generated. Failure to comply resulted in substantial fines.

A key difference exists between the industrial sites and municipal streets with respect to dust. Fine dust is carried by either wind or water. Inside an industrial plant, neither of these elements are present and the dust tends to be uniformly spread throughout the areas. On streets, vehicle traffic, wind, and rain carry dust to the gutters. This places a great degree of importance on the side brush for street sweeping.

Non-Point Source situations occur in cities such as Las Vegas and Phoenix, which receive dust from the desert blown in by the prevailing winds. Land use programs have been instituted in areas such as these to control non-point source dust.

PM10 Challenges Sweeping Equipment

The challenge for sweepers is to pickup as much dust as possible without generating airborne dust. Airborne dust is generated on a sweeper by the main and side brushes, tires, skirts that drag on the ground and sometimes the engine fan. The dry filter dust control system that TENNANT has used since 1947 controls the dust generated by the main broom and on some machines, the side brushes. It also helps to clean the dust from the surface, in much the same fashion as a vacuum cleaner.

The filtration efficiency of the filter is important and is rated in terms of percentage of particles larger than a certain size that are trapped. For instance, a typical panel filter has a nominal rating of 99.9% larger than 3 microns.

Note that this rating on the filter has nothing to do with the actual dust control of the sweeper. It only relates to the dust in the airstream exhausted by the vacuum fan. A machine could have an excellent filter, yet the side brushes and tires could still generate objectionable dust.

PM10 – What's the Cleaning Standard?

In 1997, the Air Quality Management District (AQMD) in Los Angeles instituted a new law called Rule 1186. This rule was intended to cover only the LA Basin, but other groups in the US have been looking for guidance and will probably use it. One of the key points of that rule was the requirement that significant roads were to be swept with PM10 efficient sweepers. The major problem was that there was no standard to identify what a PM10 efficient sweeper was. This caused the program effectivety date to be moved to January 1, 2000.

Members of the Society of Automotive Engineers (SAE) develop standards such as this. All the key manufacturers of street and industrial sweepers have engineering representatives on a standards committee sponsored by SAE. A subgroup of this committee, led by representatives from TENNANT, assumed the responsibility of researching and writing a standard to measure the dust sweeping differences between street sweepers.

The Test

After two years of research, discussion and testing, the manufacturers and the AQMD agreed upon a test procedure and means of measurement. The test consisted of two measurements, airborne dust and the pickup efficiency from the ground. The "dust" being swept was a mixture of sand and dry paint pigment that duplicated the composition of typical road dirt. The concentration and location in the roadway also was patterned after real world conditions. (1000# per curb mile) The distribution placed 50% of the soilage within 6" of the curb and the remainder spread over the adjacent 18".

Most broom type street sweepers use water spray systems to wet the street down ahead of the brooms in order to suppress the dust. It was acknowledged that if this type of system were used properly, it would be possible to sweep without generating

airborne dust. However, the use of water would leave a slurry on the ground that would become airborne when it dried. Further, it was thought a wet sweeper without water would have a higher sweeping efficiency, but the airborne dust generated would be unacceptable. It was also felt that if recirculating air class of sweepers were tested on a level surface with proper use of both external and internal water sprays, they could sweep effectively and control dust. It was also felt that a combination broom/vacuum sweeper such as the Model 830II, which sweeps dry but uses a dry filtered vacuum to control airborne dust, would be optimum.

Test Results Are In

A test of 18 sweepers in June of 1999 confirmed these theories/observations. The test was sponsored by the AQMD and done by the University of Calif. Riverside. After the results were discussed between the manufacturers and the AQMD, levels of acceptable performance were established. Of the 18 sweepers submitted for testing, 7 met the acceptance criteria and others were granted acceptance based on similarity to the machines tested.

The Tennant Model 830-II passed the test.

A part of the certification process is that each machine has a specified configuration and operating mode that has to be adhered to in order to be certified. In the case of the Schwarze, Tymco, Elgin, and Athey air sweepers, they must **always** use water on the brushes, in the inlet tubes, in the cross-heads, and in the hoppers. Failure to do so invalidates the certification. The Elgin Pelicans and Eagle must also **always** be using a special water system to maintain the certification.
The 830II requires only a standard dry or wet/dry configuration with the vacuum fans turned on. In fact the 830II used for certification testing was a 1 year old demo model with no modifications.

We anticipate some confusion about the significance of this list and assume that customers will have questions about it.

Questions can be directed to:

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(Adopted February 14, 1997)(Amended December 11, 1998)

(Amended September 10, 1999)

RULE 1186. PM_{10} EMISSIONS FROM PAVED AND UNPAVED ROADS, AND LIVESTOCK OPERATIONS

(a) Purpose

The purpose of this rule is to reduce the amount of particulate matter entrained in the ambient air as a result of vehicular travel on paved and unpaved public roads, and at livestock operations.

(b) Applicability

The provisions of this rule shall apply to specified land uses and activities conducted within the South Coast Air Basin portion of the South Coast Air Quality Management District which result in fugitive dust.

(c) Definitions

(1) Average Daily Trips (ADT) means the average number of vehicles that cross a given surface during a specified 24-hour time period as determined by the most recent Institute of Transportation Engineers trip generation manual, tube counts, or observations.

(2) CERTIFIED STREET SWEEPER is a sweeper that has been certified by the District as meeting the Rule 1186 sweeper certification procedures and requirements for PM_{10}-efficient sweepers.

(3) CHEMICAL STABILIZERS mean any non-toxic chemical dust suppressant which must not be used if prohibited for use by the Regional Water Quality Control Boards, the California Air Resources Board, the U.S. Environmental Protection Agency (EPA), or any applicable law, rule or regulation; and should meet any specifications, criteria, or tests required by any federal, state, or local water agency. Unless otherwise indicated, the use of a non-toxic chemical stabilizer shall be of sufficient concentration and application frequency to maintain a stabilized surface.

(4) CHEMICAL STABILIZATION means a method of dust control implemented by a person to mitigate fugitive dust and corresponding PM_{10} emissions which involves the use of non-toxic chemical stabilizers in sufficient quantities to maintain a stabilized surface.

(5) CONTINGENCY NOTIFICATION means that the U.S. EPA has determined and notified the District in writing that PM10 contingency requirements must be implemented based on a finding that: (1) PM10 and PM10 precursor emissions reductions were less than required at any three-year milestone reporting interval, or (2) the region failed to attain the PM10 standards within the time frames allotted under the Federal Clean Air Act, or (3) if as part of an Attainment/Maintenance Plan, the region is no longer in attainment of the PM10 standards.

(6) CONTRACT DATE is the date the contract has been signed by both parties but no earlier than 6 months before sweeping begins. Renewals of sweeping contracts are considered new contracts.

(7) DISTRICT'S TEST PROTOCOL: RULE 1186 CERTIFIED STREET SWEEPER COMPLIANCE TESTING means the reference test method contained in Appendix A, or hereafter approved by the Executive Officer and the U.S. Environmental Protection Agency to be an equivalent method.

(8) DUST SUPPRESSANTS are water, hygroscopic materials, or non-toxic chemical stabilizers used as a treatment material to reduce fugitive dust emissions.

(9) ESSENTIAL PUBLIC SERVICES are sewage treatment facilities, prisons, police facilities, fire fighting facilities, schools, hospitals, landfills, and water delivery operations.

(10) FEED LANE ACCESS AREAS are roads providing access from the feed preparation areas to and including feed lane areas at a livestock operation. These access roads are typically used to distribute feed from feed trucks to the animals.

(11) FUGITIVE DUST means any solid particulate matter that becomes airborne, other than that emitted from an exhaust stack, directly or indirectly as a result of the activities of man.

(12) INDEPENDENT TESTING FACILITY (OR LABORATORY) means a testing facility that meets the requirements of District Rule 304, subdivision (k) and is approved by the District to conduct certification testing under the District's Test Protocol: RULE 1186 Certified Street Sweeper Compliance Testing.

(13) LIVESTOCK OPERATIONS means any operation directly related to the raising of more than 50 animals for the primary purpose of making a profit or for a livelihood.

(14) OWNER/OPERATOR is any person who owns, leases, or operates a land use or activity subject to the requirements of this rule.

(15) PAVED ROAD means an improved street, highway, alley, public way, or easement that is covered by typical roadway materials excluding access roadways that connect a facility with a public paved roadway and are not open to through traffic. Public paved roads are those open to public access and that are owned by any federal, state, county, municipal or any other governmental or quasi-governmental agencies. Private paved roads are any paved roads not defined as public.

(16) PM_{10} is particulate matter with an aerodynamic diameter smaller than or equal to 10 microns as measured by the applicable State and Federal reference test methods.

(17) PURCHASE OR LEASE DATE is the date the purchase or lease contract for delivery of sweeping equipment has been signed by both parties.

Renewals of leasing contracts are considered new leases.

(18) ROUTINE STREET SWEEPING is street sweeping performed by local governments or their contractors at least once every three months for a given paved road.

(19) SOUTH COAST AIR BASIN means the non-desert portions of Los Angeles, Riverside, and San Bernardino counties and all of Orange County as defined in California Code of Regulations, Title 17, Section 60104. The area is bounded on the west by the Pacific Ocean, on the north and east by the San Gabriel, San Bernardino, and San Jacinto Mountains, and on the south by the San Diego county line.

(20) STABILIZED SURFACE means:

(a) any disturbed surface area or open storage pile which has been treated to prevent wind-driven fugitive dust;

(b) any unpaved road surface in which any fugitive dust plume emanating from vehicular traffic does not exceed 20 percent opacity.

(21) STREET CLEANING means the removal of post-event visible roadway accumulations using street sweeping equipment, front end loaders, haul vehicles, manual shoveling, street flushing, or any other methods determined effective by the responsible agency.

(22) TYPICAL ROADWAY MATERIALS are concrete, asphaltic concrete, recycled asphalt, asphalt or any other material of equivalent performance as determined by the Executive Officer, the California Air Resources Board, and the U.S. EPA.

(23) UNPAVED ACCESS CONNECTIONS are any unpaved road connection with a paved public road.

(24) UNPAVED ALLEY means any roadway not exceeding 25 feet in width which is primarily used for access to the rear or side entrances of abutting property that is not covered by one of the following: concrete, asphaltic concrete, recycled asphalt, or asphalt.

(25) UNPAVED ROADS are any unsealed or unpaved roads, equipment paths, or travel ways that are not covered by one of the following: concrete, asphaltic concrete, recycled asphalt, or asphalt. Public unpaved roads are any unpaved roadway owned by Federal, State, county, municipal or other governmental or quasi-governmental agencies. Private unpaved roads are all other unpaved roadways not defined as public. This definition excludes horse trails, hiking paths, bicycle paths, or other similar pathways used exclusively for purposes other than travel by motorized vehicles.

(26) VISIBLE ROADWAY ACCUMULATIONS means the deposit of particulate matter onto paved roads as a result of wind or water erosion, haul vehicle spillage, or any other event excluding vehicular track-out, which results in the accumulation of visible roadway dust covering a contiguous area in excess of 200 square feet.

(27) WIND-DRIVEN FUGITIVE DUST means visible emissions from any disturbed surface area which is generated by wind action alone.

(d) Requirements

Paved Roads

(1) Any owner or operator of a paved public road on which there is visible roadway accumulations shall begin removal of such material through street cleaning within 72 hours following any notification of the accumulation and shall completely remove such material as soon as feasible. If removal cannot be completed within 10 days of notification, the owner/operator shall notify the Executive Officer and provide information on the location of the accumulation(s) and estimated removal completion date.

(2) Any government or government agency which contracts to acquire street sweeping equipment or street sweeping services for routine street sweeping on public roads that it owns and / or maintains, where the contract date or purchase or lease date is January 1, 2000 or later, shall acquire or use only certified street sweeping equipment.

(3) Any government or government agency subject to the requirements of paragraph (d)(2) and/or its contractors shall operate and maintain the certified street sweeping equipment in accordance with the manufacturer's specifications.

Unpaved Roads

(4) Any owner or operator of an unpaved public road shall annually treat unpaved roads that have greater than the average ADT of all unpaved roads in its jurisdiction (as determined by the owner/operator) beginning January 1, 1998 and each of the 8 calendar years thereafter by either:

(A) Paving at least 1 mile of such roads using typical roadway materials; or

(B) Applying chemical stabilization to 2 miles of such roads in sufficient quantities to maintain a stabilized surface; or

(C) Taking one or more of the following actions on 3 miles of such roads:

(i) Installing signage at 1/4 mile intervals that prohibits vehicular speeds in excess of 15 miles per hour (mph) as authorized by California Vehicle Code section 22365 and/or

(ii) Installing speed control devices (e.g., speed bumps) every 500 feet and/or

(iii) Maintaining the roadway in such a manner that inhibits vehicular speeds in excess of 15 mph to 3 miles of unpaved roads in its jurisdiction.

(Note: Treatment in excess of the annual requirement can be credited toward future year requirements.)

Livestock Operations

(5) Any owner or operator of a livestock operation shall cease all hay grinding activities between 2 and 5 p.m. if visible emissions extend more than 50 feet from a hay grinding source.

(6) Any owner or operator of a livestock operation shall treat all unpaved access connections and unpaved feed lane access areas with either pavement, gravel (maintained to a depth of four inches), or asphaltic road-base no later than January 1, 1998.

(e) Contingency Requirements

When a contingency notification has occurred, the requirements of this subdivision shall become effective in the county subject to the notification 60 days after the first publication date in newspapers of general circulation in that county. Such publication shall specify that a contingency notification has occurred, and that paragraph (e)(1) is to be implemented within 60 days of a contingency notification.

Paved Roads

(1) Any owner or operator of public or private paved roads shall construct, or require to be constructed, all new or widened paved roads in accordance with the American Association of State Highway and Transportation Officials (AASHTO) guidelines or the applicable equivalent locally adopted guidelines for curbing, width of shoulders, and medians as specified below:

(A) New construction or widening of paved roads with projected average daily trips of 500 vehicles or more shall be constructed with curbs or as an alternative paved outside shoulders using typical roadway materials and having the following minimum widths:

Average Daily Trips Minimum Shoulder Width

500 - 3,000 4 feet

3,000 or greater 8 feet

(B) New construction or widening of paved roads with medians and projected average daily trips of 500 vehicles or more shall pave the median area with typical roadway materials unless:

(i) the speed limits are set at or below 45 miles per

hour; or

(ii) the medians are landscaped and maintained with grass or other vegetative ground cover and are surrounded by curbing; or

(iii) the medians are treated with chemical stabilizers in sufficient quantity and frequency to establish a stabilized surface and are surrounded by curbing.

(f) Street Sweeper Testing and Certification Procedures

(1) Any manufacturer seeking certification of street sweeping equipment as a certified street sweeper shall utilize the following procedures;

3,000 or greater 8 feet

(A) The manufacturer shall submit a signed and dated certification request to the Executive Officer, and attest to the accuracy of all statements therein, that shall include:

(i) the name and address of the manufacturer, the brand name, the model number, and a complete description of the sweeper's dust suppression system; and

(ii) confirmation that the specific sweeper configuration to be certified has been tested in accordance with District's Test Protocol: Rule 1186 Certified Street Sweeper Compliance Testing by an independent test facility or laboratory, and that test results demonstrate that the sweeper meets the Rule 1186 sweeper certification limits specified in paragraph (f)(2).

(B) Manufacturers of certified street sweeping equipment may submit a certification request for additional equipment that has identical material collection and dust suppression system(s) as equipment that was certified under the provisions of subparagraph (f)(2), by providing the information specified in clause (f)(1)(A)(i). If Executive Officer determines that the previous certification test is not sufficient to certify the additional equipment, the Executive Officer must deny the request.

(2) The Executive Officer may certify street sweeping equipment provided such equipment meets the following conditions based on a single certification test:

(A) The pick-up efficiency, as defined in the District's Test Protocol: Rule 1186 Certified Street Sweeper Compliance Testing, is greater or equal to 80 percent; and

(B) The normalized mass of entrained PM_{10}, as defined by District's Test Protocol: Rule 1186 Certified Street Sweeper

Compliance Testing, is less than or equal to 200 mg/m.

(g) Recordkeeping

(1) Any person subject to paragraph (d)(3) shall maintain operational and maintenance records demonstrating compliance with paragraph (d)(3). Such records for the previous two years of operation (or total period of operation, if less than two years) must be made available to the Executive Officer upon request.

(2) Any person subject to paragraph (d)(4) shall maintain records that document compliance with the requirements specified in paragraph (d)(4). Such records must be updated annually and must be made available to the Executive Officer upon request.

(h) Effective Date

All provisions of this rule shall become effective upon adoption of this Rule.

(i) Exemptions

(1) The provisions of this rule shall not apply to essential public services that are in compliance with District Rule 403 (Fugitive Dust).

(2) The provisions of paragraph (d)(1) shall not apply to:

(A) visible roadway accumulations that occur on roads with fewer than 500 average daily trips.

(B) paved roads that have been closed until such time that the road is again opened to vehicular activity.

(C) events of such magnitude that a State of Emergency has been declared by the Governor, provided that removal of visible roadway accumulations associated with such events are initiated and completed as soon as feasible.

(3) An owner or operator of a paved road shall be exempt from the provisions of paragraph (d)(2) provided that certified street sweepers have been purchased and are being used on all swept paved roads, other than the portion of exempt paved roads [defined as paved public roads that: 1) have curbs, or paved road shoulders in excess of four feet and 2) are not within 1,000 feet of an unpaved road], and the owner or operator of a paved road submits annually the following to the Executive Officer:

(A) a written inventory of the curb mileage swept and to be swept using certified street sweepers; and

(B) a written inventory of the exempt curb mileage.

(4) The provisions of paragraph (d)(4) shall not apply to:

(A) any unpaved road 3,000 feet above mean sea level with

fewer than 500 ADT.

(B) any unpaved road used for emergency fire or flood protection or emergency maintenance of essential service utilities to provide electricity, natural gas, telephone, water, and sewer.

(C) any unpaved public road where public access is prohibited.

(D) any unpaved alley.

(E) any jurisdiction if it:

(i) notifies the Executive Officer that it has less than 5 miles of unpaved road mileage and implements once at least one of the control strategies identified in either subparagraph (d)(4)(A) or (d)(4)(B) or (d)(4)(C) on the unpaved road mileage with greater than the average ADT (as determined by the owner/operator) by January 1, 2000.

(ii) notifies the Executive Officer that it has more than 5 but less than 10 miles of unpaved road mileage and implements at least one of the control strategies identified in either subparagraph (d)(4)(A) or (d)(4)(B) or (d)(4)(C) on unpaved roads with greater than the average ADT (as determined by the owner/operator) in each three year period beginning January 1, 1998 (with final treatments completed by December 31, 2005).

(iii) notifies the Executive Officer that all of its remaining unpaved roads have 20 ADT or less (as determined by the owner/operator).

(5) The provisions of paragraphs (d)(5) and (d)(6) shall not apply to livestock operations whose contiguous bounded areas include less than ten acres.

(6) The provisions of subparagraph (e)(1)(A) shall not apply to unpaved road shoulders provided that the area extending eight feet from the outside edge of the pavement is landscaped and maintained with grass or other vegetative ground cover.

(j) Alternative Control Options

In lieu of complying with the provisions of paragraphs (d)(4) and (d)(6) and subdivision (e), a person may submit for approval by the Executive Officer and the U.S. Environmental Protection Agency a plan for achieving equivalent emissions reductions through alternative control measures.

RULE 1186: APPENDIX A

South Coast Air Quality Management District Test Protocol

Rule 1186-Certified Street Sweeper Compliance Testing

September 1999

1 Scope - This protocol establishes a method for determining which street sweeping equipment is considered Rule 1186-certified under the provisions of South Coast Air Quality Management District (AQMD) Rule 1186.

1.1 Purpose - The purpose of this document is to describe a test protocol for gauging the PM10-efficiency of street sweeping equipment and to establish procedures to present test results. PM10-efficiency includes both the equipment's ability to remove typical urban street loadings and limit the amount of PM10 entrained during the sweeping process.

2 References

2.1 Test Methods - U.S. Environmental Protection Agency (EPA) reference test methods as established by 40 Code of Federal Regulations (CFR), Part 50, Appendix J, or EPA-published documents for EPA-approved equivalent methods for conducting particulate matter measurements (see Section 3.5). Any particulate matter air monitoring equipment used in the sweeper tests shall also be subject to prior approval by the AQMD.

3 Definitions

3.1 Street Sweeping Equipment - A self-propelled sweeper that is primarily designed to remove material from highways, arterials, collectors, and local roadways. Street sweeping equipment may use a broom or air stream to dislodge and direct material into a collection mechanism, that may be mechanical, pneumatic, or a combination of both systems to convey the swept material into a collection hopper.

3.2 Test Track - A level area (less than or equal to 3%) covered with asphalt (or equivalent) with roughness typical of paved roads on which the sweeping test is conducted that extends a minimum of 200 feet [61 meters] through an enclosed tunnel or building with a maximum height of 15 feet [4.6 meters]. The test track must contain 100 feet of curbing and a surrogate, rounded profile, speed bump (maximum dimensions - two inches tall and four inches wide) shall be placed diagonal to the test track at its midpoint (Figure 1). The shape, dimensions, and location of the speed bump shall be subject to prior AQMD approval.

3.3 Test Material - Prepared material used in the sweeping tests that consists of 90 percent (by weight) Department of Transportation washed sand and ten percent #10 Georgia Paint Pigment (calcium carbonate).

3.4 Test Material Density - Test material placed on the test track at a rate of 1,000 pounds per curb mile (i.e., 38 pounds over 200 foot test track or 17.2 kilograms over a 61 meter test track) with 50 percent deposited in the first six inches [15.2 centimeters] with the remaining 50 percent placed in the adjacent 18 inches [45.7 centimeters]. The test material shall be placed adjacent to the curb for the first 100 feet (30.5 meters) of the test track and approximately two feet away from any curbing for the remainder of the test track (see Figure 1). In instances where the test track has a fixed curb, a surrogate curb shall be installed for 100 feet to ensure that half of the material is adjacent to a curb and the remaining half is approximately two feet from the curb while ensuring that the test material is

arranged in a straight line.

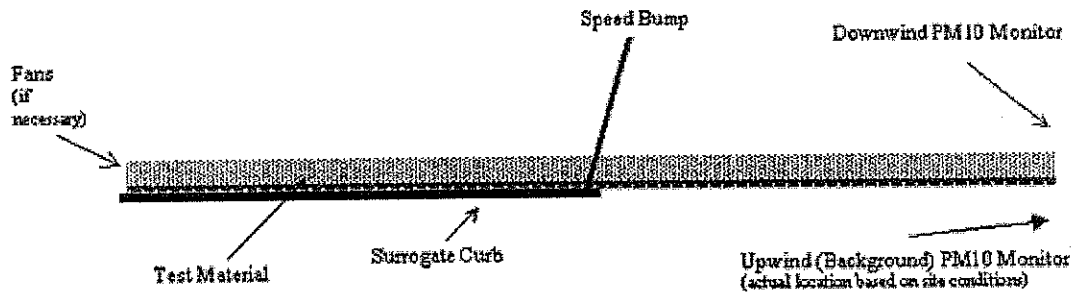

Figure 1 - Test Track (Top View)

3.5 Ambient Particulate Matter Air Monitoring - Consists of air quality monitoring equipment operated, maintained, and calibrated in accordance with Section 2.1. At a minimum, one co-located PM10 monitor will be placed at the downwind end of the tunnel and one PM10 monitor shall be placed at a suitable upwind (background) site. If necessary to ensure an adequate flow rate through the test tunnel (at least one m/s, but no more than 6 m/s), four 3/4 horsepower 42-inch [106.7 centimeter] diameter fans will also be placed at the test track entrance to ensure appropriate air circulation and mixing. The size and power of the fans and the specific location of the fans and air monitoring equipment shall be based on site specific conditions and will be subject to approval by AQMD staff prior to test runs used for certification purposes.

4 Technical Requirements

4.1 Condition of Sweeper - Prior to each test run, the sweeper must be set at the normal operational settings according to the manufacturer's specification. Where the sweeper has variable duties of operation described in its instruction manual, then the sweeper should be operated at its maximum-duty cycle. Brooms and swept material containment curtains, etc., should be in like-new condition. These settings must be provided in the test report. Dust suppression systems, if provided, shall be active during the test.

4.2 Weather Conditions - Weather conditions must be dry, with wind speeds less than 12 miles per hour [6 meters per second] and such that it will not disturb test material. Weather instrumentation to measure temperature, humidity, wind speed, and wind direction shall also be required at least three feet [0.9 meters] below the test track cover.

4.3 Site Preparation

4.3.1 Test Track Layout - The test track shall be oriented to be parallel with the prevailing wind direction, with the tunnel entrance in the upwind position.

4.3.2 Pre-Test Run Test Track Conditioning - Prior to the pre-test run sweeper conditioning, the sweeper shall make as many passes through the test track as deemed necessary to ensure that the test track is clean.

4.3.3 Pre-Test Run Sweeper Conditioning - The sweeper shall be conditioned by sweeping approximately 3/4 of a cubic yard of washed sand spread to a depth of approximately one inch prior to the first test run. This is to assure that all ducting and related equipment that may retain a thin film of dust are at an equilibrium condition. The pre-test run sweeper conditioning shall be made using the equipment's dust control method (e.g., water spray, dry filters, etc.) as specified by the manufacturer.

4.3.4 Test Material Pattern - Test material shall be placed on the test track in accordance with the specifications established in Section 3.4. The test track shall be scrubbed and dried prior to conducting subsequent test runs.

4.4 PM10-Efficient Street Sweeper Testing

4.4.1 Test Runs - The sweeper shall start sweeping at a maximum duty cycle at least 100 yards away from the test track entrance and shall continue through the test track with the objective of removing the maximum amount of test material, subject to the other test requirements. After the first test-run, all test material shall be removed in accordance with Section 4.4.2 and the test track shall be dried prior to replacing the test material for subsequent test runs. These procedures shall be repeated until three test runs have been completed.

4.4.2 Travel Speed - During each test run, the goal is for the sweeper to travel at a minimum of five miles per hour [8 kilometers per hour]. Speed may be measured by timing each sweeper run from start to finish of each test run to verify travel speeds. The average speed from the three test runs shall be computed. Due to the difficulty in maintaining a five mile per hour speed, a minimum travel speed of four miles per hour for the average of the three test runs must be demonstrated for the test to be acceptable, with no more than one individual run below 4 mph and no individual run below 3 mph.

4.4.3 Post-Test Run Material Collection - All test material remaining on the test track shall be removed using suitable recovery equipment (e.g., modified carpet extractor or industrial scrubber). The recovery equipment must demonstrate at least an 80% test material collection efficiency *and* shall be subject to AQMD approval prior to testing and shall be thoroughly rinsed with clean water between each test material collection effort.

4.4.4 Pre-Test Sweeper Pass and Test Run Ambient Particulate Matter Air Monitoring Measurements - The background and downwind ambient PM10 monitoring equipment at the exit of the test track shall be activated at the beginning of each test run and will continue to operate for two minutes.

5 Reporting - At a minimum, the following information will be included with the reported results of the PM10-efficient street sweeper performance testing. Certified copies of the raw data reporting forms must also be made available to the AQMD. Calculation methodologies are presented in Section 6.

Test date:	Test reference number:	Humidity:
Manufacturer:	Machine type:	Temperature:
Model and serial number:	Travel time:	Wind speed:
Operational adjustments:		

M_{PM10} (normalized mass of entrained PM10):

$N_{pick\text{-}up}$ (pick-up efficiency):

Comments:

6. Calculations - Unless specified otherwise, all ambient PM measurements and material collection results shall be calculated using the methodologies listed below.

6.1 Ambient Particulate Matter Air Monitoring Measurements:

$$M_{PM10} = \frac{S \times U \times \int_{o}^{T_{sampling}} (C_{PM10,test} - C_{PM10,o}) \times dt}{L}$$

where,

M_{PM10} = mass of PM10 entrained per unit length [mg/(m)]

$C_{PM10,\ test}$ = PM10 concentration measured at the downwind (end of the tunnel) monitor (μ g/m^3)

$C_{PM10,\ o}$ = baseline PM10 concentration measured at upwind (background) monitor (μ g/m^3)

S = cross sectional area of the tunnel (m^2)

U = linear speed of airflow in tunnel (meters/second)

$T_{sampling}$ = standardized duration of sampling

L = distance swept [based on length of tunnel/test track for three runs] (meters)

6.2 Material Collection:

$$\frac{W_{base} - W_{test}}{W_{base}} \times 100 = N_{pick\text{-}up}$$

where,

$N_{pick\text{-}up}$ = pick-up efficiency (%)

W_{base} = weight of test material spread over test track before the test (grams)

W_{test} = weight of test material remaining on test track after test (grams)

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AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

March 8, 2001

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

Coherex was applied as weather permitted during the month of February.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the February 2001, reporting period with the following exceptions:

2/12 – No log was turned in for the 6:30 am to 2:30 pm shift.

Sweeping of Paved Roads

All areas were documented as being swept during the February 2001 (except Zone 3, AAF Area, which was flooded a majority of the time due to a leak in a water line) reporting period with the following examples:

2/7 –Several zones were missed due to an equipment failure, hydraulic leak
2/20 – One treatment in Zone 1 was missed due to operator error.

Corrective Action

A second Tenant sweeper was purchased and is now in operation. Operators were trained on the new sweeper on 2/8/01. The second sweeper should obviously reduce down time experienced due to equipment failures.

Training of all sweeper and water truck operators is presently scheduled for March.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen
File

Chemetco
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March 9, 2001

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APR 12 2001
AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

Coherex was applied as weather permitted during the month of March. In addition, both the zinc oxide bunker and the slag pile received applications of Coherex during the month of March..

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the March 2001, reporting period with the following exceptions:

3/1- Several zones missed due to an equipment failure, PTO problems and an air leak.
3/5 – Zone A, Scale, was missed at 2:30 pm and Zone B/C, Scrap Yard, was missed at 2:40 pm and 5:40 pm due to operator error.
3/6 - – Zone A was missed at 2:30 pm and Zone C was missed between 8 pm and 8:40 pm due to operator error.
3/7 – Zones A, B and C were missed between 7:30 pm and 8:40 pm due to operator error.
3/8 - Zones A, B and C were missed between 7:30 pm and 8:40 pm due to operator error.

3/9 - Zones A, B and C were missed between 8:40 pm and 2:30 am due to operator error.
3/10 - Zones A, B and C were missed between 8:40 pm and 2:30 am due to operator error.
3/13 - Zones A, B and C were missed between 8:30 am and 10:50 am due to operator error.
3/18 – All zones were missed between 7:20 am and 8:40 am, 1:20 pm and 2:40 pm, and 5:00 and 5:45 pm due to operator error.
3/19 – All zones were missed due to an equipment failure, PTO shaft, sterring problems.
3/20 –3/21 - All zones were missed between 1:15 am and 4:45 am due to operator error.
3/26 – Zone A was missed 11:00 am and 1:00 pm due to operator error.
3/27 – Zone B was missed 10 am and 2:00 pm due to operator error.
3/29-3/30 – No log was turned in for the 10:30 pm to 6:30 am shift.

Sweeping of Paved Roads

All areas were documented as being swept during the March 2001 reporting period with the following examples:

3/14 – Zone 3, AAF, was missed due to operator error.
3/18 – Zone 3, AAF, was missed due to operator error.
3/24-3/25 – No log was turned in for the 2:30 pm to 2:30 am.

Corrective Action
Training of all sweeper and water truck operators was completed in March. The revised Fugitive Dust Control Plan was distributed to appropriate personnel after submission to the Illinois EPA.

A number of water applications were missed due to operator error. The operator responsible for most of these attended the training session in late March. In addition, duties were reviewed again with the operator and his supervisor in April.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen

Chemetco
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RECEIVED
MAY 11 2001
AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

May 8, 2001

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

Coherex was applied as weather permitted during the month of April.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the April 2001, reporting period with the following exceptions:

4/1- All zones missed due to an equipment failure, Tank leak.
4/4 – No log was turned in for the 6:30 to 2:30 pm shift
4/14– Several zones were missed between 7:15 and 10:15 am due to an equipment failure, paddle broke..
4/16 – Scrap piles were missed between 4:30 and 7:45 due to operator error.
4/23 - Zones were missed between 10:30 and 10:45 pm due to an equipment failure, no lights

4/25 to 4/26 - Zones were missed between 10:30 pm and 1:45 am due to an equipment failure, oil leak.
4/26 - Zones were missed between 11:15 and 12:15 due to an equipment failure, PTO coupling broke.
4/27 - Zones were missed between 10:00 am and 5:15 pm, and 10:30 – 10:45 pm due to an equipment failure, problems with differential and starter out.

Sweeping of Paved Roads

All areas were documented as being swept during the April 2001 reporting period with the following examples:

4/1 – All zones were missed due to an operator error.
4/4 – No log was turned in for the 6:30 am to 2;30 pm.
4/5 – One treatment was missed in Zone 1 due to operator error.
4/6 – One treatment was missed in Zone 1 due to operator error.
4/7 – Zones 1, 3, and 4 were missed due to operator error.
4/12 – Zone 4 missed due to operator error.
4/13 - Zone 3 missed due to operator error.
4/18 - One treatment was missed in Zone 1 due to operator error.
4/19 - Zone 3 was missed due to operator error.
4/22 – Zones 2 and 3 were missed due to operator error.
4/28 - One treatment was missed in Zone 1 due to operator error.
4/29 - One treatment was missed in Zone 1 due to operator error.
4/30 – all zones were missed due to operator error.

Corrective Action
All of the sweeper rounds that were missed were due to operator error. Duties were reviewed again with the supervisors as well as the drivers. Due to the hot, dry, windy weather in April, the drivers appeared focused on keeping all the roadways flushed at all hours and neglected sweeping. Sweeping will be concentrated during the late afternoons and evenings when the yard traffic slows down and watering rounds are less frequent.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen

Chemetco
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618-254-4381 • 800-444-5564

RECEIVED
MAY 29 2001
AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

May 22, 2001

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Sutton,

Pursuant to Section 5.1 of the Open Fugitive Emission Dust Control Plan dated March 2001, this letter shall serve as the required notification that the road segments have achieved 95 percent average control efficiency based on ground inventory. Therefore, Chemetco shall follow the dust suppressant application schedule below:

- Truck Lot – bi-monthly applications (two times per month);
- Granulated Slag Haul Road - bi-monthly applications (two times per month);
- E/W Canal Road - bi-monthly applications (two times per month):

If you have any questions please contact me at (618) 254-4381 ext. 268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco, Inc.

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Air Enforcement Branch, USEPA, Region 5
CAM, LLC

Chemetco
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June 8, 2001

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JUN 13 2001 EHS/VB
AIR ENFORCEMENT BRANCH
U.S. EPA, REGION 5

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

Coherex was applied as weather permitted during the month of May.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the May 2001, reporting period with the following exceptions:

5/1- One treatment in Zone 1, Scale/Receiving, was missed due to an operator error
5/2 – Scrap yard was missed between 10:30 pm and 6:30 am and all zones were missed between 9:00 am and 11:15 am due to operator error.
5/3– Scrap piles were missed between 1:30 and 1:45 pm due to operator error
5/4 – Scrap yard roads and scale/receiving were missed between 1:00 and 1:15 pm due to operator error.

5/11-5/13 – All zones were missed between 4:45 pm (5/11) and 2:30 pm (5/13) due to an equipment failure, no clutch and the air compressor broke off the motor.
5/15 – All zones were missed between 9:00 am and 11:30 am due to an equipment failure, power steering.
5/16 – All zones were missed between 6:30 am and 2:30 pm due to an equipment failure, power steering pump.
5/17 - All zones were missed between 1:00 pm and 2:30 pm and 2:30 pm and 10:30 pm due to an equipment failure, suspension went out.
5/19 - All zones were missed between 4:15 am and 7:45 am due to an equipment failure.
5/24 – All zones were missed between 2:00 pm and 7:00 pm due to an equipment failure, radiator hose.
5/28 - All zones were missed between 1:15 pm and 2:30 pm due to an equipment failure, coupling for the PTO went out.
5/29 - All zones were missed between 2:30 pm and 10:30 pm due to an equipment failure, problems with the water pump.

Sweeping of Paved Roads

All areas were documented as being swept during the May 2001 reporting period with the following examples:

5/1 – One treatment was missed in Zone 1 due to operator error.
5/2 – All zones were missed due to operator error
5/3 – All zones were missed due to operator error
5/4 – All zones were missed due to operator error
5/7 – One treatment was missed in Zone 1 due to operator error.
5/8 – One treatment was missed in Zone 1 due to operator error.
5/9 - One treatment was missed in Zone 1 due to operator error.
5/27 –Zones 1, 3, and 4 were missed. Due to operator error.
5/30 -. One treatment was missed in Zone 1 due to operator error.

Corrective Action
All of the sweeper rounds that were missed were due to operator error. Duties were reviewed again with the supervisors as well as the drivers. Sweeping will be concentrated during the late afternoons and evenings when the yard traffic slows down and watering rounds are less frequent.

As for the water truck, Chemetco is currently evaluating the purchase of a new water truck. As evidenced above, a majority of the missed zones were due to equipment failures.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen

Chemetco
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RECEIVED
JUL 11 2001
AIR ENFORCEMENT BRANCH
U.S. EPA, REGION 5

July 6, 2001

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

Coherex was applied as weather permitted during the month of June. Coherex is being applied pursuant to the maintenance schedule contained in the Open Fugitive emission Dust Control Plan dated March 2001. A letter dated May 22, 2001, was sent to your office as required prior to implementing the maintenance schedule.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the June 2001, reporting period with the following exceptions:

6/2- Areas were missed between 1:15 pm and 2:30 pm due to an equipment failure, truck overheating.
6/3- 6/4 – All areas missed between 10:30 pm and 2:30 pm due to an equipment failure, water spray came loose. It was noted that it did rain most of this time.

6/11– Areas were missed between 5:00 pm and 7:00 pm due to an equipment failure, truck overheating.
6/14 – The scrap yard road was missed at 8:15 am, the Fines Building entrance was missed at 2:00 pm and the granulated slag road was missed at noon due to operator error.
6/14 – Areas were missed between 2:30 pm and 5:00 pm due to an operator calling in sick.
6/16 – All zones were missed between 2:30 pm and 2:30 am due to an equipment failure, water spray valve broken.
6/26 – All zones were missed between 12:30 pm and 2:30 pm due to an equipment failure, tire repair and the side water spray broken.

Sweeping of Paved Roads

All areas were documented as being swept during the June 2001 reporting period with the following examples:

6/5 – Zones 2 and 3 (Scrap Yard and AAF) missed due to operator error.
6/6 – One treatment was missed in Zone 1 due to operator error.
6/7 – One treatment was missed in Zone 1 due to operator error.
6/8 – One treatment was missed in Zone 1 due to operator error.
6/8 – Zone 3 (AAF) missed due to operator error.
6/10 – Zones 2 and 3 and one treatment in Zone 1 were missed due to operator error.
6/11 - One treatment was missed in Zone 1 due to operator error.
6/12 – One treatment was missed in Zone 1 due to operator error.
6/13 -. One treatment was missed in Zone 1 due to operator error.
6/14 - One treatment was missed in Zone 1 due to operator error.
6/16 – No log was turned in for the 2:30 am to 2:30 pm shift.
6/17 - One treatment was missed in Zone 1 due to operator error.
6/18 – Zone 2 was missed due to operator error.
6/19 – Zone 3 was missed due to operator error.
6/20 - Zone 3 was missed due to operator error.
6/21 - Zone 3 was missed due to operator error.
6/22 - Zone 3 was missed due to operator error.
6/27 – One treatment in Zone 1 was missed due to operator error.

Corrective Action
All of the sweeper rounds that were missed were due to operator error. Duties were again reviewed with the supervisors as well as the drivers. Sweeping will be concentrated during the late afternoons and evenings when the yard traffic slows down and watering rounds are less frequent. A meeting was held the week of June 25, 2001, with all drivers in attendance.

As for the water truck, Chemetco is currently evaluating the purchase of a new water truck. As evidenced above, a majority of the missed zones were due to equipment failures.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen

Chemetco
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618-254-4381 • 800-444-5564

RECEIVED
AUG 1 4 2001
AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

ugust 8, 2001

Don Sutton, Manager
llinois EPA
BOA/Permits
021 N. Grand Ave. E.
.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

Coherex was applied as weather permitted during the month of July. Coherex is being applied pursuant to the maintenance schedule contained in the Open Fugitive emission Dust Control Plan dated March 2001. A letter dated May 22, 2001, was sent to your office as required prior to implementing the maintenance schedule.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the July 2001, reporting period with the following exceptions:

7/1- No Log was turned in 2:30 pm to 10:30 pm shift.
7/2– All zones were missed between 10 am and 2:30 pm due to an equipment failure, fuel tank fell off. All zones were missed between 7:30 pm and 10:30 pm due to an equipment failure, wheel bearing went bad.

/3– All areas were missed between 10:30 pm (7/2) and 2:30 pm due to an equipment ailure, bad wheel bearing.
/5 – The scrap yard road was missed at 10:15 am due to operator error.
/6 – No Log was turned in 6:30 pm to 2:30 pm shift.
/8-7/9 - All areas were missed between 8:00 pm (7/8) and 2:30 pm due to an equipment ailure, drive shaft broken.
/11 - All areas were missed between 8:00 am and 10:30 pm due to an equipment failure, rake and spray failing.
/16 - All areas were missed between 8:00 am and 10:30 pm due to an equipment failure, 'TO.
'/17 – All areas were missed between 8:00 am and 10:30 pm due to an equipment failure,
'/18 – Zone C, Scrap Piles, were missed during the 6:30am to 2:30 pm shift due to operator error. One treatment in Zone B, Scrap Yard Roads, was missed due to operator rror.
'/20 – All areas were missed between 6:30 am and 2:30 pm due to an equipment failure, '?
'/21 – 7/23 - All zones were missed between 2:30 pm (7/21) and 6:30 am (7/23) due to n equipment failure, PTO and water pumps failed.
'/23 – All zones were missed between 6:30 am and 2:30 pm due to the operator going lown due to heat.
'/24 - All zones were missed between 6:30 am and 2:30 pm due to the operator going lown due to heat.
'/25 – 7/27 – All zones were missed between 10:30 am and 2:30 pm due to no operator vailable. (Due to heat, one operator down with others staying over to try and cover at east part of the shift.)
7/28 – Zone C, Scrap Piles, were missed due to operator error.
7/29 – Zone C, Scrap Piles, were missed due to operator error.
7/30 – 7/31 - All zones were missed between 10:30 pm (7/30) and 2:30 am (7/31) due to n equipment failure, battery/starter problems.

Sweeping of Paved Roads

All areas were documented as being swept during the July 2001 reporting period with the following examples:

7/1 – No log was turned in for the 2:30 pm to 10:30 pm shift
7/6 – No log was turned in for the 6:30 am to 2:30 pm shift.
7/7 – No log was turned in for the 2:30 am to 2:30 pm shift
7/9 – All zones missed due to equipment failures, brush problems, and a man went down due to heat.
7/10 – One treatment was missed in Zone 1 due to equipment failures, brush problems.
7/11 – All zones missed due to equipment failures, brush problems.
7/21 - One treatment was missed in Zone 1 due to operator error.
7/24 – Zone 2 missed due to operator error.

30 - One treatment was missed in Zone 1 and Zone 3 due to operator error.

orrective Action

hemetco is currently evaluating the purchase of a new water truck. As evidenced ›ove, a majority of the missed zones were due to equipment failures. Many of the perator errors were from a single operator. A meeting will be held with this operator to › over responsibilities, logs, etc.

: you have any questions, please contact me at (618) 254-4381 ext.268.

incerely,

leather Young, CHMM
:nvironmental Manager
:hemetco

:c: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen

Chemetco
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RECEIVED
SEP 12 2001 ATS/VB
AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

September 7, 2001

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

Coherex was applied as weather permitted during the month of August. Coherex is being applied pursuant to the maintenance schedule contained in the Open Fugitive emission Dust Control Plan dated March 2001. A letter dated May 22, 2001, was sent to your office as required prior to implementing the maintenance schedule.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the August 2001, reporting period with the following exceptions:

8/1-8/2 – All zones were missed between 10:30 pm and 6:30 am due to an equipment failure, starter
8/2– All zones were missed between 6:30 am and 1:15 pm due to an equipment failure, starter

8/3– All areas were missed between 12:30 pm and 2:30 pm due to an equipment failure, bad PTO.
8/6 – All zones were missed between 2:30 am and 6:30 am due to no operator being available.
8/7-8/8 – All zones were missed between 10:30 pm (8/7) and 7:00 pm due to an equipment failure, PTO went out
8/9 - All zones were missed between 8:15 am and 2:30 pm due to an equipment failure, water tank was unstable
8/10 - All areas were missed between 6:30 am and 1:00 pm due to an equipment failure, unstable water tank.
8/10-8/11 - All areas were missed between 2:30 pm (8/10) and 2:30 pm (8/11) due to an equipment failure, PTO.
8/12 – All areas were missed between 2:30 am and 2:30 pm due to an equipment failure, PTO.
8/13 – All zones were missed between 6:30 am and 9:00 am due to an equipment failure, PTO, and 2:30 pm and 4:45 pm and 5:30 pm and 10:30 pm due to an equipment failure, starter.
8/15 – All areas were missed between 6:30 am and 10:45 am due to an equipment failure. The drive shaft was damaged.
8/17 - All zones were missed between 6:30 am and 8:15 am and 2:30 pm and 3:15 pm due to an equipment failure, PTO
8/20 – All zones were missed between 2:30 pm and 10:30 pm due to an equipment failure, PTO
8/23 - All zones were missed between 10:30 am and 2:30 pm due to no operator being available.
8/26 – All zones were missed between 4:15 pm and 7:45 pm due to an operator error.
8/28 – All zones were missed between 2:30 pm and 4:00 pm due to an equipment failure, PTO.
8/29 – All zones were missed between 2:30 pm and 4:15 pm due to an equipment failure, PTO.

Sweeping of Paved Roads

All areas were documented as being swept during the August 2001 reporting period with the following examples:

8/1 – One treatment was missed in Zone 1 due to operator error.
8/5 – One treatment was missed in Zone 1 due to operator error.
8/14 – One treatment was missed in Zone 1 due to equipment failures, main brush problems.
8/16 – All zones missed due to equipment failures, main brush problems.
8/26 - One treatment was missed in Zone 1 due to operator error.

Corrective Action

Chemetco is currently evaluating the purchase of a new water truck. As evidenced above, a majority of the missed zones were due to equipment failures.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco
Maintenance/Labor Foremen

Chemetco
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RECEIVED
OCT 15 2001 ETS/113
AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

October 8, 2001

Don Sutton, Manager
Illinois EPA
BOA/Permits
1021 N. Grand Ave. E.
P.O. Box 19276
Springfield, IL 62794-9276

RE: Monthly Report – Fugitive Particulate Matter

Dear Mr. Sutton,

This report is being submitted monthly in accordance with the Consent Order filed and signed January 4, 2000. Pursuant to Condition 13.a.3 of the aforementioned Order, this report is to be submitted to both the Illinois EPA and USEPA within seven (7) working days of the end of the calendar month.

Dust Suppressant

Coherex was applied as weather permitted during the month of September. Coherex is being applied pursuant to the maintenance schedule contained in the Open Fugitive emission Dust Control Plan dated March 2001. A letter dated May 22, 2001, was sent to your office as required prior to implementing the maintenance schedule.

Water Flooding of Paved, Unpaved Areas and Piles

All areas were documented as being as being flooded unless freezing temperatures, snow, or rain prevailed during the September 2001, reporting period with the following exceptions:

9/3–9/4 - All zones were missed between 11:30 am (9/3) and 2:30 pm (9/4) due to an equipment failure, drive shaft broke;
9/4–9/5 - All zones were missed between 7:00 pm (9/4) and 12:00 pm (9/5) due to an equipment failure, drive shaft broke;

9/6– All areas were missed between 6:30 am and noon due to an equipment failure, Drive shaft;
9/10 – All zones were missed between 10:00 am and 11:00 am due to an operator error;
9/14 – All zones were missed between noon and 2:30 pm due to an equipment failure, working on PTO;
9/15-9/17 - All zones were missed between 11:30 am (9/15) and 2:30 pm (9/17) due to an equipment failure, drive shaft;
9/20-9/21 - All areas were missed between 12:30 pm (9/20) and 9:00 am (9/21) due to an equipment failure, drive shaft and PTO;
9/23-9/24 - All areas were missed between noon (9/23) and 6:30 am (9/24) due to an equipment failure, drive shaft;
9/24 – No log was turned in for the 2:30 pm to 10:30 pm shift, new operator's first day.
9/25-9/26 - All zones were missed between 10:30 pm (9/25) and 6:30 am (9/25) due to an equipment failure, drive shaft;
9/26-9/27 – All areas were missed between 7:30 pm (9/26) and 2:30 pm (/27) due to an equipment failure, rear axel broke; and,
9/28 - All zones were missed between 2:30 pm and 6:30 pm due to an equipment failure, PTO.

Sweeping of Paved Roads

All areas were documented as being swept during the September 2001 reporting period with the following examples:

9/7 – One treatment was missed in Zone 1 due to operator error;
9/24 – No log was turned in for the 2:30 pm to 10:30 pm; new operator's first day, and,
9/25-9/26 - No log was turned in for the 10:30 pm (9/25) to 6:30 am (9/26), operator called in sick and could not get replacement.

Corrective Action
Chemetco is still evaluating the purchase of a new water truck. As evidenced above, a majority of the missed zones were due to equipment failures.

A meeting with the drivers is scheduled for the week of September 8, 2001.

If you have any questions, please contact me at (618) 254-4381 ext.268.

Sincerely,

Heather Young, CHMM
Environmental Manager
Chemetco

Cc: Sarah Phelps, IEPA Collinsville Field Office
Jeff Trevino, USEPA, Region 5
Kim Fock, Chemetco

FUGITIVE DUST PLAN &
MONTHLY REPORTS

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF ILLINOIS

UNITED STATES OF AMERICA,

Plaintiff, CIV. NO. 93-482-WDS

v. Judge Stiehl

CHEMETCO, INC.,

Defendant.
_____/

CONSENT DECREE

APPENDIX D

(CPMMS PROTOCOL)

CONTINUOUS PARTICULATE MASS MONITOR SYSTEM PROTOCOL (FOR CONSENT DECREE IN U.S. v. CHEMETCO, INC., NO. 93-482-WDS, S.D. ILL)

I. Purpose

U.S. EPA and Chemetco agree that the Chemetco shall procure, install, calibrate, operate, and maintain a Continuous Particulate Mass Monitoring System ("CPMMS") on each of the emission points (stacks) serving the Furnaces and their air pollution control devices to:

A. Provide Chemetco with near real time, particulate mass emissions rate data for improving operation and maintenance of the Furnaces and the associated air pollution control devices and thereby minimizing particulate and lead emissions at all times;

B. Provide U.S. EPA and Chemetco with continuous particulate mass emissions information in the units of the applicable Illinois emissions standard and thereby minimize their reliance upon surrogate measurements, like opacity and pressure drop across control devices, for monitoring compliance with the Furnaces' particulate emissions rate;

C. Minimize the number of stack tests that would be required, by the Consent Decree to which this Protocol is appended ("Consent Decree"), for determining 'continuous compliance' with the Furnaces' particulate emissions rate and for potentially eliminating the need for stack tests after the certification of the CPMMSs and through the life of the Consent Decree;

D. Provide an agreed source of credible evidence for demonstrating 'continuous compliance' with the particulate emission limits;

E. Demonstrate the utility of a CPMMS for monitoring a secondary copper smelter's furnace emissions.

II. Monitoring Equipment

A. The CPMMS shall be comprised of a continuous particulate mass monitor ("Mass Monitor") measuring particulate matter concentration on an hourly basis and a monitoring device or system ("Flow Monitor") for measuring the exhaust gas flow on an hourly basis. Chemetco shall provide a means of computing and recording the values of the particulate emission rate in pounds per hour from the Mass Monitor hourly mass concentration values and the Flow Monitor hourly values. Chemetco shall also provide a means of computing and recording the allowable particulate emission rate on an hourly basis for each "Process Emission Unit" using the equations in Illinois Administrative Code Title 35, §212.321 and §212.322 and information on the Furnace charges from the Raw Materials Management System.

III. Process Emission Units

A. CPMMSs shall be installed to monitor continuously the particulate mass emissions rate from the Process Emission Units - Furnaces No. 1 and 3 discharging through Stacks No. 1 and 3, and Furnaces No. 2 and 4 discharging through Stacks No. 2 and 4.

B. Furnaces No. 1 and 3, as a Process Emission Unit, shall be subject to a process weight rate emission limitation pursuant to Illinois Administrative Code Title 35, §212.322. For each hour of operation of the Process Emission Unit, Chemetco shall compute and record the allowable particulate emission limit and shall combine the CPMMSs' measured emissions from each stack to provide, in pounds per hour, the particulate matter emission rate.

C. Furnaces No. 2 and 4, as a Process Emission Unit, shall be subject to a process weight rate emission limitation pursuant to Illinois Administrative Code Title 35, §212.321.For each hour of operation of the Process Emission Unit, Chemetco shall compute and record the allowable particulate emission limit and shall combine the CPMMSs' measured emissions from each stack to provide, in pounds per hour, the particulate matter emission rate.

IV. Installation and Certification Schedule

A. Within 60 days following Chemetco's receipt of U.S. EPA's approval of the Continuous Particulate Mass Monitoring Plan required by Paragraph 18 of the Consent Decree, Chemetco shall procure and install a CPPMS on each stack serving Furnaces No. 1 & 3 and on each stack serving Furnaces No. 2 & 4. Chemetco shall install the Mass Monitors pursuant to the installation requirements found in Section 5 of ISO 10155:1995(E); (with the exception that the particulate matter reference measurement method to be used should be Reference Method 5, Appendix A, 40 C.F.R. Part 60 instead of ISO 9096) and shall install the Flow Monitors pursuant to the installation requirements found in Section 1.2.1 of Appendix A, 40 C.F.R. Part 75. If Chemetco chooses to install CPMMSs which require heated bypass duct systems for proper sampling and processing of wet, aerosol-laden exhaust gases, the installation and certification schedule shall be extended an additional 60 days to provide for the design and engineering of those bypass systems.

B. No later than 30 days after Chemetco installs and begins to operate its CPMMS, Chemetco shall conduct and complete tests to demonstrate that the "Mass Monitor" conforms to the performance characteristics and test specifications found in the international standard for the automated monitoring of the mass concentration of particulate matter in stationary source gas streams, ISO 10155:1995(E);

C. No later than 30 days after Chemetco installs and begins to operate its CPMMS, Chemetco shall conduct and complete tests to demonstrate that the installed "Flow Monitor" conforms to the performance characteristics and test specifications found in the 40 C.F.R. Part 75 Appendix A, Sections 2.1.4, 2.2.2, 6.3.2, 6.5.2, 6.5.8, 6.5.9, 6.5.10, 7.2.2 and 7.3

D. From the date of installation and operation of the CPMMS to no later than 210 days after entry of the Consent Decree, Chemetco's combined emissions from Furnaces 1 & 3 discharged through stacks 1 & 3 shall comply with an interim particulate matter emission rate of 32.00 pounds per hour and Chemetco's combined emissions from Furnaces 2 & 4 discharged through stacks 2 & 4 shall comply with an interim particulate matter emission rate of 13.00 pounds per hour.

V. Certification

A. Chemetco shall test each CPMMS to demonstrate conformance with the certification requirements;

B. Chemetco shall test the Mass Monitor in each CPMMS to demonstrate conformance with the Response Time, Zero Drift, Span, Span Drift and Calibration specifications found in be Section 6 of ISO 10155:1995(E); using the test procedures in Section 7;

C. During the Mass Monitor Calibration test, Chemetco shall acquire at least nine sets of particulate concentration measurements for each CPMMS (each set a minimum of one hour duration). The Chemetco shall arrange for acquisition of at least three sets of such data reflecting a combination of Furnace Modes within a Process Emission Unit that are associated with low emission rates, at least three sets of data reflecting a combination of Furnace Modes within a Process Emission Unit associated with intermediate emission rates, and at least three sets of data reflecting a combination of Furnace Modes within a Process Emission Unit associated with high emission rates.

D. Chemetco shall test the Flow Monitor in each CPMMS to demonstrate conformance with the Calibration Error specification - less than or equal to 3.0 percent of span - using the test procedures in Sections 6.3.2 and 7.2.2 of 40 C.F.R. Part 75 Appendix A; the span of the Flow Monitor shall be 125 percent of either the maximum potential velocity or maximum potential flow (scfh -wet basis) in the monitored stack;

E. Chemetco shall test the Flow Monitor in each CPMMS to demonstrate conformance with the Relative Accuracy specification - 15 percent - using the test procedures in Sections 6.5.2, 6.5.4, 6.5.8, 6.5.9 and 6.5.10.

VI. Quality Control

A. Chemetco shall perform on the Flow Monitor a daily calibration error test and an interference check (40 C.F.R. Part 75, Appendix A, Sections 2.2.2.1 and 2.2.2.2, respectively). The Chemetco shall perform on the Mass Monitor a daily Zero and Span Drift Check (ISO 10155:1995(E) Section 7.3.3). Corrective actions or adjustments are required on the monitors if calibration error or drift values or accumulated automatic adjustments exceed 6 percent of the

span or interference is detected.

VII. Record Keeping & Reporting

A. Within 30 days following completion of certification tests required by Paragraph 18.c. of the Consent Decree, Chemetco shall report to U.S. EPA, in accord with provisions in the Consent Decree, test results and supporting data on the certification of each of the continuous particulate mass monitoring systems.

B. Chemetco shall maintain in an electronic database records of its process weight (furnace charge) in tons per hour, the Process Emission Unit's allowable emission rate in pounds per hour, each Mass Monitor's hourly values, each Flow Monitor's hourly value, each CPMMS emission rate in pounds per hour, the Process Emission Unit's emission rate in pounds per hour, and the percentage of lead in the charge. Those records should be available for review and inspection by U.S. EPA and IEPA.

C. Chemetco shall compute and store the allowable emission rates for Furnaces No. 1 & 3 using the equation $E = C + A(P)^B$.

E = allowable emission rate in pounds per hour.
C = 0 for process weight rates up to 30 tons per hour or -40 for process rates in excess of 30 tons per hour.
A = 4.10 for process weight rates up to 30 tons per hour or 55.0 tons per hour for process weight rates in excess of 30 tons per hour.
^{B} = 0.67 for process weight rates up to 30 tons per hour or 0.11 tons per hour for process weight rates in excess of 30 tons per hour.
P = process weight rate in tons per hour.

D. Subject to the provisions of Paragraph 14.a. of the Consent Decree, Chemetco shall compute and store the allowable emission rates for Furnaces No. 2 & 4 using the equation $E = A(P)^B$.

E = allowable emission rate in pounds per hour.
A = 2.54 for process weight rates up to 450 tons per hour or 24.8 tons per hour for process weight rates in excess of 450 tons per hour.
^{B} = 0.534 for process weight rates up to 450 tons per hour or 0.16 tons per hour for process weight rates in excess of 450 tons per hour.
P = process weight rate in tons per hour.

E. No later than 30 days after the end of a calendar quarter, starting with the calendar quarter containing the certification of the CPMMS, Chemetco shall submit to U.S. EPA a report for the calendar quarter of all one hour periods of particulate emissions rates (pounds per hour) for each Process Emission Unit that were in excess of the limits established in Illinois Administrative Code Title 35, §212.321 or §212.322. The report shall include: date, time, magnitude of

particulate emission rate, the corresponding allowable emission rate, statements on the probable cause of the excess emissions, statements on any corrective action taken, claims for exemptions, and information on any periods of non-operation or malfunction of the CPMMS. The report should contain a signed statement certifying that "the information contained in the report is true, accurate, and complete." If there were no emission rates in excess of the allowable emission limits for the whole calendar quarter, Chemetco should report that fact.

VIII. Facility Changes

If during the duration of the Consent Decree, Chemetco materially changes the pollution control devices at its facility, Chemetco shall adjust, recalibrate, or recertify its CPMMS or install additional monitoring equipment if necessary, to accomplish the continuous mass monitoring requirements of this Decree.

NPN ENVIRONMENTAL

RECEIVED

MAR 15 2000

AIR ENFORCEMENT BRANCH,
U. S. EPA, REGION 5

March 10, 2000
Contract C-00005

Mr. Nhien Pham
U.S. EPA Region V
AE-17J
77 W. Jackson Blvd.
Chicago, IL 60604-3507

Re: Project Status Report
Chemetco Consent Decree No. 93-482-WDS

Nhien:

As per our discussion, NPN Environmental Engineers, Inc. (NPN Environmental) is submitting the attached Project Status Report on behalf of Chemetco regarding the above referenced Consent Decree. NPN Environmental has been contracted by the Electric Power Research Institute (EPRI) to provide professional environmental engineering services for compliance activities associated with this Consent Decree at Chemetco's secondary smelting facility located in Hartford, Illinois.

This EPRI contract has been funded jointly by Illinois Power and Chemetco. The added value of this contract is the vast resources brought to the project team through EPRI's database of past research and investigation in air pollution control. This ultimately provides Chemetco with a viable solution to meet the requirements of the Consent Decree. Additionally, NPN Environmental through EPRI provides an independent third party approach to the compliance requirement of the Consent Decree.

I will continue to provide you with project status reports at significant and timely stages of this project. If you have any questions, please contact me at 636-343-1300.

Sincerely,

Nicolaus P. Neumann, P.E., R.G., DEE
Project Principal

Attachment

CC: Kim Fock (Chemetco) w/o Attachment
George von Stamwitz (Armstrong Teasdale) w/o Attachment

927 Horan Drive • St. Louis, MO 63026 • (636) 343-1300 • FAX (636) 343-8192 • www.npnenv.com

PARTICULATE CEM EVALUATION FORM

Manufacturer: Verewa
Kollaustrasse 105
D-22453 Hamburg, Germany

Phone: 49 40/55 42 18-0
Fax: 49 40/58 41 54
Web Address: www.verewa@durag.de

Contact(s):

Model: F-107

Units in operation (U.S.): 0 (hundreds in Germany)

Closest sales/service representative:
A.A. Hanson & Assoc.
30W260 Butterfield Rd. Suite 208
Warrenville, IL 60555

Phone:630-393-6600
Fax:630-393-2766
Web Address:

Contact(s): Jeff Hanson

Description of theory of analysis. Beta absorption.

Description of operation, required routine maintenance, and installation requirements: Continuously extracts sample for tape absorption analysis. C-14 source is safe, stable, and can be operated without license. Moving parts require inspection and replacement depending on sample atmosphere.

Known Interferences: Changes in process over time. Heavy PM loading.

Notable features, report format, storage format: Auto-purge works online. PLC compatible with RS-232 output. No on-site calibration; calibration is done at factory based on expected stack gas and process parameters.

Manufacturer contact discussion: Unit is essentially a first generation model of the Durag F-904 and F-904-K units. Durag recommends the F-904-K over both of the other types for continuous monitoring.

Owner/User contact discussion: None

Relative Cost: High – approx. $30K per unit.

Project Status Report

Chemetco Air Pollution Control Evaluation

DATE: March 2, 2000

TO: Kim Fock (Chemetco)

FROM: Joe Darmody (NPN Environmental)

RE: Project Status Report #1

FILE: Contract C-00005

DISTRIBUTION:
Greg Cotter (Chemetco)
Mike Wilkening (Chemetco)
George von Stamwitz (Armstrong Teasdale)
Ray Ehrhard (EPRI)
Nic Neumann (NPN Environmental)
Brian Gregory (NPN Environmental)
Jay Turner (Washington University)

Background

NPN Environmental Engineers, Inc. (NPN Environmental) has entered into a service agreement with the Electric Power Research Institute (EPRI) to provide professional environmental engineering and testing services at Chemetco's secondary smelting facility in Hartford, Illinois. This service agreement with EPRI is funded jointly by Illinois Power and Chemetco.

Scope of Work

The scope of the project (developed by NPN Environmental, Chemetco, and EPRI) was based primarily on portions of a Consent Decree (No. 93-482-WDS) entered into by Chemetco and the United States Environmental Protection Agency (USEPA) signed into effect on January 4, 2000. Specifically, the scope of work developed and currently being implemented addresses:

1. Issues regarding USEPA's request for Chemetco to research the applicability and practicality of installing and successfully operating a

Continuous Particulate Mass Monitoring System (CPMMS) on the exhaust stacks for the four furnaces; and

2. Baseline source testing to verify operation of the CPMMS system, validate an established calibration curve of the CPMMS once installed, and establish baseline operating ranges for pollution control devices.

USEPA's goal for the facility is to establish a credible emissions monitoring system for the purpose of continuously demonstrating compliance with applicable particulate emission limitations (in particular, Illinois' Process Weight Rule), as well as reduce the number of required source tests the facility must perform that would be otherwise necessary for determining "continuous compliance."

The scope of work being performed by NPN Environmental (as referenced in the *Statement of Work* provided to EPRI by NPN Environmental) includes all coordination, research, and testing requirements of the proposed CPMMS system. Specifications, installation, operation, and maintenance of the pollution control devices, CPMMS system, and all other operational equipment and systems are being handled by Chemetco. Sections of the Consent Decree not being addressed as part of this scope of work include any activities regarding the secondary particulate capture system as well as miscellaneous activities Chemetco must address throughout the facility not related to the CPMMS project or source testing of the furnace stacks.

Considering the requirements of the Consent Decree, a scope of work was developed with the following major tasks:

- Task 1 – Project Management/Coordination
- Task 2 – Emissions Characterization
- Task 3 – CPMMS Research/Reporting/Recommendations
- Task 4 – CPMMS Verification and Baseline Sampling

The first three tasks have begun. The following sections detail the status of the individual tasks as well as the planned and anticipated schedule of additional efforts.

Task 1 – Project Management/Coordination

Regular project coordination meetings and site visits have been and will continue to be conducted by the project team. These meetings and visits are documented by NPN Environmental's Project Manager and this record distributed to EPRI and facility personnel. The meetings have been instrumental in assigning responsibilities for various tasks being performed, gathering facility-specific information, and coordinating future tasks (especially the upcoming emissions testing). Thus far, the active project team consists of the following individuals:

Name	Organization	Responsibility
Ray Ehrhard	EPRI	Project Coordinator
Kim Fock	Chemetco	Facility Coordinator
Greg Cotter	Chemetco	Facility Engineer
Mike Wilkening	Chemetco	Facility Engineer
George von Stamwitz	Armstrong Teasdale	Facility Legal Council
Nic Neumann	NPN Environmental	Project Principal
Joe Darmody	NPN Environmental	Project Manager
Brian Gregory	NPN Environmental	Project Engineer
Jay Turner	Washington University	Project Consultant

Additional project engineers and scientists for NPN Environmental have and will be involved as the project progresses and the emissions characterization begins.

Task 2 – Emissions Characterization

Chemetco is in the process of updating and enhancing the final stage of particulate controls on both furnace sets by replacing existing mist eliminator pads with a bank of chevron filters designed specifically for high efficiency particulate arrestence. Completion of this installation is anticipated to be March 7, 2000. For the purpose of evaluating potential CPMMS technologies and manufacturers, a series of emissions characterizations tests are scheduled to be performed. Pending the facility's successful completion of the filter installation, testing is preliminarily scheduled to commence March 9 and be completed by March 17. The emissions characterization testing will consist of quantifying the following pollutant concentrations and parameters on all four exhaust stacks: particulate matter, nitrogen oxides, sulfur dioxide, hydrogen chloride, chlorine, moisture, dew point, temperature, and volumetric flow rate.

Data generated during this testing will be used to evaluate the applicability of specific CPMMS technologies and manufacturers. Based on the results of the testing, specific recommendations for or against particular CPMMS technologies can be made. If testing proceeds as scheduled, results will be available by March 24 which will provide the necessary data to complete the CPMMS evaluation process and facilitate generation of the initial report to USEPA due May 3, 2000. Delays in the testing schedule could hinder evaluation and subsequently completion of this report by the 120-day deadline.

Task 3 – CPMMS Research/Reporting/Recommendations

The first step in evaluating applicable CPMMS technologies was to identify existing technologies and manufacturers of these systems. *Attachment 1* of this report is a summary form of the various technologies and manufacturers of CPMMS systems initially identified by NPN Environmental and Chemetco. Contact has been made with

all identified manufacturers, and the attached survey forms detail the primary evaluations completed by NPN Environmental. Currently, 12 separate particulate sensing technologies have been identified. For each of these technologies, one or more manufacturers have been contacted. This original screening has identified not only technologies (and specific units) that may be applicable to this project, but equally as important, it has identified units and technologies that are not. Of the initial 12 technologies, 8 remain as viable possibilities for further consideration and possible field testing. In addition to the listed technologies, new technologies and manufacturers are continuously being sought.

Further evaluation of several individual units is in progress. NPN Environmental is awaiting multiple reports of field test data documenting field trials of several units being considered. Abstracts of these reports show the performance of the CPMMS evaluated (relative to Method 5 reference testing) is reasonably accurate within a month of installation and calibration but drift from an established calibration curve over a period of a few months.

From this remaining list of technologies and manufacturers, NPN Environmental and Chemetco hope to identify viable candidates for field trials. Results of the scheduled emissions characterization will aid in evaluation of individual units. Following analysis of the emissions characterization and after exhausting all practical avenues of research into the CPMMS technologies, NPN Environmental and Chemetco will select individual units for initial field testing. As part of the Consent Decree, a formal written report will be submitted to USEPA within 120 days (May 5) documenting a CPMMS Plan for the technologies selected for field trials. A draft Table of Contents for this submittal is being developed by NPN Environmental. Elements of Appendix D of the Consent Decree will specifically be addressed as well as recommendations for the CPMMS installation on the four exhaust stacks at Chemetco.

Task 4 – CPMMS Verification and Baseline Sampling

There has been no project activity regarding this task.

ATTACHMENT 1

CPMMS Evaluation Summary

CPMMS EVALUATION SUMMARY

3/3/00

TECHNOLOGY	MANUFACTURER	MODEL
Acoustic Shock	Jonas, Inc.	Particle Monitor
Beta Absorption	Durag, Inc. Durag, Inc. Verewa	F-904-K D-RX-250 F-107
Carbon 14 Absorption	Durag, Inc.	F-904
Electrodynamic Induction	PCME Andersen	Stackflow 2000
Extractive Scattered Light	SICK, Inc. Sigrist	RM-200 CTNR
Isokinetic Extraction	Air Monitor Corp. Altech Environment USA (AKA:"Emissions SA" and "Environment SA")	CAM Beta 5M
Light Interruption	BHA Group, Inc. BHA Group, Inc. BHA Group, Inc. BHA Group, Inc.	CPM-700 CPM-1000 CPM-2000 CPM-5000
Laser Backscatter	*United Sciences	300L
Light Backscatter	ESC Durag, Inc.	P-5B D-R-300
Optic Intensity	PCME Andersen	SC-600
Photometric Extraction	TSI, Inc. (Dekati)	Dustrak RBD
Triboelectric	Goyen Goyen Goyen	BBD3 EMP3 EMS6

- * NPN personnel conducted a site inspection/owner interview of an installed/operating unit on 2/22/00.

MISCELLANEOUS

According to the manufacturers; the triboelectric and photometric technologies are probably not appropriate for this application.

Sensible Technologies, Inc. only supplies area/ambient monitors.

BHA Group personnel indicated that their Auburn line product is not designed for this application.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Air Monitor Corp.
178 Mine Lake Court
Raleigh, NC 27615-6458

Phone: 919-844-3100
Fax: 919-844-3105
Web Address: www.airmonitor.com

Contact(s): Steve Pegg

Model: CAM- (Flow only no mass PM units.) **Units in operation (U.S.):**

Closest sales/service representative:
Durken Equipment
2383 Chaffee
St. Louis, MO 63146

Phone: 432-2040
Fax:
Web Address:

Contact(s): Ron Tomasella

Description of theory of analysis. Pitot Tube

Description of operation, required routine maintenance, and installation requirements: Continuously measures flow rate from a single "average" sample point. Unit has an auto-purge system and a controller/logger.

Known Interferences: Wet dust. – Heavy PM loading.

Notable features, report format, storage format: Auto-purge works online. PLC compatible with hook-ups and connections. An additional way of cleaning is a port access at the back of the unit using a gun barrel type cleaning rod.

Manufacturer contact discussion: No PM monitoring equipment. This unit is compatible for use with PM monitors which do not have volumetric flow capability.

Owner/User contact discussion: None

Relative Cost: Low – approx. $6k per unit

PARTICULATE CEM EVALUATION FORM

Manufacturer: Altech Environment USA
2623 Kaneville Court
Geneva, IL 60154

Phone: 630-262-4400
Fax: 630-262-6220
Web Address: www.altechusa.com

Contact(s): Mr. Musa Zada

President

Model: Beta 5M

Units in operation (U.S.): 1- (50-100 Worldwide.)

Closest sales/service representative:
SAME

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Isokinetic extraction. Beta ray attenuation.

Description of operation, required routine maintenance, and installation requirements: Tape is used to sample analyze and record concentration on a rolling basis. TPM concentration is calculated based on gravimetric analysis and comparison of beta source results to clean filter analysis prior to sampling. Tape is changed monthly. Unit can be used for any PM makeup. Isokinetic extraction is based at single point pre-chosen.

Known Interferences: None.

Notable features, report format, storage format: Has auto-cal system with PLC format 4-20 ma output and reports as needed. Light source has unlimited life, never needs replacement. PM makeup is not important. Unit is very rugged; same unit has been used at Dupont tests, Ely Lilly tests, a test in France, and the current ORNL tests.

Manufacturer contact discussion: During the Ely Lilly tests, the unit performed to 97% of Method 5 data results. A unit will be installed the week of 3/6/00 at the ORNL site for evaluation. An additional unit will be at the EPRI CEM's conference in San Antonio in May '00.

Owner/User contact discussion: ORNL- Jim Dunn 865-241-3737. 3/1/00 unit will be installed next week.

Relative Cost: High – approx. $50k per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: BHA Group, Inc.
8800 East 63rd Street
Kansas City, MO 64133

Phone: 816-356-8400
Fax: 816-353-1873
Web Address: www.verewa@durag.com

Contact(s): Brian Vancrum
Stephanie Talley (rep for western IL.)

ext. 541

Model: CPM Series units,700,1000,2000,5000 **Units in operation (U.S.):** hundreds

Closest sales/service representative:
SAME

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Light Interruption.

Description of operation, required routine maintenance, and installation requirements: Continuously cleans lens so no build-up or calibration is needed. No moving parts. Annual inspection is recommended. Requires 5 stack diameters of straight flow for sample point.

Known Interferences: Water Droplets.

Notable features, report format, storage format: Auto-purge works online continuously so the lenses are always being cleaned and the light interruption does not decay. PLC compatible with pre-set alarm capability. No on-site calibration; on-site during installation of the unit.

Manufacturer contact discussion: Unit is different from other light based detection systems in that it measures the light interruption rather than the amount of particles moving by the source.

Owner/User contact discussion: None
PER JAY TURNER- 3/2/00- Ken Cushing (Southern Research Institute) Model CPM-5000; Unit used for utility application, owner is pleased with unit performance. Unit can be light-emitting diode or laser based light source. The optics purging system is sound. Ken says that his unit was calibrated in the field over a range of PM loadings. They use a Kurz instrument (hot-wire)for flow-rate data used in an array on the stack cross section and multiplexed through a single source.
BLG:(Past experience with the hot-wire type technology is that it works bet in low moisture environments and does not work well in saturated environments.)

Relative Cost: Med. – approx. $16k per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Durag Incorporated
1970 Christensen Ave.
West St. Paul, MN 55118

Phone: 651-451-1710
Fax: 651-457-7684
Web Address: www.durag.com

Contact(s): Mr. Carl Gohdes

Environmental/Emissions Products Manager

Model: F-904

Units in operation (U.S.):

Closest sales/service representative:
A.A. Hanson & Assoc.
30W260 Butterfield Rd. Suite 208
Warrenville, IL 60555

Phone: 630-393-6600
Fax: 630-393-2766
Web Address:

Contact(s): Jeff Hanson

Description of theory of analysis. Dual Detector Charged Absorption.

Description of operation, required routine maintenance, and installation requirements: Tape is used to continuously analyze and record concentration on a rolling basis. TPM concentration is calculated based beta source results. Tape is changed monthly and sample pump unit is replaced annually. Unit can be used for any PM makeup.

Known Interferences: Changes in process system over time.

Notable features, report format, storage format: Has auto-cal system with PLC format and reports. TPM concentration is on dry-basis and corrected to 68 from stack temperature. PM makeup is not important.

Manufacturer contact discussion: Thinks this unit may work for this application.

Owner/User contact discussion: DOE – Oak Ridge Tosca incinerator- Jim Dunn- 865-241-3737- Unit had trouble with moisture content in stack for period of 7/99-1/00. Since much work on moistrue interference has been fixed unit works O.K..- 3/1/00.

Relative Cost: High – approx. $50k per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Durag Incorporated
1970 Christensen Ave.
West St. Paul, MN 55118

Phone: 651-451-1710
Fax: 651-457-7684
Web Address: www.durag.com

Contact(s): Mr. Carl Gohdes

Environmental/Emissions Products Manager

Model: F-904

Units in operation (U.S.): 2 ("hundreds in Germany")

Closest sales/service representative:
A.A. Hanson & Assoc.
30W260 Butterfield Rd. Suite 208
Warrenville, IL 60555

Phone: 630-393-6600
Fax: 630-393-2766
Web Address:

Contact(s): Jeff Hanson

Description of theory of analysis. Light Scattering

Description of operation, required routine maintenance, and installation requirements: Continuously runs optical scan which analyzes and records on a rolling basis. TPM concentration is calculated based on light absorption similar to an opacity monitor. Optics system must be changed every six months. Unit can be used for any PM makeup.

Known Interferences: Suspended water droplets.

Notable features, report format, storage format: Has auto-cal system with PLC format and reports. TPM concentration is on dry-basis and corrected to 68 from stack temperature. System is very mobile; has virtually no moving parts. TPM makeup is not important. Thinks this unit may work for this application.

Manufacturer contact discussion: Thinks this unit may work for this application.

Owner/User contact discussion: None

Relative Cost: Med. – approx. $15K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Durag Incorporated
1970 Christensen Ave.
West St. Paul, MN 55118

Phone: 651-451-1710
Fax: 651-457-7684
Web Address: www.durag.com

Contact(s): Mr. Carl Gohdes

Environmental/Emissions Products Manager

Model: F-904-K

Units in operation (U.S.):

Closest sales/service representative:
A.A. Hanson & Assoc.
30W260 Butterfield Rd. Suite 208
Warrenville, IL 60555

Phone: 630-393-6600
Fax: 630-393-2766
Web Address:

Contact(s): Jeff Hanson

Description of theory of analysis. Single Detector Charged Absorption.

Description of operation, required routine maintenance, and installation requirements: Tape is used to continuously analyze and record concentration on a rolling basis. TPM concentration is calculated based beta source results. Tape is changed monthly and sample pump unit is replaced annually. Unit can be used for any PM makeup.

Known Interferences: Changes in process system over time.

Notable features, report format, storage format: Has auto-cal system with PLC format and reports. TPM concentration is on dry-basis and corrected to 68 from stack temperature. PM makeup is not important.

Manufacturer contact discussion: Thinks the F-904 would work better for this application.

Owner/User contact discussion: None

Relative Cost: High – approx. $50k per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Durag Incorporated
1970 Christensen Ave.
West St. Paul, MN 55118

Phone: 651-451-1710
Fax: 651-457-7684
Web Address: www.durag.com

Contact(s): Mr. Carl Gohdes

Environmental/Emissions Products Manager

Model: D-RX-250

Units in operation (U.S.): "dozens"

Closest sales/service representative:
A.A. Hanson & Assoc.
30W260 Butterfield Rd. Suite 208
Warrenville, IL 60555

Phone: 630-393-6600
Fax: 630-393-2766
Web Address:

Contact(s): Jeff Hanson

Description of theory of analysis. Triboelectric Tape

Description of operation, required routine maintenance, and installation requirements: Continuously runs tape which absorbs tpm and analyzes via a beta source on a rolling basis. TPM concentration is calculated based on beta source results. Tape must be changed monthly and a manual calibration performed.

Known Interferences: Requires steady-state operation in regards to stack parameters.

Notable features, report format, storage format: Does Not have an auto-cal system, must be calibrated manually. TPM concentration is on dry-basis and corrected to 68 from stack temperature.

Manufacturer contact discussion: Tough to calibrate for plant personnel. Does not recommend this unit for our application.

Owner/User contact discussion: None

Relative Cost: Low – approx. $5K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Environmental Systems Corp.
200 Tech Center Drive
Knoxville, TN 37912

Phone: 423-688-7900
Fax: 423-687-8977
Web Address: www.envirosys.com

Contact(s): Tom Carlson - VP
Bob Nusplinger

Steve Drevik

Model: P-5B

Units in operation (U.S.): 1 – 2 dozen (dozens are in Korea)

Closest sales/service representative:
SAME AS ABOVE

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Light source backscatter.

Description of operation, required routine maintenance, and installation requirements: Similar operation to opacity monitor. Depending on PM loading, the filters and blowers need to be checked not more than quarterly. Unit needs only one port for installation.

Known Interferences: Water droplets. Gas stream characteristics need to be steady.

Notable features, report format, storage format: Auto cal. Report format can be in any form. Blower is only moving part.

Manufacturer contact discussion: Manufacturer has specific experience in dealing with IEPA reporting formats and requirements. Thinks unit can be used for this application if there are no water droplets at measuring point.

Owner/User contact discussion: None

Relative Cost: Med. – approx. $13K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Goyen Valve Corp.
25327 Avenue Stanford
Valencia, CA 91355

Phone: 661-257-0566
Fax: 661-257-8990
Web Address: www.goyenvalve.com

Contact(s): Odette Alsen
Harry Daggett- 2/11/00

odette_alsen@southcorp-usa.com
Product Manager

Model: BBD3,EMP3,EMS6,EMP5,EMS4

Units in operation (U.S.): thousands

Closest sales/service representative:
SAME AS ABOVE

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Triboelectric detectors (all)

Description of operation, required routine maintenance, and installation requirements: Laser uses one-way scan to determine PM concentrations. Only one port is needed. Unit calibration curve is determined via zero determination. There is no scheduled maintenance required (unit has no moving parts). This unit is used just for broken bag/filter detection.

Known Interferences: Water droplets.

Notable features, report format, storage format: Solid state; no moving parts. Virtually any output can be used with PLC compatible data/communication system.

2/11/00- Mr. Daggett indictaed that the monitor can be added to obtain flowrates. Also that a two point zero-span curve can be programmed for M5 comparison. The unit cannot generate stand alone pm emissions.

Manufacturer contact discussion: Units essentially only detect changes in PM loading. These units would probably not work for PM emission monitoring.

Owner/User contact discussion: None

Relative Cost: Low – approx. $8K per unit. OR LESS

PARTICULATE CEM EVALUATION FORM

Manufacturer: Jonas Incorporated
113 Faun Rd.
Wilmington, DE 19803

Phone: 302-478-1375
Fax: 302-478-8173
Web Address:

Contact(s): Lee Machmemer

E-mail – jonasinc@mindspring.com

Model: Particle Monitor

Units in operation (U.S.): 10

Closest sales/service representative:
SAME AS ABOVE

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Acoustic Shock

Description of operation, required routine maintenance, and installation requirements: Continuously monitors acoustic impact(s) on probe at an average velocity point. No moving parts. Unit is calibrated using a wave-guide curve according to impact intensity. Material for each probe is selected based on each installation's gas characteristics.

Known Interferences: Water droplets.

Notable features, report format, storage format: PLC compatible with pre-set alarm capability. No on-site calibration; on-site during installation of the unit. Four units can use central computer for data collections/storage/reporting.

Manufacturer contact discussion: Unit can be used at any temperature, any PM loading, with any variation in stack parameters. Manufacturer will conduct a 5-day feasibility study for $9,500 plus T&L or a non-limited study for $9,500 plus $2,800/week.

Owner/User contact discussion: None

Relative Cost: High – approx. $28K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: PCME Andersen
500 Technology Court
Smyrna, GA 30082

Phone: 800-241-6898
Fax: 770-319-0336
Web Address: www.pcmeinc.com

Contact(s): Bruce Kemp

Model: SC-600

Units in operation (U.S.): 1 – (dozens in UK)

Closest sales/service representative:
SAME

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Optic intensity

Description of operation, required routine maintenance, and installation requirements: Opacity type single light source determines changes in intensity versus calibrated intensity. Has auto cal. Maintenance consists of cleaning lenses as needed.

Known Interferences: Water droplets.

Notable features, report format, storage format: Uses stand-alone logger with windows based software to store and report. Can be downloaded to PLC controls.

Manufacturer contact discussion: Operation, maintenance, and performance is similar to opacity monitor.

Owner/User contact discussion: None

Relative Cost: Low – approx. $10K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: PCME Andersen
500 Technology Court
Smyrna, GA 30082

Phone: 800-241-6898
Fax: 770-319-0336
Web Address: www.pcmeinc.com

Contact(s): Bruce Kemp

Model: Stackflow 2000 (variation)

Units in operation (U.S.): 1 – (new application)

Closest sales/service representative:
SAME

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Electrodynamic "charged" Technology

Description of operation, required routine maintenance, and installation requirements: Interactions between charged particles and induction rod rejects DC current derived from collisions while measuring using AC current. The probes are coated with an appropriate material to reduce corrosion/buildup/condensation, etc. Maintenance consists of cleaning probes as needed with IPA and reinstalling. Unit is a dual probe device but can be installed in a large sample port.

Known Interferences: Particle buildup from "sticky" stack gas. Water droplets.

Notable features, report format, storage format: Uses stand-alone logger with windows based software to store and report. Can be downloaded to PLC controls.

Manufacturer contact discussion: Better than triboelectric in most cases. Variations in PM loading do not effect as long as probe is kept clean.

Owner/User contact discussion: None

Relative Cost: Med. – approx. $15K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Sensible Technologies, Inc.
1656 Townhurst, Suite F
Houston, TX. 77043

Phone: 888-722-8287
Fax: 713-722-8577
Web Address: www.sensibletechnologies.com

Contact(s): Jim McCabe

President

Model: None

Units in operation (U.S.):

Closest sales/service representative:
Same

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Various; does not manufacture at component level.

Description of operation, required routine maintenance, and installation requirements: Expertise is in area/fence line/ambient/ and meteorological monitoring. Does not list any source monitoring capability.

Known Interferences: Temperature above 110 degrees F. Acids/bases/heavy PM, etc.

Notable features, report format, storage format: Reporting is routinely done for regulatory compliance and is 100% automated.

Manufacturer contact discussion: Has no in-situ stack monitoring experience for continuous operation.

Owner/User contact discussion:

Relative Cost: Low less than $5K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: SICK Inc.
6900 West 110th Street
Bloomington, MN 55438

Phone: 612-941-6780
Fax: 612-941-9287
Web Address: www.sickoptic.com

Contact(s):

Model: RM-200

Units in operation (U.S.): Dozens

Closest sales/service representative:
MEMCO Sales & Service Corp.
7250 N. Cicero Ave Suite LL1
Lincolnwood, IL 60646-7627

Phone: 847-329-9393
Fax: 847-329-9397
Web Address:

Contact(s): George Folds
Don Jenkinson

Description of theory of analysis. Heated extraction with optic flowrate.

Description of operation, required routine maintenance, and installation requirements: Single port mounted instrument. Portion of gas stream is extracted (heated) and analyzed. An optic flow monitor is used in combination with the extractive system. The extracted portion of the sample is analyzed via scattered light method in a heated chamber. Unit uses single point extraction. Unit has several moving parts so general maintenance is conducted quarterly or semi-annually.

Known Interferences: Aerosols. (Water droplets do not effect performance due to the extractive design.)

Notable features, report format, storage format: PLC compatible data storage and report capability. As a general rule; the maximum stack temperature should be 230 degrees F.

Manufacturer contact discussion: Extraction eliminates water droplet problem. Between the PM and the flow units there is more on-site panel/sample equipment than with other units.

Owner/User contact discussion: None

Relative Cost: Med. – approx. $20K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Sigrist-Photometer AG
Hofurlistrasse 1
CH-6373 Ennetburgen, Switzerland

Phone: 41 41 620 50 64
Fax: 41 41 620 41 80
Web Address: www.photometer.com

Contact(s):

Model: CTNR

Units in operation (U.S.): 2

Closest sales/service representative:
Peak Process Controls, Inc.
39 Brownsville Court
P.O. Box 26
Schomberg, Ontario Canada

Phone: 905-939-0555
Fax: 905-939-0550
Web Address:

Contact(s): T.J. Medland

Description of theory of analysis. Extractive Light Scatter

Description of operation, required routine maintenance, and installation requirements: A heated sample is extracted and analyzed via light scatter. The light source must be replaced bi-annually. Set-up requires typical stack diameter requirements.

Known Interferences: None

Notable features, report format, storage format: Works best on wet stacks. PLC compatible outputs. Computer based report system.

Manufacturer contact discussion: 4 units can be used with one central computer for data acquisition and reporting. RS-422 or 4-20mA outputs available.

Owner/User contact discussion: Eli Lilly-Lafayette, IN
One unit is currently being evaluated at the TOSCA ORNL site test. Jim Dunn 865-241-3737- 3/1/00- Indicated that the unit has worked well for a period of 8 months. The light source was replaced once. "has chugged along good" other than that.

Relative Cost: High – approx. $60K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Spectrum Systems, Inc.

Phone: 850-944-3392
Fax:
Web Address: www.specsys.com

Contact(s): H. Gordon Jones

President

Model: None

Units in operation (U.S.):

Closest sales/service representative:
Same

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Various; does not manufacture at component level.

Description of operation, required routine maintenance, and installation requirements: Expertise is in Opacity,Sox,Nox,CO,CO2,O2, and THC CEM's systems. Also has volumetric flowmeters which are used for stack monitoring. NO particulate CEM's currently.

Known Interferences:

Notable features, report format, storage format: Reporting is routinely done for regulatory compliance and is 100% automated.
Company also provides CEM certification and RATA testing services.

Manufacturer contact discussion:

Owner/User contact discussion:

Relative Cost: Medium approx. $20K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: TSI Inc. (Dekati Brand)
500 Cardigan Road
P.O. Box 64394
St. Paul, MN 55164

Phone: 888-483-4712
Fax: 41 41 620 41 80

Web Address: www.dekati.fi/dekati/distributors.html

Contact(s): Roger Williams

Model: Dustrak RBD

Units in operation (U.S.): hundreds

Closest sales/service representative:
SAME

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Photometric HEPA filter

Description of operation, required routine maintenance, and installation requirements: Mobile unit primarily used for area or ambient applications. Unit must be cleaned regularly during field use. The HEPA filter is analyzed via photometric scan and a PM concentration is calculated. An additional flow monitor would need to be added to determine mass emissions. Dekati Does Not supply this flow unit.

Known Interferences: CANNOT OPERATE IN TEMPERATURES ABOVE 140 F. Any oxides from combustion will effect performance.

Notable features, report format, storage format: Has analog data storage and collection system. Records on-line continuously.

Manufacturer contact discussion: Does not recommend these units or this technology for stack applications of any kind.

Owner/User contact discussion: None

Relative Cost: Very Low –$3,300 per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: United Sciences-Monitor Labs Inc.
76 Inverness Drive East
Englewood, CO 80112

Phone: 800-422-1499
Fax: 303-792-7870
Web Address: www.monitorlabs.com

Contact(s): Gary Siver
Ernie Letterman

816-524-2600

Model: 300L

Units in operation (U.S.): approx. 2,000

Closest sales/service representative:
Inquest
Columbia, MO

Phone: 573-443-8052
Fax:
Web Address:

Contact(s): John Kunkel

Description of theory of analysis. Ruby Laser backscatter

Description of operation, required routine maintenance, and installation requirements: Laser uses one-way scan to determine PM concentrations. Unit calibration curve is determined via M5 or M17. There is no scheduled maintenance required (unit has no moving parts). This unit is used just for TPM.

Known Interferences: Water droplets.

Notable features, report format, storage format: Solid state light diode; no moving parts. No bounce-back signal is required. Zero drift is approximately 2% over time. On-site calibration is similar to opacity monitor cal. 4-20 Ma output with PLC compatible data/communication system.

Manufacturer contact discussion: Unit works best in atmosphere where PM concentrations change or are cyclic in nature.

Owner/User contact discussion: 2/22/00- Conducted site visit of installed unit at a chemical manufacturing facility which uses the unit for process control via monitoring PM concentration continuously via hook-up to the plant PLC system.
The unit uses one port on the stack and is relatively small (12 in. X 8 in.) with the cover cabinet and blowback assembly being approx. 3 feet tall and 2 feet square. The sample length is 5 feet. The unit is easy to calibrate with a supplied cal prism. Calibration time takes less than 1 hour. The plant does not have a set calibration frequency and they do not feel they need one due to the consistent operation of the unit. The unit has been installed in an extremely acidic and harsh environment for two years without ANY maintenance requirements or down time due to parts failure.
Noted problems: "once in a while" due to process upsets; the sample tube blowback system cannot keep up with loading and the unit needs to be manually blown clean.
Owner Comments: Unit works great and requires little if any maintenance. No failures. Unit was installed in an existing 4 inch flange port. Uses PLC compatible 4-20 ma output.
NPN Comments: The unit is much smaller than the usual CEM monitor. The environment in which this unit operates is much harsher than the environment in the Chemetco stacks. This stack is a high moisture stack much like the Chemetco stacks.

Relative Cost: Med. – approx. $20K per unit.

CONTINUOUS PARTICULATE MASS MONITORING PLAN CHEMETCO, INC.

Prepared for:

MR. NHIEN PHAM
USEPA – REGION V
AE-17J
77 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604-3507

Prepared by:

CHEMETCO, INC.
3576 CHEMETCO LANE
HARTFORD, ILLINOIS 62048

and

NPN ENVIRONMENTAL ENGINEERS, INC.
927 HORAN DRIVE
ST. LOUIS, MISSOURI 63026

May 2000
Project C-00005.C

May 2, 2000
Contract C-00005.C

RECEIVED
MAY 03 2000
AIR ENFORCEMENT BRANCH,
U. S. EPA, REGION 5

Mr. Nhien Pham
US Environmental Protection Agency
Region 5
77 West Jackson Boulevard (AE-17J)
Chicago, IL 60604-3590

RE: Chemetco, Inc.
Hartford, IL
Consent Decree No. 93-482-WDS

Mr. Pham:

On behalf of Chemetco, Inc., NPN Environmental Engineers, Inc. is submitting the enclosed ***Continuous Particulate Mass Monitoring Plan*** in compliance with the requirements of Consent Decree No. 93-482-WDS.

If you have any questions, please contact Joe Darmody or me at 636-343-1300.

Sincerely,

Nicolaus P. Neumann, P.E., R.G., DEE
Project Principal

c: Mr. Greg Sukys (US Department of Justice)
Mr. Jeffrey Trevino (USEPA)
Mr. Kim Fock (Chemetco)
Mr. Greg Cotter (Chemetco)
Mr. Mike Wilkening (Chemetco)
Mr. George von Stamwitz (Armstrong Teasdale)
Mr. Jeff Benbeneck (Illinois EPA-Collinsville)
Mr. Jay Turner (Washington University)
Mr. Ray Ehrhard (EPRI)

927 Horan Drive • St. Louis, MO 63026 • (636) 343-1300 • FAX (636) 343-8192 • www.npnenv.com

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FIGURE

Figure 1	CPMMS Recommendations Decision Tree	

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APPENDIXES

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Appendix D	Vendor Quotations
Appendix E	Installation and Certification Protocol
Appendix F	Recordkeeping and Reporting Requirements

INTRODUCTION

NPN Environmental Engineers, Inc. (NPN Environmental) has entered into a service agreement with Electric Power Research Institute (EPRI) to provide professional environmental engineering and testing services at Chemetco Inc.'s (Chemetco) secondary smelting facility in Hartford, Illinois. This service agreement with EPRI is funded jointly by Illinois Power and Chemetco.

The scope of the project (developed by NPN Environmental, Chemetco, and EPRI) was based primarily on portions of Consent Decree No. 93-482-WDS entered into by Chemetco and the United States Environmental Protection Agency (USEPA) signed into effect on January 4, 2000. Specifically, the scope of work developed and currently being implemented addresses:

1. Issues regarding USEPA's request for Chemetco to research the applicability and practicality of installing and successfully operating a Continuous Particulate Mass Monitoring System (CPMMS) on the exhaust stacks for the four furnaces; and

2. Baseline source testing to verify operation of the CPMMS system, validate an established calibration curve of the CPMMS once installed, and establish baseline operating ranges for pollution control devices.

USEPA's goal for the facility is to research and establish a credible emissions monitoring system for the purpose of continuously demonstrating compliance with applicable particulate emission limitations (in particular, Illinois' Process Weight Rule), as well as reduce the number of required source tests the facility must perform that would otherwise be necessary for determining "continuous compliance."

The scope of work being performed by NPN Environmental (as referenced in the *Statement of Work* provided to EPRI by NPN Environmental) includes all coordination, research, and testing requirements of the proposed CPMMS system. Specifications, installation, operation, and maintenance of the pollution control devices, CPMMS system, and all other operational equipment and systems are being handled by Chemetco. Sections of the Consent Decree not being addressed as part of this scope of work include any activities regarding the secondary particulate capture system as well as miscellaneous activities Chemetco must address throughout the facility not related to the CPMMS project or source testing of the furnace stacks.

Objectives

EPRI requested NPN Environmental provide environmental consulting and testing service assistance to Chemetco regarding ongoing air pollution control issues associated with secondary metals recovery operations at the Hartford, Illinois site. Pollution control equipment installed in the past did not fully meet the regulatory requirements and

Chemetco is under regulatory scrutiny by both the USEPA and Illinois Environmental Protection Agency (IEPA).

This plan is designed to document the following:

- Consent Decree Compliance Activities
- Evaluation of available CPMMS technology for use in this application
- Recommendations for CPMMS installation

The objective of this effort is to provide expert consultation, research, and testing in support of the development of a successful compliance strategy for Chemetco and includes the following tasks:

Task 1 – Project Management Coordination
Task 2 – Emissions Characterization
Task 3 – CPMMS Research and Recommendations
Task 4 – Mass Monitor Verification Sampling

Task 1 – Project Management Coordination

NPN Environmental is the primary coordinator for all project activities between EPRI and Chemetco in accordance with the regulatory requirements established between Chemetco and USEPA.

Task 2 – Emissions Characterization

NPN Environmental conducted particulate matter testing on the new Chevron Filter Systems to gather design information and determine air stream characterizations for CPMMS specification and evaluation.

Task 3 – CPMMS Research and Recommendations

NPN Environmental conducted extensive research of particulate mass monitoring system alternatives to meet the operational conditions and emission characteristics at Chemetco. This research included Internet searches, manufacturer information and interviews, site visits, and technical review of quotations. This report of findings and recommendations for the CPMMS system represents Chemetco's best effort to comply with the CPMMS Plan mandated in the Consent Decree.

Task 4 – Mass Monitor Verification Sampling

NPN Environmental will conduct initial field testing and verification sampling in accordance with USEPA criteria for the selected mass monitoring system along with documentation of sampling activities.

Project Status

Tasks 2 and 3 are essentially complete. The following sections further detail the status of the individual tasks as well as the planned and anticipated schedule of additional efforts.

Task 1 – Project Management Coordination

Regular project coordination meetings and site visits have been and will continue to be conducted by the project team. These meetings and visits are documented by NPN Environmental's Project Manager and have been instrumental in assigning responsibilities for various tasks being performed, gathering facility-specific information, and coordinating future tasks. The project team consists of the following individuals:

Name	Organization	Responsibility
Kim Fock	Chemetco	Facility Coordinator
Greg Cotter	Chemetco	Facility Engineer
Mike Wilkening	Chemetco	Facility Engineer
George von Stamwitz	Armstrong Teasdale	Facility Legal Counsel
Nic Neumann, P.E.	NPN Environmental	Project Principal
Joe Darmody	NPN Environmental	Project Manager
Brian Gregory	NPN Environmental	Project Engineer
Ray Ehrhard	EPRI	Project Coordinator
Jay Turner, D.Sc.	Washington University	Project Consultant

Task 2 – Emissions Characterization

Chemetco completed the removal of the inoperable rotofilters and mist eliminator filters and installed new Chevron filters as final particulate matter control on both furnace sets the week of March 6, 2000. For the purpose of evaluating potential CPMMS technologies and manufacturers, a series of emissions characterization tests was performed by NPN Environmental the weeks of March 13 and 20, 2000. Characterization testing was completed on March 22, 2000.

At the time emissions characterization testing was conducted, the new particulate control systems had only been in-place for less than one week. Due to the time constraints of this project, testing of the new system was not delayed. Consequently, emissions testing was conducted while several parameters of the new systems were still being optimized. The results of this testing likely indicate a somewhat less than optimal performance of the control systems but were sufficient for emissions characterization purposes.

Emissions characterization testing consisted of quantifying the following pollutant concentrations and parameters on all four exhaust stacks: particulate matter, particle size distribution, nitrogen oxides, sulfur dioxide, hydrogen chloride, chlorine, moisture, dew point, temperature, and volumetric flow rate.

Data generated during this testing was used to evaluate the applicability of specific CPMMS technologies and manufacturers. Based on the results of the testing, additional specific recommendations for or against particular CPMMS technologies and specific units were made.

Task 3 – CPMMS Research and Recommendations

Throughout the course of this project, evaluations of CPMMS technologies have been made based on discussions between project team members and evaluations of vendor information, as well as emission data. Initially, 18 particulate mass monitoring units representing 4 major measurement technologies were identified by means of direct communication with equipment vendors, industry experts, academic experts, as well as reviewing product literature and searching the Internet. A number of CPMMS technologies were eliminated from evaluation with the help of Mr. Jay Turner, D.Sc. (Washington University) due to their obvious inadequacies for the sources at Chemetco. Following this initial screening process, a total of eight individual manufacturers were sent Request for Quotes on behalf of Chemetco. From this remaining list of technologies and manufacturers, NPN Environmental and Chemetco have identified three viable candidates for field trials. Following review of characterization data, a decision was made on which units will likely meet operational criteria for the project. A full technology and systems evaluation is detailed in the **CPMMS Evaluation** section of this report.

Task 4 – Mass Monitor Verification Sampling

There has been no activity regarding this project task.

CPMMS Performance Requirements

Chemetco has agreed to install and operate a CPMMS at its facility. The parties agree that the purpose of such system includes, but is not limited to:

- Providing Chemetco with near real time emissions data for improving operation and maintenance of the furnaces and associated air pollution control devices at the facility
- Providing Chemetco and USEPA with continuous particulate mass emissions information in standard units of measurement, thereby minimizing reliance on surrogate measurements of emissions (such as opacity and pressure drop across control devices) from the facility's emission points (stacks) that have been contested in other cases as not accurately reflecting the existence of particulate limit excursion
- Providing an agreed source of credible evidence for demonstrating continuous compliance with particulate emission limits while

minimizing the number of required stack tests that would otherwise be necessary for determining "continuous compliance"

Essentially, the CPMMS will be comprised of a continuous particulate mass monitor and a flow monitoring device. Chemetco will also provide a means of computing and recording the allowable particulate emission rate on an hourly basis for each "Process Emission Unit" using the equations in Illinois Administrative Code Title 35, §212.321 and §212.322 and information on the furnace charges from the Raw Materials Management System.

CPMMSs shall be installed to continuously monitor the particulate mass emissions rate from the Process Emissions Units – Furnaces 1 and 3 discharging through Stacks 1 and 3 and Furnaces 2 and 4 discharging through Stacks 2 and 4.

Furnaces 1 and 3 (as a Process Emissions Unit), shall be subject to a process weight rate emission limitation pursuant to Illinois Administrative Code Title 35, §212.322. Furnaces 2 and 4 (as a Process Emissions Unit), shall be subject to a process weight rate emission limitation pursuant to Illinois Administrative Code Title 35, §212.321. For each hour of operation of the Process Emissions Unit, Chemetco shall compute and record the allowable particulate emission limit and combine the CPMMS measured emissions from each stack to provide (in pounds per hour) particulate matter emission rate.

DISCUSSION OF AVAILABLE TECHNOLOGIES

Mass monitor techniques for the CPMMS can be classified into four groups based on the measurement principle – acoustic, beta absorption, optical, and triboelectric. Each measurement technique has inherent advantages and disadvantages for particle mass monitoring in general and the Chemetco application in particular. In many cases, the nature and extent of potential implementation issues cannot be fully evaluated for a given instrument from its basic theory of operation and vendor-provided information. Thus, vendors were provided with results from initial stack testing as described in the following section. Details concerning the preliminary technology evaluation and responses to the Request for Quotes are provided in the **CPMMS Evaluation** section.

EMISSIONS CHARACTERIZATION TESTING

The documented testing was conducted within the guidelines of EPA Methods found in 40 CFR Part 60 test methods (for the purpose of quantifying baseline emissions). Testing was conducted March 14 through 22, 2000.

Project participants included Mr. Joe Darmody and Mr. Brian Gregory (NPN Environmental), and Mr. Greg Cotter (Chemetco). Primary coordinators were Mr. Darmody and Mr. Gregory; process and operational data was collected by Mr. Cotter; and facility coordination was performed by Mr. Cotter.

Furnace stacks 1 and 3 were sampled simultaneously on March 21, 2000 to determine the total particulate emissions from the furnace exhaust. Testing was performed using a Method 5 train for two consecutive 96-minute runs. EPA Test Method 5 was utilized to quantify total particulate emissions, volumetric flow, and moisture during each run.

Furnace stacks 2 and 4 were sampled simultaneously on March 22, 2000 to determine the total particulate emissions from the furnace exhaust. Testing was performed using a Method 5 train for two consecutive runs of 96-minutes and 120-minutes. EPA Test Method 5 was utilized to quantify total particulate emissions, volumetric flow, and moisture during each run.

Gaseous emissions testing was performed on March 14-17, 2000 for sulfur dioxide, nitrogen oxides, hydrogen chloride, and chlorine emissions.

Previously installed sample ports were utilized for all sampling at the stack outlets. Each stack exhaust diameter is approximately 4.77 feet. The sampling ports were located approximately two diameters downstream from the stack reduction point.

Particulate Matter Testing

Sampling Methods

The particulate sampling was conducted using the following test methods as set forth in 40 CFR Part 60:

Method 1:	Sample and Velocity Traverses for Stationary Sources
Method 2:	Determination of Stack as Velocity and Volumetric Flow Rate (Type S Pitot Tube)
Method 3:	Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight
Method 4:	Determination of Moisture Content in Stack Gases
Method 5:	Determination of Particulate Emissions from Stationary Sources

Two separate test runs were performed to determine the average total particulate emissions from each stack exhaust during the beginning and end portions of the heat cycles.

Sampling and Analytical Procedures

The isokinetic particulate tests were conducted with standard Method 5 sampling equipment. Method 5 data was collected at each sampling traverse point for the duration of each run. Pre- and post-test leak checks were performed on the Pitot tube and sample train for each sample run.

All parameters required by EPA Method 5 were monitored throughout each of the sample runs. Method 5 data was later used for velocity, flow, and emission rate determination.

Moisture content was determined prior to sample recovery by gravimetric analysis of the impinger catch using an electronic balance having an accuracy of 0.1 grams.

The particulate catch for each run from the nozzle, probe, and filter was quantitatively recovered, rinsed in triplicate and HPLC-grade acetone, and retained in labeled 250 ml amber jars with Teflon-lined lids. The filter was recovered and placed in a labeled petri dish.

Sample analyses performed by NPN Environmental followed Method 5 parameters. Particulate concentrations were determined by gravimetric analysis while particle size distribution data was performed via computer controlled scanning electron microscopy (CCSEM). A copy of the CCSEM results can be found in *Appendix A – Initial Test Data.*

Sampling Results

The results of the particulate testing are present in **Table 1 – Particulate Emissions Data – Peak Charging Conditions** and include particulate concentrations, air velocity, volumetric flow, and moisture content. All calculations, sampling parameters, and actual emissions rates are presented in *Appendix A.*

It is critical to note that all particulate sampling was conducted while individual furnaces were operating at peak charge conditions. Testing was scheduled such that the initial charge of each batch was captured during the course of sampling on each furnace set. By capturing emissions from this peak charging condition for each furnace, the results presented in **Table 1** represent worst-case emissions with respect to the charge of an individual furnace.

TABLE 1
Particulate Emissions Data – Peak Charging Conditions
March 21 – 22, 2000

Stack Location	Run	Date	Temp (°F)	Dew Point (°F)	Moisture (%)	Volumetric Flow (dscfm)	Velocity (ft/min)	Total Particulate Concentration (gr/dscf)
Stack 1	1	3/21/00	174	131	12.5	22,700	1,670	0.07
	2	3/21/00	158	105	5.5	25,400	1,690	0.01
Stack 3	1	3/21/00	144	144	18.1	30,900	2,320	0.05
	2	3/21/00	149	122	8.8	35,400	2,400	0.08
Stack 2	1	3/22/00	125	125	6.7	35,200	2,230	0.53*
	2	3/22/00	141	109	6.0	29,500	1,910	0.02
Stack 4	1	3/22/00	137	85	4.5	45,900	2,900	0.03
	2	3/22/00	144	90	4.1	44,600	2,840	0.01

Particulate size distribution data can be found in Appendix A.
**Material from the fan assembly was dislodged during Run 1 on Stack 2 causing an upset during the test run. The corrective action taken after the test for this occurrence was cleaning of the fan and fan housing material build-up.*

Particulate Emissions Comments

Results of the initial testing (excluding Stack 2, Run 1 upset condition) pass all requirements for process weight rate rule. The new Chevron filter addition (as a dry stage) to the mist eliminator has shown significant improvements in visual opacity on all four stacks.

Since the first series of testing, the water spraying systems have been adjusted and monitored daily to optimize efficiency of the overall systems. Further testing is planned to evaluate the new technology described within this document. This configuration of the particulate control systems has been complete for approximately one week.

Gaseous Emissions Testing

Sampling Methods

The gaseous sampling was conducted using the following test methods as set fourth in 40 CFR Part 60:

Method 1:	Sample and Velocity Traverses for Stationary Sources
Method 2:	Determination of Stack as Velocity and Volumetric Flow Rate (Type S Pitot Tube)
Method 3:	Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight
Method 4:	Determination of Moisture Content in Stack Gases
Method 6C:	Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental analyzer procedure)
Method 7E:	Determination of Oxides of Nitrogen Emissions from Stationary Sources (Instrumental analyzer procedure)
Method 26A:	Emissions from Stationary Sources (Modified for single point testing)

Three separate test runs were performed to determine the average NO_x, SO_x, HCl, Cl_2, emissions and associated stack parameters from each stack exhaust during the beginning, middle, and end portions of the heat cycles. The heat cycle prepared for Stack 4 was sampled on Stack 3 due to operational problems with the Stack 4 fan.

Sampling and Analytical Procedures

The gaseous tests were conducted to further determine the stack gas characteristics used for researching an appropriate CPMMS. Flow data was collected twice at each stack during the duration of each run. Pre- and post-test leak checks were performed on the Pitot tube and sample train for each sample run.

Moisture content was determined prior to sample recovery by gravimetric analysis of the impinger catch using an electronic balance having an accuracy of 0.1 grams.

The HCl and Cl_2 catch for each run was quantitatively recovered, rinsed in triplicate with HPLC-grade water, and retained in labeled 250 ml amber jars with Teflon-lined lids.

Continuous sample analyses were performed by NPN Environmental using the associated data software package. HCl and Cl_2 concentrations were determined by ion chromatography analysis by an USEPA certified laboratory. A copy of the gaseous test results can be found in *Appendix A*.

Sampling Results

Results of baseline gaseous emission testing are presented in **Table 2 – Gaseous Emissions Data** and include NO_x, SO_x, HCl, and Cl_2 emission rates and volumetric flow. All calculations for the sampling parameters and actual emission rates are presented in *Appendix A*.

TABLE 2
Gaseous Emissions Data
March 14-17, 2000

Source	Date	Run	Flowrate (dscfm)	NO_x (lb/hr)	SO_x (lb/hr)	HCl (lb/hr)	Cl_2 (lb/hr)
Stack 1	3/16/00	1	27,529	9.5	0	0.13	0.07
		2	23,117	4.1	0	0.10	0.09
		3	22,208	2.5	0	0.08	0.13
		Avg.	24,284	5.4	0	0.10	0.10
Stack 3	3/15/00	1	33,467	0	0	0.56	0.40
		2	33,697	0	0	0.32	0.24
		3	33,392	1.4	0	0.17	0
		Avg.	33,519	0.46	0	0.35	0.21
Stack 2	3/14/00	1	38,061	4.9	0	0.24	0.12
		2	46,771	2.2	0	0.18	0.07
		3	42,219	0	0	0.24	0.12
		Avg.	42,350	2.4	0	0.22	0.10
Stack 3 (Heat Cycle 4)	3/17/00	1	34,056	6.0	0	0.24	0.15
		2	33,370	2.2	0	0.25	0.22
		3	33,699	4.4	0	0.25	0.20
		Avg.	33,708	4.2	0	0.25	0.19

Gaseous Emissions Comments

Gaseous emissions testing proceeded as expected and showed no significant constituents or characteristics incompatible with the proposed installation of a CPMMS.

CPMMS EVALUATION

Technology Evaluation

Several instruments are commercially available for continuous monitoring of particulate matter mass in ambient and stack gas environments. However, relatively few applications to-date provide performance information directly translatable to Chemetco's secondary smelter facility. For example, coal-fired utility boilers and waste combustors have dry stack gas conditions – up to 15% moisture but no entrained water droplets. The possibility for entrained water droplets is significant for Chemetco's stack gases, and this defines an important performance criteria for continuous monitoring instruments. The research being performed by Chemetco attempts to identify an unproven technology which will provide continuous particulate mass emissions data for a source which has heretofore never been specifically evaluated for this type of monitoring system.

For stack monitoring applications, the instruments can be classified into four groups based on their measurement principle – acoustic, beta absorption, optical, and triboelectric. Each mass monitor has inherent advantages and disadvantages resulting from the underlying measurement technology and as operationalized in a given instrument. However, the major differences largely appear between measurement classes with often subtle differences between various commercial instruments within a given measurement class. This section emphasizes technology evaluation primarily from the perspective of the underlying measurement principles rather than specific features of a certain commercial instrument.

Several factors and issues must be considered when evaluating mass monitors for the Chemetco CPMMS application including, but not limited to, the following:

- Relationship of the measured quantity to particle mass loading in the exhaust gas stream – As previously described, opacity is not an acceptable measurement variable for this CPMMS application. Ideally, the measured property should be directly related to particle mass with relatively little sensitivity to particle size, composition, and morphology.

- Appropriateness of point- or path-integrated measurements within the stack to quantify stack cross-sectional average values – It is not feasible to conduct stack traverses during CPMMS applications; therefore, the monitor method should either provide a point- or path-integrated measurement which correlates with cross-sectional average particle mass concentration, or provide for an array of probes to adequately characterize the cross-section average particle mass concentration.

- *In situ* versus extractive technologies – *In situ* measurement methods generally require less hardware to be mounted on platforms outside the stack and often have fewer moving parts. However, extractive methods

can provide for gas stream conditioning prior to particle mass measurement. This is particularly important for cases where water droplets and/or water vapor might adversely affect an *in situ* measurement.

- Compatibility of measurement technology with the stack gas environmental properties – Interference (especially water droplets and water vapor) is a concern for many measurement methods. Ideally, the monitor method should be free from interference and insensitive to changes in stack gas composition.

- Compatibility of sampling hardware with the stack gas environment – Measurement methods should be free from significant fouling of probes, optical windows, or other problems which would require excessive routine maintenance or instrument calibration.

- Capital investments and operation and maintenance costs should be competitive with the alternative of a sustained stack testing program.

The absolute performance (and in some cases even relative performance) of a given measurement method for each of the above factors cannot be evaluated from the available information. Thus, it is important to use engineering judgement and a weight of evidence approach for evaluating available technologies.

The four main technologies for stack gas mass monitors are based on acoustic, beta absorption, optical, and triboelectric principles. Each of these technologies is briefly described as follows:

- *Acoustic shock technologies* – This is an *in situ* technique whereby particle collisions with a probe induce an acoustic signal which is proportional to the kinetic energy of the particle/probe collision.

  Advantages: As an *in situ* technique, particle handling and gas stream manipulation is minimized. There are no optical windows or moving parts.

  Disadvantages: The probe response is sensitive to changes in flue gas velocity. The probe response may drift as a particle deposit builds up on the probe.

  Example: Jonas Inc., Particle Monitor.

- *Beta absorption technologies* – Stack gas applications of this technology are always extractive. A particle-laden stack gas sample is continuously drawn through a heated probe and conditioned as necessary to reduce

known interference (especially water droplets). The particles are impacted onto a tape for a predetermined time interval, and the particle deposit is subsequently exposed to a ^{14}C beta emission source. Transmission of the low-energy beta rays through the particle deposit is measured; this signal can be quantitatively related to the mass of the deposited particles with relatively few assumptions.

Advantages: The stack gas can be conditioned prior to particle mass measurement. Minimal hardware (only a sample probe) is placed in the stack. Beta ray penetration through the particle deposit does not depend on particle morphology and size and has a very weak dependence on particle composition. Particles are deposited on the tape and thus are available for subsequent chemical analysis in the event a particle mass concentration excursion is observed and warrants investigation.

Disadvantages: It is a single point measurement; multiplexing for multiple probes would require additional flow control hardware. The instrument has several moving parts including the tape drive mechanism.

Examples: Altech Environment USA, Model BETA 5M; Durag, Inc., Models F-904/F-904-K (for single and dual channel detectors, respectively); and Verewa, Model F-701.

- *Triboelectric technologies* – This is an *in situ* technique whereby the charge on particles striking a probe is measured. The particles are presumably charged by triboelectric action during upstream processing and/or during transport in the ducts. A modified approach measures the current induced in a probe when charged particles pass by the probe.

  Advantages: As an *in situ* technique, particle handling and gas stream manipulation is minimized. There are no optical windows or moving parts. In some cases, several probes can be multiplexed to obtainstack cross-sectional average values.

  Disadvantages: The probe is susceptible to fouling, thus requires frequent cleaning in high particle mass loading environments. The calibration is specific to each flue gas environment. Probe response is sensitive to changes in the particle size distribution, water droplet/vapor concentration, and possibly other operation variables. Indeed, this technique is expected to perform relatively poorly in environments where there are changes in operating conditions including raw materials.

  Examples: Durag, Inc., Model D-RX 250; and Goyen Valve Corp., several models.

- *Optical technologies* – A variety of optical-based instruments are available including both *in situ* and extractive techniques. One subclass is transmissometers, whereby the fraction of an incident light beam transmitted throughout the stack gas is measured. This is the design basis for many opacity meters. The path-integrated signal can be related to the particle concentration for a given value of the aerosol extinction coefficient, which is a function of particle size, composition, morphology and in some cases, flue gas composition. Thus, stack gas-specific calibration is required, and the response is sensitive to changes in operating conditions which impact these parameters.

  Another subclass is light scattering instruments, whereby an incident light beam is scattered by particles. The scattered light intensity is measured at a defined angle to the incident beam. This technique has greater sensitivity than a transmissometer but is usually based on a sensing volume rather than a path integration across the stack. Like the transmissometer, a field calibration is required and the response is sensitive to particle size, composition, morphology and perhaps also flue gas composition. Interference arising from entrained water droplets can be reduced using an extractive technique with flue gas preconditioning prior to light scattering measurement.

  Examples: BHA Group Inc., several models (*in situ* transmissometers); PCME Andersen, Model SC6000 (*in situ* transmissometer); Durag, Inc., Model D-R 300 (*in situ* backscattering); Environment Systems Corp., Model P-5B (*in situ* backscattering); United Sciences – Monitor Labs Inc., Model 300L (*in situ* backscattering); SICK Inc., Model RM-200 (extractive light scattering); and Sigrist-Photometer AG, Model CTNR (extractive forward scattering).

Based on an initial evaluation of continuous mass monitor techniques for the Chemetco application, there are potential issues with each of the available technologies due to anticipated transient variations in flue gas properties in general and aerosol properties in particular. Triboelectric methods are unsuitable because they cannot compensate for changes in water droplet/vapor concentration. Optical techniques appear the most promising from a technology evaluation perspective, but actual suitability depends on individual make and model characteristics. Acoustic and beta absorption methods also will be included in the detailed evaluation.

Systems Evaluation

As discussed earlier, a variety of devices capable of continuously monitoring particulate matter emissions are currently commercially available. Of the approaches surveyed, some are not suitable for this type of stack monitoring. According to USEPA reports and various manufacturers, it should be noted that in Germany, light scattering has been deemed sufficiently reliable in many stack conditions for this method to have received

ISO certification for use as a continuous emissions monitor (CEM). Metal recovery furnaces are a separate, special class of facilities, as are other esoteric systems for which suitability must be demonstrated without reference to other classes of facilities.

Abstracts of previous EPRI project reports show performance of the CPMMSs evaluated (relative to Method 5 reference testing) is reasonably accurate within a month of installation and calibration but drifts from an established calibration curve over a period of a few months for most units.

Surveys of state-of-the-art technology for continuous monitoring of particulate matter are attached in *Appendix B – CPMMS Evaluation Surveys*. A total of 4 potential technologies, 11 manufacturers, and 18 models were surveyed. These surveys draw primarily upon direct communications with vendors, developers, and product literature. Each survey provides a discussion of technical approaches available or being pursued to make the measurement, capabilities, advantages, and disadvantages; developmental status; and certification testing history, if any, of each approach. Each survey then ends with an assessment of the feasibility of using CEMS for compliance monitoring. The initial CPMMS evaluation list is summarized in **Table 3 – CPMMS Evaluation Summary**.

TABLE 3
CPMMS Evaluation Summary

Technology	Manufacturer	Model
Acoustic Shock	Jonas, Inc.	Particle Monitor
Beta Absorption	Altech Environment USA* (a/k/a: Emissions SA and Environment SA) Durag, Inc.* Verewa	BETA 5M F-904 / F-904-K F-701
Optical – Extractive Light Scattering	SICK, Inc. Sigrist*	RM-200 CTNR
Optical – *In Situ* Transmissometers	BHA Group, Inc. BHA Group, Inc. BHA Group, Inc. BHA Group, Inc. PCME Andersen	CPM-700 CPM-1000 CPM-2000 CPM-5000 SC-600
Optical – *In Situ* Light Scattering	Environmental Systems Corp. Durag, Inc. United Sciences**	P-5B D-R 300 300L
Triboelectric	Durag, Inc. Goyen Goyen Goyen	D-RX-250 BBD3 EMP3 EMS6

TABLE 3 (cont.)
CPMMS Evaluation Summary

Technology	Manufacturer	Model
Isokinetic Extraction (flow monitor)	Air Monitor Corp.	CAM
Electrodynamic Induction (flow monitor)	PCME Andersen	Stackflow 2000

**NPN Environmental personnel conducted a site inspection/owner interview of an installed/operating unit on 4/17/00.*
***NPN Environmental personnel conducted a site inspection/owner interview of an installed/operating unit on 2/22/00.*

None of these devices have received USEPA approval for stack particulate matter mass emissions monitoring. Most units actually measure secondary properties of particles from which the mass may be inferred rather than making a direct measurement of mass.

Table 3 includes the commercially available CPMMS Technologies based on available information. Eight specific manufacturers (listed in **Table 4 – Final Vendor Request List**) were requested to submit quotations. This packet is included in *Appendix C – Request for Quotation*. Actual vendor quotations are included in *Appendix D*. This table is not intended to be a comprehensive compilation of vendors.

As discussed earlier, the technologies identified in **Table 4** were assessed in terms of their particulate measurement ranges and sensitivities to parameters other than particulate mass loading which can give rise to biases in the measurement.

TABLE 4
Final Vendor Request List

Vendor	Technology	Model
Peak Process Controls Incorporated 39 Brownsville Court P.O. Box 26 Schomberg, Ontario Canada L0G1T0 Mr. T.J. Medland 905-939-0555	Optical – extractive light scattering	Sigrist CTNR
Jonas, Inc. 1113 Faun Road Wilmington, DE 19803 Mr. Lee Machemer 302-478-1375	Acoustic shock	Particle Monitor

TABLE 4 (cont.)
Final Vendor Request List

Vendor	Technology	Model
Altech Environment USA 2623 Kaneville Court Geneva, IL 60154 Mr. Musa Zada 630-262-4400	Beta absorption	Model BETA 5M
Durag, Inc. 1970 Christensen Avenue West St. Paul, MN 55118 Mr. Carl Gohdes 651-451-1710	Beta absorption	Model D-R-300
PCME Andersen 500 Technology Court Smyrna, GA 30082 Mr. Bruce Kemp 800-241-6898	Optical – *in situ* transmissometer	Model SC-600
MEMCO Sales & Service Corporation 7250 North Cicero Avenue, Suite LL1 Lincolnwood, IL 60646-7627 Mr. George Folds 847-329-9393	Optical – extractive light scattering	SICK Model RM-200
United Sciences-Monitor Labs Inc. 76 Inverness Drive East Englewood, CO 80112 Mr. Ernie Letterman 816-524-2600	Optical – *in situ* light scattering	Model 300L
Environmental Systems Corporation 200 Tech Center Drive Knoxville, TN 37912 Mr. Bob Nusplinger 423-688-7900	Optical – *in situ* light scattering	Model P-5B

CPMMS RECOMMENDATIONS

Information collected during both the CPMMS research and emissions characterization testing was evaluated by the project team against the criteria detailed in this report. Particular consideration was given to matching an appropriate monitoring technology with not only the emission characteristics of the furnaces, but also the variability of a secondary smelting process. As previously discussed, triboelectric technologies were deemed unsuitable. Given the possibility for entrained water droplets in the stack during certain conditions, preference was generally given to those technologies most likely able to handle such interference.

Eight vendors were requested to provide a quotation for the project; the instruments included four *in situ* units and four extractive units (in the latter case, two beta absorption devices and two optical light scattering devices). Two vendors (United Sciences-Monitor Labs and Environmental Systems Corporation) declined to provide a quotation based on the stack emissions characterization provided in this request. The project team evaluated the six quotations received and based on all information received heretofore, judged three of these six as being less likely to completely fulfill the rigorous requirements of the Consent Decree and objectives defined in this plan. The remaining three units were further evaluated and judged to have the possibility of fulfilling the requirements and goals of the Consent Decree and specifically, passing the verification testing for a CPMMS. These three units were ranked in the order of preference by the project team as follows:

1. Peak Process Controls, Inc.
   Technology: Optical – Extractive Light Scattering
   Model: Sigrist CTNR

2. Jonas, Inc.
   Technology: Acoustic Shock
   Model: Particle Monitor

3. Altech Environment USA
   Technology: Beta Absorption
   Model: BETA 5M

Based on data collected during our research and the responses from CPMMS vendors found in *Appendix D*, recommendations are described below and in **Figure 1 – CPMMS Recommendations Decision Tree**:

1. Chemetco purchase or otherwise acquire one Peak Process Controls Sigrist CTNR unit to be installed at the Stack 3 location. The Stack 3 location is recommended as the initial point of installation due to its higher potential to emit as well as having a wider band of expected emissions.

2. Upon installation and manufacturer calibration of the unit in accordance with the protocol in the Consent Decree and referenced in *Appendix E*, an initial field assessment will be performed on the unit using Method 5 as a comparison standard to evaluate the performance and potential to pass the rigorous verification testing.

3. Should field assessment of the initial unit indicate the likelihood of passing verification testing, NPN Environmental will proceed with this testing. Should verification testing meet the requirements of the Consent Decree for the initial Sigrist unit, this unit will be installed on the remaining three stacks and verification testing performed on these units.

4. Should either the field assessment indicate or actual verification testing prove that the Sigrist unit cannot meet the requirements of the Consent Decree, a similar evaluation process for the remaining two CPMMS units identified as potential options for field assessment will be initiated.

NPN Environmental personnel will conduct all verification testing per the protocol found in *Appendix E*.

Chemetco personnel will be responsible for the reporting requirements found in *Appendix F*.

SCHEDULE

Significant efforts have been made by all project team members thus far to comply with all requirements of the Consent Decree. Operational changes at the facility in addition to installation of two new particulate control systems have made a noticeable difference in mass and visible emissions from the furnace. Chemetco's commitment to achieving, demonstrating, and maintaining compliance is illustrated by the significant undertaking proposed in the recommendations of this report.

As specifically stated in the Consent Decree, one purpose of the proposed particulate mass monitoring system installation is to demonstrate the utility of a CPMMS for monitoring a secondary smelter's furnace emissions. Additionally, a CPMMS has not previously been utilized in the United States on a system similar to Chemetco. Throughout the course of research performed during this project, it was made evident that matching the variable characteristics of the furnace exhausts with the complex and sensitive nature of current CPMMS technology was going to be an arduous task. Current CPMMS technologies have been utilized in the United States for little more than process control devices or dust collector bag break detectors. Current EPRI studies on many of these technologies (most on dry control devices) have not been completely successful after a period of only months in operation.

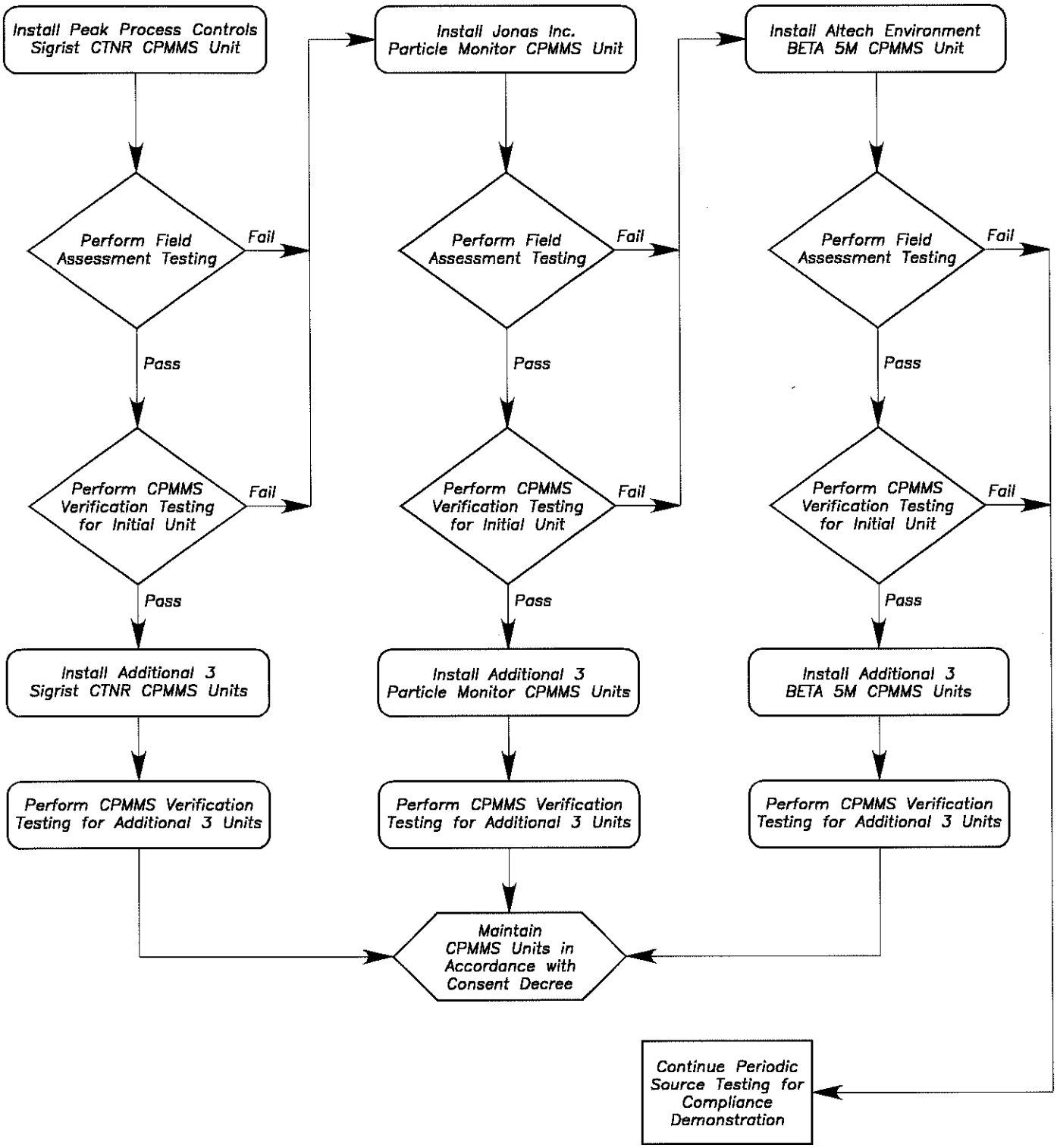
The recommendations contained in this report were developed from research conducted by the project team, which included Chemetco as well as significant assistance from EPRI's independent contractor (NPN Environmental) and their consultant (Mr. Jay Turner, D.Sc.). These recommendations reflect the complexity of attempting to fit a CPMMS technology to a secondary smelter exhaust which utilizes a wet particulate control system to provide "credible evidence for demonstrating continuous compliance with the particulate emission limits." The three CPMMS units recommended have the potential to provide this means of continuous compliance demonstration and are listed in order of confidence to succeed.

To properly specify, order, customize, install, calibrate, operate, field test, and verify a single CPMMS unit on an emission source such as a secondary smelting operation, a substantial amount of time will be required to complete these tasks. As illustrated in *Figure 1*, Chemetco is committed to a thorough evaluation of multiple CPMMS technologies if necessary. Again, this laborious and costly undertaking will take time to properly complete. Because of the nature of these technologies and the sources on which they will be installed, it is anticipated that several iterations of field testing, tuning, adjusting, and calibrating will be necessary prior to either verifying the unit's operations or eliminating a technology from consideration.

Chemetco is asking USEPA to consider the current implementation schedule of the Consent Decree as it relates to the CPMMS installation and verification. To properly complete the research on CPMMS technologies on secondary smelting operations by either demonstrating that a recommended CPMMS technology works or exhausting the recommendations of this report, a substantial amount of time will be required. Chemetco is requesting this time be granted to properly implement CPMMS directives of the Consent Decree.

Due to the lead time in ordering and customizing the first CPMMS unit and the necessary facility improvements and installation, Chemetco plans to begin immediate implementation of the recommendations of this report. Much site work must be performed prior to receiving and installing the first CPMMS unit for evaluation. Chemetco appreciates any and all verbal or written comments on the recommendations of this Plan and is willing to meet with USEPA personnel to discuss the logistics of implementation of these recommendations such that all requirements of the Consent Decree can be appropriately met.

FIGURE 1
CPMMS Recommendations
Decision Tree



APPENDIX A

Initial Test Data

CYCLONIC FLOW DETERMINATIONS

PAGE 1 OF 3

PLANT NAME Chemetco
CITY/STATE Hartford, IL
TEST LOC. Stack 1
BAROMETRIC PRES. (Pbar) 30.14 in. Hg
PITOT/ORIFICE ID N/A
THERMOCOUPLE ID SL
HORIZONTAL DUCT FLYASH/DUST BUILDUP > 1" DEPTH? YES____ NO X
(IF YES, SEE PAGE 2 FOR INSTRUCTIONS.)

JOB NO. C-00005.13
DATE 3/16/00
PERSONNEL KAR, MWS, SSW, BZG
STATIC PRES. (Pg) +0.08 in. H_2O
PITOT COEF (Cp) 0.84
MANOMETER ID Digital
DUCT LENGTH/DIA. 58"
WIDTH N/A

PRELIMINARY TRAVERSES
START-FINISH TIMES:
_____ - _____

TEST PT	YAW ANG. °	dP in H_2O	TEMP °F
1	0	.15	126
2	0	.21	126
3	0	.26	126
4	0	.25	126
5	0	.26	126
6	0	.25	126
7	0	.23	126
8	0	.25	126
9	0	.27	126
10	0	.29	126
11	0	.21	126
12	0	.24	126
13	0	.15	126
14	0	.22	126
15	0	.22	126
16	0	.23	126
17	0	.24	126
18	0	.27	126
19	0	.27	126
20	0	.28	126
21	0	.30	126
22	0	.28	126
23	0	.27	126
24	0	.20	126
AVG.	0	.24	126

ALIGNMENT APPROACH DATA
(OMIT IF AVERAGE OF YAW ANGLES < 20°)

RUN NO.*		RUN NO.*		RUN NO.*	
BASE TIME	MIN./ POINT**	BASE TIME	MIN./ POINT*	BASE TIME	MIN./ POINT**
AVG. ΔP_V ***		AVG. ΔP_V ***		AVG. ΔP_V ***	

NOTE: YAW ANGLE AVERAGE IS SUM OF THE ABSOLUTE VALUES DIVIDED BY NUMBER OF MEASUREMENTS, AND MUST BE </= 20°.

Δ P AVERAGE IS SQUARE OF AVERAGE SQUARE ROOT
* FROM ISOKINETIC SAMPLING FIELD DATA SHEET
** MINUTES/POINT = COS ϕ (BASE TIME)
*** AVERAGE $\Delta P_V = [(\Sigma \cos \phi \ (\Delta P)^{0.5} / n]^2$

SEE PAGE 2 FOR CYCLONIC FLOW CHECK CRITERIA

CYCLONIC FLOW DETERMINATIONS

PLANT NAME Chemetco
CITY/STATE Hartford, IL
TEST LOC. Stack 2
JOB NO. C-000051B
DATE 3/14/00
PERSONNEL KAR, SSW, MWS, BLG
BAROMETRIC PRES. (Pbar) 30.25 in. Hg
STATIC PRES. (Pg) +.08 in. H_2O
PITOT/ORIFICE ID N/A
PITOT COEF (Cp) 0.84
MANOMETER ID Digital
THERMOCOUPLE ID SL
DUCT LENGTH/DIA. 58"
WIDTH N/A
HORIZONTAL DUCT FLYASH/DUST BUILDUP > 1" DEPTH? YES____ NO X
(IF YES, SEE PAGE 2 FOR INSTRUCTIONS.)

PRELIMINARY TRAVERSES
START-FINISH TIMES:
_____ - _____

TEST PT	YAW ANG. °	dP in H_2O	TEMP °F
1	12	.41	115
2	30	.30	115
3	0	.34	115
4	25	.38	115
5	0	.57	115
6	0	.42	115
7	30	.11	115
8	15	.05	115
9	10	.03	115
10	0	.08	115
11	0	.15	115
12	0	.19	115
13	0	.40	115
14	0	.48	115
15	0	.65	115
16	0	.67	115
17	0	.69	115
18	0	.72	115
19	30	.71	115
20	0	.70	115
21	0	.80	115
22	0	.95	115
23	0	1.10	115
24	6	1.00	115
AVG.	7	0.50	

ALIGNMENT APPROACH DATA
(OMIT IF AVERAGE OF YAW ANGLES < 20°)

RUN NO.*		RUN NO.*		RUN NO.*	
BASE TIME	MIN./ POINT**	BASE TIME	MIN./ POINT*	BASE TIME	MIN./ POINT**
AVG. ΔP_V ***		AVG. ΔP_V ***		AVG. ΔP_V ***	

NOTE: YAW ANGLE AVERAGE IS SUM OF THE ABSOLUTE VALUES DIVIDED BY NUMBER OF MEASUREMENTS, AND MUST BE </= 20°.

Δ P AVERAGE IS SQUARE OF AVERAGE SQUARE ROOT
* FROM ISOKINETIC SAMPLING FIELD DATA SHEET
** MINUTES/POINT = COS ϕ (BASE TIME)
*** AVERAGE $\Delta P_V = [(\Sigma \cos \phi\ (\Delta P)^{0.5}/n)]^2$

SEE PAGE 2 FOR CYCLONIC FLOW CHECK CRITERIA

CYCLONIC FLOW DETERMINATIONS

PAGE 3 OF 3

PLANT NAME Chemetco
CITY/STATE Hartford, IL
TEST LOC. Stack 3
JOB NO. C-00005.13
DATE 3/15/00
PERSONNEL KAR, SSW, MWS, BLG
BAROMETRIC PRES. (Pbar) 30.13 in. Hg
STATIC PRES. (Pg) +0.1 in. H_2O
PITOT/ORIFICE ID N/A
PITOT COEF (Cp) 0.84
MANOMETER ID Digital
THERMOCOUPLE ID SL
DUCT LENGTH/DIA. 58"
WIDTH N/A
HORIZONTAL DUCT FLYASH/DUST BUILDUP > 1" DEPTH? YES____ NO X
(IF YES, SEE PAGE 2 FOR INSTRUCTIONS.)

PRELIMINARY TRAVERSES
START-FINISH TIMES:
_____ - _____

TEST PT	YAW ANG. °	dP in H_2O	TEMP °F
1	20	.03	152
2	10	.21	152
3	18	.20	152
4	0	.26	152
5	0	.32	152
6	0	.62	152
7	30	.58	152
8	0	.63	152
9	15	.63	152
10	15	.55	152
11	15	.55	152
12	0	.18	152
13	0	.41	152
14	0	.46	152
15	0	.45	152
16	0	.41	152
17	0	.43	152
18	0	.50	152
19	15	.48	152
20	10	.49	152
21	10	.48	152
22	0	.48	152
23	0	.48	152
24	0	.38	152
AVG.	7	.43	152

ALIGNMENT APPROACH DATA
(OMIT IF AVERAGE OF YAW ANGLES < 20°)

RUN NO.*		RUN NO.*		RUN NO.*	
BASE TIME	MIN./ POINT**	BASE TIME	MIN./ POINT*	BASE TIME	MIN./ POINT**
AVG. ΔP_V ***		AVG. ΔP_V ***		AVG. ΔP_V ***	

NOTE: YAW ANGLE AVERAGE IS SUM OF THE ABSOLUTE VALUES DIVIDED BY NUMBER OF MEASUREMENTS, AND MUST BE <= 20°.

Δ P AVERAGE IS SQUARE OF AVERAGE SQUARE ROOT
* FROM ISOKINETIC SAMPLING FIELD DATA SHEET
** MINUTES/POINT = COS ϕ (BASE TIME)
*** AVERAGE $\Delta P_V = [(\Sigma \cos \phi\ (\Delta P)^{0.5})/n]^2$

SEE PAGE 2 FOR CYCLONIC FLOW CHECK CRITERIA

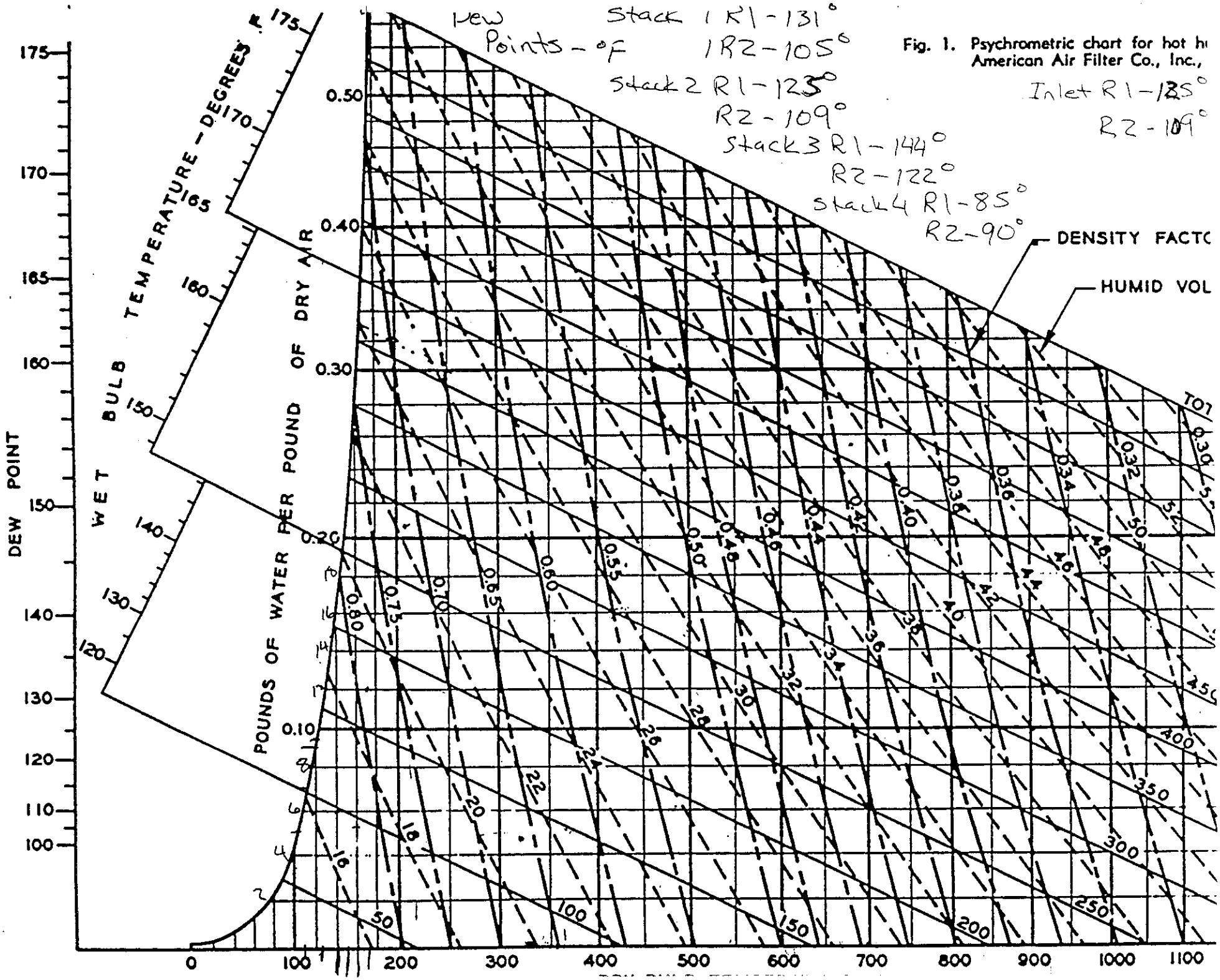


Fig. 1. Psychrometric chart for hot hu
American Air Filter Co., Inc.,

CHEMETCO PARTICULATE CONCENTRATION RESULTS

Date	Stack (run)	Flowrate (dscfm)	PM Concentration (gr/dscf)
03/21/00	Inlet 1	54,200	0.2317
03/21/00	Inlet 2	62,500	0.1769
Inlet Average		**58,350**	**0.4086**
03/21/00	1 – 1	22,700	0.0660
03/21/00	1 – 2	25,400	0.0101
Stack 1 Average		**24,050**	**0.0381**
03/21/00	3 – 1	30,900	0.0501
03/21/00	3 – 2	35,400	0.0822
Stack 3 Average		**33,150**	**0.0662**
Efficiency %			
03/22/00	2 – 1	35,200	0.5347
03/22/00	2 – 2	29,500	0.0215
Stack 2 Average		**32,350**	**0.2781**
03/22/00	4 – 1	45,900	0.0288
03/22/00	4 – 2	44,600	0.0126
Stack 4 Average		**45,250**	**0.0207**

TEST LOCATION: CHEMETCO STACK 1
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #1

Stack Sampling Results

Volume of Water Collected

Vwstd = (Vl0)(0.04707)
Vwstd = (192.3)(0.04707)
Vwstd = 9.05 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + ΔH/13.6)(γ))/Tm
Vmstd = ((17.64)(63.66)(30.32 + 1.59/13.6)(0.9775))/526
Vmstd = 63.5 cubic feet

Moisture Content

Bws = Vwstd/(Vmstd + Vwstd)
Bws = 9.05/(63.5 + 9.05)
Bws = 0.1247 = 12.47%

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (.44)(1) + (.32)(21) + (.28)(0 + 78)
Md = 29.0 lb/lb mole

Molecular Weight of Stack Gas

Ms = (Md(1-Bws)) + 18(Bws)
Ms = 29(1-0.1247)+ 18(0.1247)
Ms = 27.6 lb/lb mole

Velocity of Stack Gas

Vs = 85.49 (60 min/hr) Cp $(\Delta P)^{0.5}((Ts+459.6)/Ps/Ms)^{0.5}$
Vs = 85.49 (60)(0.84)(0.446)((634)/30.33/27.6)^0.5
Vs = 1670 ft/min

TEST LOCATION: CHEMETCO STACK 1
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #1

Total Flow of Stack Gas

Qa = As X Vs
Qa = 18.35 x 1670
Qa = 30,645 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = 30644.5 x 528/634 x 30.33/29.92
Qs = 25,900 SCFM

Qstd = Qs(1 - Bws)
Qstd = 25900(1-0.1247)
Qstd = 22,700 DSCFM

Vsstd = Qstd/As
Vsstd = 22700/18.35
Vsstd = 1240 ft/min

Percent Isokinetic

Is = (.09450) Ts Vmstd/(Ps Vs An Θ (1-Bws))
Is = (.09450)(634)(63.5)/((30.33)(1670)(0.000524)(96)(1-0.1247))
Is = 102.35

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd
Cs = (15.43)(0.2717)/63.5
Cs = 0.0660 grains/dscf
0.004279 grams/dscf

Dew Point of Stack Gas

DP = 131 degrees F

TEST LOCATION: CHEMETCO STACK 1
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #2

Stack Sampling Results

Volume of Water Collected

Vwstd = (VI0)(0.04707)
Vwstd = (81.6)(0.04707)
Vwstd = 3.84 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + ΔH/13.6)(γ))/Tm
Vmstd = ((17.64)(67.18)(30.42 + 1.64/13.6)(0.9775))/531
Vmstd = 66.6 cubic feet

Moisture Content

Bws = Vwstd/(Vmstd + Vwstd)
Bws = 3.84/(66.6 + 3.84)
Bws = 0.0545 = 5.45%

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (.44)(0) + (.32)(21) + (.28)(0 + 79)
Md = 28.8 lb/lb mole

Molecular Weight of Stack Gas

Ms = (Md(1-Bws)) + 18(Bws)
Ms = 28.8(1-0.0545)+ 18(0.0545)
Ms = 28.2 lb/lb mole

Velocity of Stack Gas

Vs = 85.49 (60 min/hr) Cp $(\Delta P)^{0.5}((Ts+459.6)/Ps/Ms)^{0.5}$
Vs = 85.49 (60)(0.84)(0.461)((618)/30.43/28.2)^0.5
Vs = 1690 ft/min

TEST LOCATION: CHEMETCO STACK 1
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #2

Total Flow of Stack Gas

Qa = As X Vs
Qa = 18.35 x 1690
Qa = 31,012 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = 31011.5 x 528/618 x 30.43/29.92
Qs = 26,900 SCFM

Qstd = Qs(1 - Bws)
Qstd = 26900(1-0.0545)
Qstd = 25,400 DSCFM

Vsstd = Qstd/As
Vsstd = 25400/18.35
Vsstd = 1380 ft/min

Percent Isokinetic

Is = (.09450) Ts Vmstd/(Ps Vs An Θ (1-Bws))
Is = (.09450)(618)(66.6)/((30.43)(1690)(0.000524)(96)(1-0.0545))
Is = 95.41

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd
Cs = (15.43)(0.0434)/66.6
Cs = 0.0101 grains/dscf
0.000652 grams/dscf

Dew Point of Stack Gas

DP = 105 degrees F

TEST LOCATION: CHEMETCO STACK 2
TEST DATE: 3/22/00
PROJECT NO. C-00005.B
RUN #1

Stack Sampling Results

Volume of Water Collected

Vwstd = (Vl0)(0.04707)
Vwstd = (89.6)(0.04707)
Vwstd = 4.22 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + ΔH/13.6)(γ))/Tm
Vmstd = ((17.64)(58.19)(30.5 + 1.22/13.6)(1.004))/533.3
Vmstd = 59.1 cubic feet

Moisture Content

Bws = Vwstd/(Vmstd + Vwstd)
Bws = 4.22/(59.1 + 4.22)
Bws = 0.0666 = 6.66%

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (.44)(0) + (.32)(21) + (.28)(0 + 79)
Md = 28.8 lb/lb mole

Molecular Weight of Stack Gas

Ms = (Md(1-Bws)) + 18(Bws)
Ms = 28.8(1-0.0666)+ 18(0.0666)
Ms = 28.1 lb/lb mole

Velocity of Stack Gas

Vs = 85.49 (60 min/hr) Cp $(\Delta P)^{0.5}((Ts+459.6)/Ps/Ms)^{0.5}$
Vs = 85.49 (60)(0.84)(0.6265)((585)/30.53/28.1)^0.5
Vs = 2230 ft/min

TEST LOCATION: CHEMETCO STACK 2
TEST DATE: 3/22/00
PROJECT NO. C-00005.B
RUN #1

Total Flow of Stack Gas

Qa = As X Vs
Qa = 18.35 x 2230
Qa = 40,921 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = 40920.5 x 528/585 x 30.53/29.92
Qs = 37,700 SCFM

Qstd = Qs(1 - Bws)
Qstd = 37700(1-0.0666)
Qstd = 35,200 DSCFM

Vsstd = Qstd/As
Vsstd = 35200/18.35
Vsstd = 1920 ft/min

Percent Isokinetic

Is = (.09450) Ts Vmstd/(Ps Vs An Θ (1-Bws))
Is = (.09450)(585)(59.1)/((30.53)(2230)(0.000314)(96)(1-0.0666))
Is = 102.34

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd
Cs = (15.43)(2.0479)/59.1
Cs = 0.5347 grains/dscf
0.034651 grams/dscf

Dew Point of Stack Gas

DP = 125 degrees F

TEST LOCATION: CHEMETCO STACK 2
TEST DATE: 3/22/00
PROJECT NO. C-00005.B
RUN #2

Stack Sampling Results

Volume of Water Collected

Vwstd = (Vl0)(0.04707)
Vwstd = (84.9)(0.04707)
Vwstd = 4.00 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + ΔH/13.6)(γ))/Tm
Vmstd = ((17.64)(62.09)(30.51 + 0.901/13.6)(1.004))/532.8
Vmstd = 63.1 cubic feet

Moisture Content

Bws = Vwstd/(Vmstd + Vwstd)
Bws = 4/(63.1 + 4)
Bws = 0.0596 = 5.96%

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (.44)(0) + (.32)(21) + (.28)(0 + 79)
Md = 28.8 lb/lb mole

Molecular Weight of Stack Gas

Ms = (Md(1-Bws)) + 18(Bws)
Ms = 28.8(1-0.0596)+ 18(0.0596)
Ms = 28.2 lb/lb mole

Velocity of Stack Gas

Vs = 85.49 (60 min/hr) Cp $(\Delta P)^{0.5}((Ts+459.6)/Ps/Ms)^{0.5}$
Vs = 85.49 (60)(0.84)(0.5305)((601)/30.53/28.2)^0.5
Vs = 1910 ft/min

TEST LOCATION: CHEMETCO STACK 2
TEST DATE: 3/22/00
PROJECT NO. C-00005.B
RUN #2

Total Flow of Stack Gas

Qa = As X Vs
Qa = 18.35 x 1910
Qa = 35,049 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = 35048.5 x 528/601 x 30.53/29.92
Qs = 31,400 SCFM

Qstd = Qs(1 - Bws)
Qstd = 31400(1-0.0596)
Qstd = 29,500 DSCFM

Vsstd = Qstd/As
Vsstd = 29500/18.35
Vsstd = 1610 ft/min

Percent Isokinetic

Is = (.09450) Ts Vmstd/(Ps Vs An Θ (1-Bws))
Is = (.09450)(601)(63.1)/((30.53)(1910)(0.000314)(120)(1-0.0596))
Is = 104.06

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd
Cs = (15.43)(0.0878)/63.1
Cs = 0.0215 grains/dscf
0.001391 grams/dscf

Dew Point of Stack Gas

DP = 109 degrees F

TEST LOCATION: CHEMETCO STACK 3
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #1

Stack Sampling Results

Volume of Water Collected

Vwstd = (VI0)(0.04707)
Vwstd = (263.2)(0.04707)
Vwstd = 12.39 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + ΔH/13.6)(γ))/Tm
Vmstd = ((17.64)(53.9)(30.32 + 1.1/13.6)(1.004))/519
Vmstd = 55.9 cubic feet

Moisture Content

Bws = Vwstd/(Vmstd + Vwstd)
Bws = 12.39/(55.9 + 12.39)
Bws = 0.1814 = 18.14%

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (.44)(0) + (.32)(21) + (.28)(0 + 79)
Md = 28.8 lb/lb mole

Molecular Weight of Stack Gas

Ms = (Md(1-Bws)) + 18(Bws)
Ms = 28.8(1-0.1814)+ 18(0.1814)
Ms = 26.8 lb/lb mole

Velocity of Stack Gas

Vs = 85.49 (60 min/hr) Cp $(\Delta P)^{0.5}((Ts+459.6)/Ps/Ms)^{0.5}$
Vs = 85.49 (60)(0.84)(0.6238)((604)/30.33/26.8)^0.5
Vs = 2320 ft/min

TEST LOCATION: CHEMETCO STACK 3
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #1

Total Flow of Stack Gas

Qa = As X Vs
Qa = 18.35 x 2320
Qa = 42,572 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = 42572 x 528/604 x 30.33/29.92
Qs = 37,700 SCFM

Qstd = Qs(1 - Bws)
Qstd = 37700(1-0.1814)
Qstd = 30,900 DSCFM

Vsstd = Qstd/As
Vsstd = 30900/18.35
Vsstd = 1680 ft/min

Percent Isokinetic

Is = (.09450) Ts Vmstd/(Ps Vs An Θ (1-Bws))
Is = (.09450)(604)(55.9)/((30.33)(2320)(0.000314)(96)(1-0.1814))
Is = 110.26

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd
Cs = (15.43)(0.1814)/55.9
Cs = 0.0501 grains/dscf
0.003245 grams/dscf

Dew Point of Stack Gas

DP = 144 degrees F

TEST LOCATION: CHEMETCO STACK 3
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #2

Stack Sampling Results

Volume of Water Collected

Vwstd = (Vl0)(0.04707)
Vwstd = (124.1)(0.04707)
Vwstd = 5.84 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + ΔH/13.6)(γ))/Tm
Vmstd = ((17.64)(59.4)(30.42 + 1.28/13.6)(1.004))/527.5
Vmstd = 60.9 cubic feet

Moisture Content

Bws = Vwstd/(Vmstd + Vwstd)
Bws = 5.84/(60.9 + 5.84)
Bws = 0.0875 = 8.75%

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (.44)(0) + (.32)(21) + (.28)(0 + 79)
Md = 28.8 lb/lb mole

Molecular Weight of Stack Gas

Ms = (Md(1-Bws)) + 18(Bws)
Ms = 28.8(1-0.0875)+ 18(0.0875)
Ms = 27.9 lb/lb mole

Velocity of Stack Gas

Vs = 85.49 (60 min/hr) Cp $(\Delta P)^{0.5}((Ts+459.6)/Ps/Ms)^{0.5}$
Vs = 85.49 (60)(0.84)(0.6588)((609)/30.43/27.9)^0.5
Vs = 2400 ft/min

TEST LOCATION: CHEMETCO STACK 3
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #2

Total Flow of Stack Gas

Qa = As X Vs
Qa = 18.35 x 2400
Qa = 44,040 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = 44040 x 528/609 x 30.43/29.92
Qs = 38,800 SCFM

Qstd = Qs(1 - Bws)
Qstd = 38800(1-0.0875)
Qstd = 35,400 DSCFM

Vsstd = Qstd/As
Vsstd = 35400/18.35
Vsstd = 1930 ft/min

Percent Isokinetic

Is = (.09450) Ts Vmstd/(Ps Vs An Θ (1-Bws))
Is = (.09450)(609)(60.9)/((30.43)(2400)(0.000314)(96)(1-0.0875))
Is = 104.68

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd
Cs = (15.43)(0.3244)/60.9
Cs = 0.0822 grains/dscf
0.005327 grams/dscf

Dew Point of Stack Gas

DP = 122 degrees F

TEST LOCATION: CHEMETCO STACK 4
TEST DATE: 3/22/00
PROJECT NO. C-00005.B
RUN #1

Stack Sampling Results

Volume of Water Collected

Vwstd = (Vl0)(0.04707)
Vwstd = (77.9)(0.04707)
Vwstd = 3.67 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + ΔH/13.6)(γ))/Tm
Vmstd = ((17.64)(78.62)(30.5 + 2.3/13.6)(0.9775))/529.8
Vmstd = 78.5 cubic feet

Moisture Content

Bws = Vwstd/(Vmstd + Vwstd)
Bws = 3.67/(78.5 + 3.67)
Bws = 0.0447 = 4.47%

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (.44)(2.5) + (.32)(20) + (.28)(0 + 77.5)
Md = 29.2 lb/lb mole

Molecular Weight of Stack Gas

Ms = (Md(1-Bws)) + 18(Bws)
Ms = 29.2(1-0.0447)+ 18(0.0447)
Ms = 28.7 lb/lb mole

Velocity of Stack Gas

Vs = 85.49 (60 min/hr) Cp $(\Delta P)^{0.5}((Ts+459.6)/Ps/Ms)^{0.5}$
Vs = 85.49 (60)(0.84)(0.8162)((597)/30.53/28.7)^0.5
Vs = 2900 ft/min

TEST LOCATION: CHEMETCO STACK 4
TEST DATE: 3/22/00
PROJECT NO. C-00005.B
RUN #1

Total Flow of Stack Gas

Qa = As X Vs
Qa = 18.35 x 2900
Qa = 53,215 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = 53215 x 528/597 x 30.53/29.92
Qs = 48,000 SCFM

Qstd = Qs(1 - Bws)
Qstd = 48000(1-0.0447)
Qstd = 45,900 DSCFM

Vsstd = Qstd/As
Vsstd = 45900/18.35
Vsstd = 2500 ft/min

Percent Isokinetic

Is = (.09450) Ts Vmstd/(Ps Vs An Θ (1-Bws))
Is = (.09450)(597)(78.5)/((30.53)(2900)(0.000314)(96)(1-0.0447))
Is = 104.22

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd
Cs = (15.43)(0.1466)/78.5
Cs = 0.0288 grains/dscf
0.001868 grams/dscf

Dew Point of Stack Gas

DP = 85 degrees F

TEST LOCATION: CHEMETCO STACK 4
TEST DATE: 3/22/00
PROJECT NO. C-00005.B
RUN #2

Stack Sampling Results

Volume of Water Collected

Vwstd = (Vl0)(0.04707)
Vwstd = (85.1)(0.04707)
Vwstd = 4.01 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + ΔH/13.6)(γ))/Tm
Vmstd = ((17.64)(95.35)(30.51 + 2/13.6)(0.9775))/538
Vmstd = 93.7 cubic feet

Moisture Content

Bws = Vwstd/(Vmstd + Vwstd)
Bws = 4.01/(93.7 + 4.01)
Bws = 0.041 = 4.1%

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (.44)(0) + (.32)(21) + (.28)(0 + 79)
Md = 28.8 lb/lb mole

Molecular Weight of Stack Gas

Ms = (Md(1-Bws)) + 18(Bws)
Ms = 28.8(1-0.041)+ 18(0.041)
Ms = 28.4 lb/lb mole

Velocity of Stack Gas

Vs = 85.49 (60 min/hr) Cp $(\Delta P)^{0.5}((Ts+459.6)/Ps/Ms)^{0.5}$
Vs = 85.49 (60)(0.84)(0.7893)((604)/30.54/28.4)^0.5
Vs = 2840 ft/min

TEST LOCATION: CHEMETCO STACK 4
TEST DATE: 3/22/00
PROJECT NO. C-00005.B
RUN #2

Total Flow of Stack Gas

Qa = As X Vs
Qa = 18.35 x 2840
Qa = 52,114 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = 52114 x 528/604 x 30.54/29.92
Qs = 46,500 SCFM

Qstd = Qs(1 - Bws)
Qstd = 46500(1-0.041)
Qstd = 44,600 DSCFM

Vsstd = Qstd/As
Vsstd = 44600/18.35
Vsstd = 2430 ft/min

Percent Isokinetic

Is = (.09450) Ts Vmstd/(Ps Vs An Θ (1-Bws))
Is = (.09450)(604)(93.7)/((30.54)(2840)(0.000314)(120)(1-0.041))
Is = 102.39

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd
Cs = (15.43)(0.0768)/93.7
Cs = 0.0126 grains/dscf
0.00082 grams/dscf

Dew Point of Stack Gas

DP = 90 degrees F

TEST LOCATION: CHEMETCO INLET STACK
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #1

Stack Sampling Results

Volume of Water Collected

Vwstd = (VI0)(0.04707)
Vwstd = (252.4)(0.04707)
Vwstd = 11.88 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + ΔH/13.6)(γ))/Tm
Vmstd = ((17.64)(65.62)(30.32 + 1.67/13.6)(0.9973))/527
Vmstd = 66.7 cubic feet

Moisture Content

Bws = Vwstd/(Vmstd + Vwstd)
Bws = 11.88/(66.7 + 11.88)
Bws = 0.1512 = 15.12%

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (.44)(0) + (.32)(20.5) + (.28)(0 + 79.5)
Md = 28.8 lb/lb mole

Molecular Weight of Stack Gas

Ms = (Md(1-Bws)) + 18(Bws)
Ms = 28.8(1-0.1512)+ 18(0.1512)
Ms = 27.2 lb/lb mole

Velocity of Stack Gas

Vs = 85.49 (60 min/hr) Cp $(\Delta P)^{0.5}((Ts+459.6)/Ps/Ms)^{0.5}$
Vs = 85.49 (60)(0.84)(0.2953)((584)/25.5/27.2)^0.5
Vs = 1170 ft/min

TEST LOCATION: CHEMETCO INLET STACK
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #1

Total Flow of Stack Gas

Qa = As X Vs
Qa = 70.9 x 1170
Qa = 82,953 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = 82953 x 528/584 x 25.5/29.92
Qs = 63,900 SCFM

Qstd = Qs(1 - Bws)
Qstd = 63900(1-0.1512)
Qstd = 54,200 DSCFM

Vsstd = Qstd/As
Vsstd = 54200/70.9
Vsstd = 760 ft/min

Percent Isokinetic

Is = (.09450) Ts Vmstd/(Ps Vs An Θ (1-Bws))
Is = (.09450)(584)(66.7)/((25.5)(1170)(0.00083)(96)(1-0.1512))
Is = 109.46

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd
Cs = (15.43)(1.0016)/66.7
Cs = 0.2317 grains/dscf
0.015016 grams/dscf

Dew Point of Stack Gas

DP = 125 degrees F

TEST LOCATION: CHEMETCO INLET STACK
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #2

Stack Sampling Results

Volume of Water Collected

Vwstd = (Vl0)(0.04707)
Vwstd = (136.6)(0.04707)
Vwstd = 6.43 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + ΔH/13.6)(γ))/Tm
Vmstd = ((17.64)(78.01)(30.32 + 2.24/13.6)(0.9973))/537
Vmstd = 77.9 cubic feet

Moisture Content

Bws = Vwstd/(Vmstd + Vwstd)
Bws = 6.43/(77.9 + 6.43)
Bws = 0.0762 = 7.62%

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (.44)(0) + (.32)(20.5) + (.28)(0 + 79.5)
Md = 28.8 lb/lb mole

Molecular Weight of Stack Gas

Ms = (Md(1-Bws)) + 18(Bws)
Ms = 28.8(1-0.0762)+ 18(0.0762)
Ms = 28.0 lb/lb mole

Velocity of Stack Gas

Vs = 85.49 (60 min/hr) Cp $(\Delta P)^{0.5}((Ts+459.6)/Ps/Ms)^{0.5}$
Vs = 85.49 (60)(0.84)(0.3145)((569)/25.45/28)^0.5
Vs = 1210 ft/min

TEST LOCATION: CHEMETCO INLET STACK
TEST DATE: 3/21/00
PROJECT NO. C-00005.B
RUN #2

Total Flow of Stack Gas

Qa = As X Vs
Qa = 70.9 x 1210
Qa = 85,789 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = 85789 x 528/569 x 25.45/29.92
Qs = 67,700 SCFM

Qstd = Qs(1 - Bws)
Qstd = 67700(1-0.0762)
Qstd = 62,500 DSCFM

Vsstd = Qstd/As
Vsstd = 62500/70.9
Vsstd = 880 ft/min

Percent Isokinetic

Is = (.09450) Ts Vmstd/(Ps Vs An Θ (1-Bws))
Is = (.09450)(569)(77.9)/((25.45)(1210)(0.00083)(96)(1-0.0762))
Is = 110.87

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd
Cs = (15.43)(0.8929)/77.9
Cs = 0.1769 grains/dscf
0.011462 grams/dscf

Dew Point of Stack Gas

DP = 109 degrees F

RJ Lee *Group*, Inc.

350 Hochberg Road
Monroeville, PA 15146
Tel: (724) 325-1776
Fax: (724) 733-1799

The Materials Characterization Specialists

April 28, 2000

Mr. Brian Gregory
NPN Environmental
927 Horan Drive
Fenton, MO 63026

RE: Results from CCSEM Analysis
RJ Lee Group Project No. ESH004050
NPN Environmental Purchase Order No. C-00005.B

Dear Mr. Gregory:

Enclosed you will find a summary of the analytical results for the 23 Method 5 samples which we received on April 5, 2000 (reference Request for Laboratory Services dated April 3, 2000). The samples were identified as follows:

NPN Environmental Sample ID	RJ Lee Group Inc. Sample No.	Description
0617086	Inlet Run 1-1	Beaker
0617087	Inlet Run 1-2	Beaker
0617088	Stack 1 – Run 1	Beaker
0617089	Stack 1 – Run 2	Beaker
0617090	Inlet Run 2-1	Beaker
0617091	Inlet Run 2-2	Beaker
0617092	Stack 3 – Run 1	Beaker
0617093	Stack 3 – Run 2	Beaker
0617094	Stack 2 – Run 1-1	Beaker
0617095	Stack 2 – Run 1-2	Beaker
0617096	Stack 2 – Run 2	Beaker
0617097	Stack 4 – Run 1	Beaker
0617098	Stack 4 – Run 2	Beaker
0617099	Inlet – 01	Filter
0617100	Inlet – 02	Filter
0617101	Stack 1-01	Filter
0617102	Stack 1-02	Filter
0617103	Stack 3-01	Filter
0617104	Stack 3-02	Filter
0617105	Stack 2 – Run 1	Filter
0617106	Stack 2 – Run 2	Filter
0617107	Stack 4-01	Filter
0617108	Stack 4-02	Filter
0617109	Blank Filters	Filter

The purpose of this investigation was to provide size distribution by composition types of the particulate matter collected on the samples.

The samples were prepared using our standard techniques involving the redeposition of particulate matter onto a polycarbonate filter. The particles were analyzed by computer-controlled scanning electron microscopy (CCSEM) techniques.

Attached to this report are three tables and two graphs for each sample. Table 1 reports the relative abundance of the various particle species detected during the analysis. Table 2 reports the number percent distribution by measured physical diameter and Table 3 reports the estimated mass distribution by measured physical diameter for the compositional classes. The totals from Tables 2 and 3 are graphically presented and the cumulative percentages have been overlayed.

For each sample the particulate matter was classified based of the predominant elemental constituents and was listed as 'Classes'. The first column of numbers in Tables 2 and 3 are the percentages of the corresponding class for entire sample. The remaining columns segregate that first column into size bins. For example; in Table 3 for the Stack 1 Run 1 Beaker sample, the Pb/Cl-rich class is 22.8% (by Mass) of the total particulate detected on the sample, and 37.8% of that 22.8% was detected in the 5.0 - 10.0 micrometer size range.

In summary, the Pb/Cl-rich and/or Pb/Cl/Sn-rich particle classes were detected at greater than 16 percent, by mass on 15 of the 17 stack samples. While, with the exception of the Inlet Run 1-2 sample, the lead-containing particle classes were relatively less abundant on the inlet samples relative to the stack samples.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Sample disposition as noted on COC.

Should you have any questions regarding this information, please do not hesitate to contact me.

Sincerely,

John C. Johns
Project Manager
Environmental Services

jcj
Attachments

RJ LeeGroup, Inc.

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Client_Name	NPN Environ
Client_Number	Stack 1 Run 1
Project_Number	ESH004050
Sample_Number	617088
Comment	Beaker

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb/Cl-rich	116	2.31	22.81
Pb/Cl/Sn-rich	13	0.07	21.37
Si/Al-rich	58	1.44	13.11
C-rich	541	88.34	7.64
Al-rich	51	1.40	6.55
Zn/S-rich	13	0.07	4.76
Cu/Sn-rich	5	0.03	4.61
Si-rich	54	0.47	4.08
Ca-rich	7	0.04	3.41
Fe-rich	30	0.53	3.11
Zn/Cl-rich	32	0.36	2.77
Pb-rich	46	4.40	2.60
Al/S-rich	12	0.44	2.02
Na/Cl-rich	2	0.01	0.48
Misc.	12	0.06	0.40
Si/Mg-rich	6	0.03	0.17
Na/S-rich	1	0.01	0.07
Zn/Sn-rich	1	0.01	0.03
Totals	1000	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	2.3	0.0	8.4	33.7	42.5	11.5	3.2	0.7	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.1	0.0	0.0	0.0	0.0	61.5	30.8	0.0	7.7	0.0	0.0
Si/Al-rich	1.4	0.0	13.5	54.1	20.0	7.6	4.3	0.0	0.4	0.0	0.0
C-rich	88.3	7.9	62.8	26.0	3.2	0.2	0.0	0.0	0.0	0.0	0.0
Al-rich	1.4	13.9	27.8	41.7	4.8	9.3	2.2	0.4	0.0	0.0	0.0
Zn/S-rich	0.1	0.0	0.0	0.0	15.4	53.8	23.1	7.7	0.0	0.0	0.0
Cu/Sn-rich	0.0	0.0	0.0	0.0	0.0	60.0	20.0	20.0	0.0	0.0	0.0
Si-rich	0.5	0.0	0.0	0.0	60.2	32.0	6.6	1.1	0.0	0.0	0.0
Ca-rich	0.0	0.0	0.0	0.0	28.6	42.9	14.3	14.3	0.0	0.0	0.0
Fe-rich	0.5	0.0	0.0	36.4	45.1	14.6	3.9	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.4	0.0	0.0	54.7	14.6	24.8	5.8	0.0	0.0	0.0	0.0
Pb-rich	4.4	0.0	17.7	57.4	23.4	1.4	0.1	0.0	0.0	0.0	0.0
Al/S-rich	0.4	0.0	44.1	44.1	3.5	2.4	5.9	0.0	0.0	0.0	0.0
Na/Cl-rich	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0
Misc.	0.1	0.0	0.0	0.0	25.0	75.0	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	33.3	66.7	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	7.1	57.2	28.2	5.8	1.3	0.3	0.0	0.0	0.0	0.0

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Client_Name	NPN Environ
Client_Number	Stack 1 Run 1
Project_Number	ESH004050
Sample_Number	617088
Comment	Beaker

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	22.8	0.0	0.0	1.8	9.8	19.6	37.8	30.9	0.0	0.0	0.0
Pb/Cl/Sn-rich	21.4	0.0	0.0	0.0	0.0	5.7	15.9	0.0	78.4	0.0	0.0
Si/Al-rich	13.1	0.0	0.0	0.9	3.1	8.8	33.4	0.0	53.8	0.0	0.0
C-rich	7.6	0.3	11.7	35.0	36.5	13.9	2.7	0.0	0.0	0.0	0.0
Al-rich	6.6	0.0	0.1	2.7	2.6	18.3	43.1	33.2	0.0	0.0	0.0
Zn/S-rich	4.8	0.0	0.0	0.0	0.5	6.1	41.8	51.6	0.0	0.0	0.0
Cu/Sn-rich	4.6	0.0	0.0	0.0	0.0	7.0	5.7	87.3	0.0	0.0	0.0
Si-rich	4.1	0.0	0.0	0.0	6.5	25.0	43.8	24.7	0.0	0.0	0.0
Ca-rich	3.4	0.0	0.0	0.0	1.1	7.2	4.1	87.6	0.0	0.0	0.0
Fe-rich	3.1	0.0	0.0	0.8	11.5	21.9	65.8	0.0	0.0	0.0	0.0
Zn/Cl-rich	2.8	0.0	0.0	0.9	5.4	22.9	70.8	0.0	0.0	0.0	0.0
Pb-rich	2.6	0.0	1.0	13.6	49.0	25.0	11.4	0.0	0.0	0.0	0.0
Al/S-rich	2.0	0.0	0.1	2.4	1.4	2.1	93.9	0.0	0.0	0.0	0.0
Na/Cl-rich	0.5	0.0	0.0	0.0	0.0	13.1	86.9	0.0	0.0	0.0	0.0
Misc.	0.4	0.0	0.0	0.0	15.4	84.6	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.2	0.0	0.0	0.0	13.2	86.8	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.9	3.8	7.8	13.6	30.2	19.7	23.8	0.0	0.0

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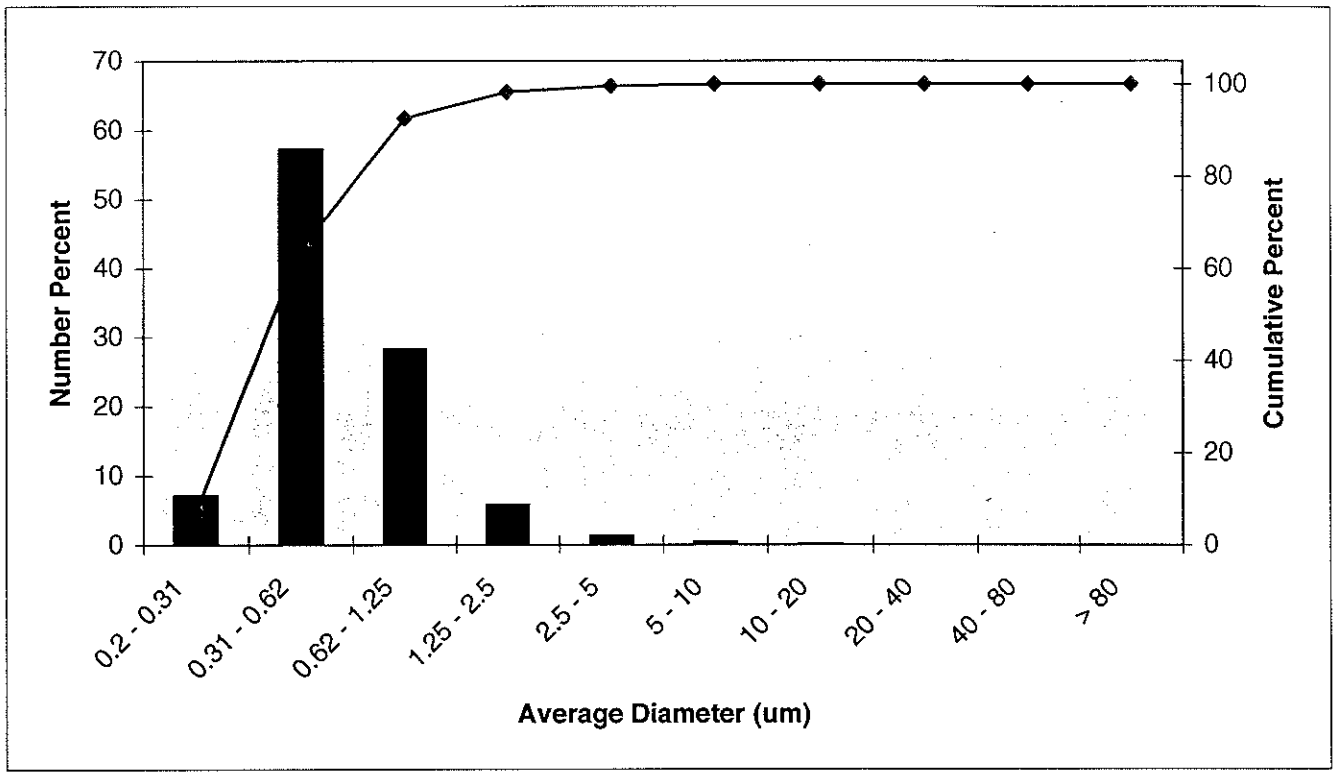
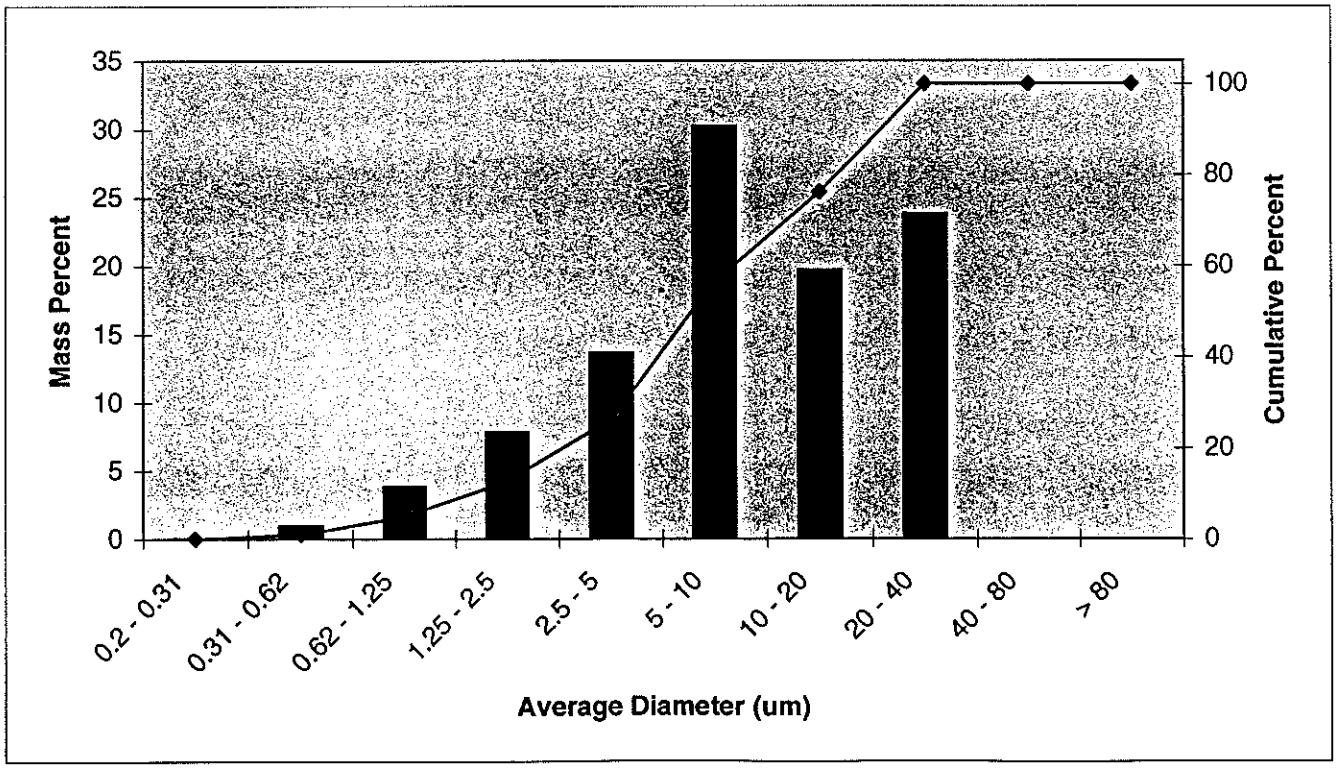
PH 724/325-1776 FAX 724/733-1799

Stack 1 Run 1, Beaker (617088)





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Client_Name	NPN Environ
Client_Number	Stack 1 - 01
Project_Number	ESH004050
Sample_Number	617101
Comment	Filter

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb/Cl-rich	201	4.89	38.11
Pb/Cl/Sn-rich	45	0.48	14.43
C-rich	373	73.11	11.10
Si/Al-rich	17	0.03	7.81
Pb-rich	81	9.19	6.10
Zn/Cl-rich	63	5.23	4.89
Sn/Pb-rich	7	0.01	4.41
Ca-rich	15	0.03	4.30
Al-rich	30	4.18	2.63
Zn/Sn-rich	12	0.22	1.78
Fe-rich	2	0.00	1.67
Si-rich	2	0.00	1.65
Al/S-rich	8	0.80	0.39
Zn/S-rich	5	0.01	0.21
Misc.	8	0.01	0.17
Zn-rich	3	0.40	0.10
Na/Cl-rich	6	1.19	0.08
Cu/Sn-rich	2	0.00	0.08
Sn-rich	1	0.20	0.07
Totals	881	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	4.9	8.1	52.7	20.3	14.7	3.6	0.6	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.5	0.0	0.0	0.0	88.0	10.1	1.9	0.0	0.0	0.0	0.0
C-rich	73.1	13.7	69.2	15.5	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.0	0.0	0.0	0.0	17.6	52.9	23.5	5.9	0.0	0.0	0.0
Pb-rich	9.2	0.0	64.8	34.5	0.4	0.3	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	5.2	0.0	49.3	38.0	11.9	0.8	0.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.0	0.0	0.0	0.0	14.3	28.6	57.1	0.0	0.0	0.0	0.0
Ca-rich	0.0	0.0	0.0	0.0	20.0	73.3	0.0	6.7	0.0	0.0	0.0
Al-rich	4.2	0.0	80.6	9.5	9.8	0.1	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.2	0.0	90.7	0.0	5.1	2.5	1.7	0.0	0.0	0.0	0.0
Fe-rich	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0
Si-rich	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0
Al/S-rich	0.8	0.0	74.3	24.8	0.2	0.7	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	0.0	0.0	0.0	0.0	40.0	60.0	0.0	0.0	0.0	0.0	0.0
Misc.	0.0	0.0	0.0	0.0	75.0	25.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.4	0.0	49.8	49.8	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	1.2	16.7	66.7	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.2	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	10.6	66.9	18.7	3.4	0.4	0.1	0.0	0.0	0.0	0.0

RJ LeeGroup, Inc.

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Client_Name	NPN Environ
Client_Number	Stack 1 - 01
Project_Number	ESH004050
Sample_Number	617101
Comment	Filter

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	38.1	0.0	1.1	2.1	19.7	32.8	44.3	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	14.4	0.0	0.0	0.0	41.6	23.6	34.8	0.0	0.0	0.0	0.0
C-rich	11.1	1.5	32.7	43.7	21.3	0.8	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	7.8	0.0	0.0	0.0	0.8	7.5	31.0	60.7	0.0	0.0	0.0
Pb-rich	6.1	0.0	11.7	35.0	7.6	24.3	21.3	0.0	0.0	0.0	0.0
Zn/Cl-rich	4.9	0.0	4.9	21.1	37.1	27.9	9.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	4.4	0.0	0.0	0.0	1.2	10.1	88.7	0.0	0.0	0.0	0.0
Ca-rich	4.3	0.0	0.0	0.0	1.0	21.4	0.0	77.7	0.0	0.0	0.0
Al-rich	2.6	0.0	10.5	5.7	75.1	8.7	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	1.8	0.0	0.6	0.0	8.8	23.5	67.1	0.0	0.0	0.0	0.0
Fe-rich	1.7	0.0	0.0	0.0	0.0	22.3	77.7	0.0	0.0	0.0	0.0
Si-rich	1.7	0.0	0.0	0.0	0.0	7.7	0.0	92.3	0.0	0.0	0.0
Al/S-rich	0.4	0.0	14.3	36.2	5.4	44.1	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	0.2	0.0	0.0	0.0	18.2	81.8	0.0	0.0	0.0	0.0	0.0
Misc.	0.2	0.0	0.0	0.0	57.6	42.4	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.1	0.0	11.0	52.2	0.0	36.8	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.1	3.6	49.4	47.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.1	0.0	0.0	0.0	33.3	66.7	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.2	5.4	9.3	20.6	22.4	32.4	9.6	0.0	0.0	0.0

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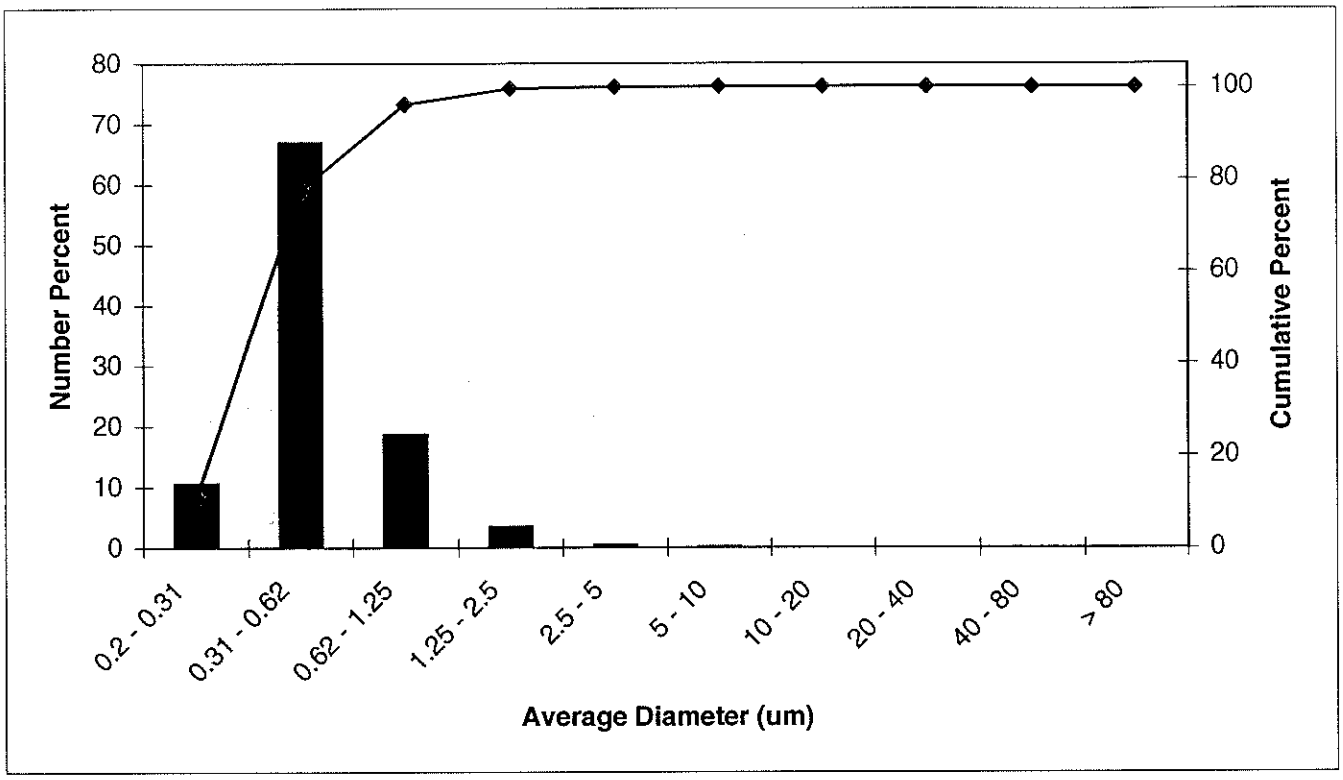
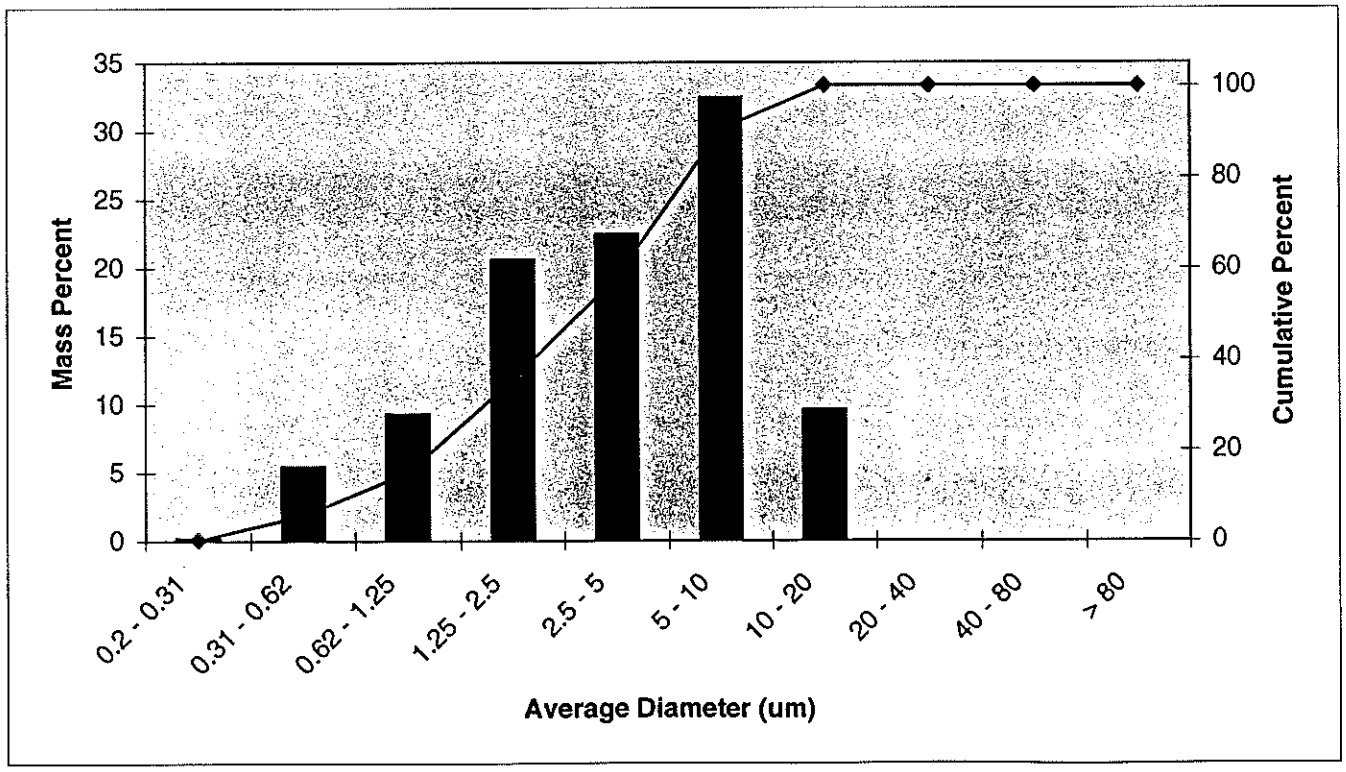
Stack 1 - 01, Filter (617101)





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Client_Name	NPN ENVIRO
Client_Number	STACK 1 RUN 2
Project_Number	ESH004050
Sample_Number	617089
Comment	BEAKER

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb/Cl-rich	137	9.55	27.76
Pb/Cl/Sn-rich	28	1.20	16.73
Pb-rich	87	10.42	16.32
Si-rich	85	3.09	5.37
C-rich	332	53.10	5.09
Misc.	27	0.84	3.85
Si/Al-rich	45	2.82	3.79
Al-rich	74	6.35	3.64
Zn/S-rich	18	0.56	3.25
Fe-rich	44	5.13	2.94
Zn/Cl-rich	25	1.53	2.38
Cu/Sn-rich	2	0.02	1.77
Sn/Pb-rich	11	0.30	1.73
Zn/Sn-rich	9	0.28	1.68
Fe/Cr-rich	9	0.81	1.27
Cu-rich	3	0.03	1.01
Al/S-rich	19	2.17	0.79
Ca-rich	10	0.82	0.58
Zn-rich	3	0.57	0.03
Si/Mg-rich	1	0.01	0.02
Sn-rich	1	0.19	0.01
Na/Cl-rich	1	0.19	0.00
Totals	971	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	9.6	0.0	25.8	39.7	27.8	4.9	1.9	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	1.2	0.0	0.0	31.5	53.7	12.1	1.9	0.9	0.0	0.0	0.0
Pb-rich	10.4	5.5	38.2	45.4	8.8	1.7	0.3	0.1	0.0	0.0	0.0
Si-rich	3.1	0.0	18.4	30.7	33.9	15.2	1.8	0.0	0.0	0.0	0.0
C-rich	53.1	8.9	60.7	26.8	3.1	0.5	0.1	0.0	0.0	0.0	0.0
Misc.	0.8	0.0	22.6	45.3	9.4	18.7	4.0	0.0	0.0	0.0	0.0
Si/Al-rich	2.8	0.0	20.1	40.3	31.2	7.1	1.2	0.0	0.0	0.0	0.0
Al-rich	6.4	3.0	53.7	26.8	12.1	4.2	0.2	0.0	0.0	0.0	0.0
Zn/S-rich	0.6	0.0	0.0	34.0	48.0	14.0	4.0	0.0	0.0	0.0	0.0
Fe-rich	5.1	3.7	51.7	29.6	12.8	2.0	0.2	0.0	0.0	0.0	0.0
Zn/Cl-rich	1.5	0.0	12.4	62.0	19.0	5.1	1.5	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.3	0.0	62.9	0.0	11.1	22.3	3.7	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.3	0.0	0.0	67.9	4.0	24.1	4.0	0.0	0.0	0.0	0.0
Fe/Cr-rich	0.8	0.0	0.0	69.8	24.7	5.5	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.0	0.0	0.0	0.0	0.0	66.7	33.3	0.0	0.0	0.0	0.0
Al/S-rich	2.2	0.0	26.2	43.6	28.7	1.5	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.8	0.0	23.0	23.0	51.4	2.7	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.6	0.0	33.3	66.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	5.7	47.7	32.2	11.1	2.7	0.5	0.0	0.0	0.0	0.0

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724/325-1776 • 724/733-1799 FAX

Client_Name NPN ENVIRO
Client_Number STACK 1 RUN 2
Project_Number ESH004050
Sample_Number 617089
Comment BEAKER

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	27.8	0.0	0.2	2.8	19.6	18.7	58.6	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	16.7	0.0	0.0	0.7	5.5	17.3	9.1	67.4	0.0	0.0	0.0
Pb-rich	16.3	0.0	0.8	5.3	9.1	14.3	10.1	60.4	0.0	0.0	0.0
Si-rich	5.4	0.0	0.3	2.3	19.9	48.8	28.7	0.0	0.0	0.0	0.0
C-rich	5.1	0.4	10.9	28.5	20.9	28.1	11.2	0.0	0.0	0.0	0.0
Misc.	3.9	0.0	0.1	1.2	4.0	33.3	61.4	0.0	0.0	0.0	0.0
Si/Al-rich	3.8	0.0	0.3	2.3	17.8	41.0	38.6	0.0	0.0	0.0	0.0
Al-rich	3.6	0.0	1.7	5.7	22.9	49.8	19.8	0.0	0.0	0.0	0.0
Zn/S-rich	3.2	0.0	0.0	2.3	8.2	29.1	60.4	0.0	0.0	0.0	0.0
Fe-rich	2.9	0.0	1.8	6.3	24.8	47.0	20.1	0.0	0.0	0.0	0.0
Zn/Cl-rich	2.4	0.0	0.1	5.1	17.2	31.0	46.6	0.0	0.0	0.0	0.0
Cu/Sn-rich	1.8	0.0	0.0	0.0	0.0	5.9	94.1	0.0	0.0	0.0	0.0
Sn/Pb-rich	1.7	0.0	0.5	0.0	7.6	59.5	32.3	0.0	0.0	0.0	0.0
Zn/Sn-rich	1.7	0.0	0.0	0.9	1.5	43.0	54.5	0.0	0.0	0.0	0.0
Fe/Cr-rich	1.3	0.0	0.0	8.7	34.5	56.7	0.0	0.0	0.0	0.0	0.0
Cu-rich	1.0	0.0	0.0	0.0	0.0	24.3	75.7	0.0	0.0	0.0	0.0
Al/S-rich	0.8	0.0	0.9	10.2	57.1	31.8	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.6	0.0	0.5	7.6	80.4	11.5	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.0	0.0	21.4	78.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.9	4.3	14.6	25.4	33.7	21.1	0.0	0.0	0.0

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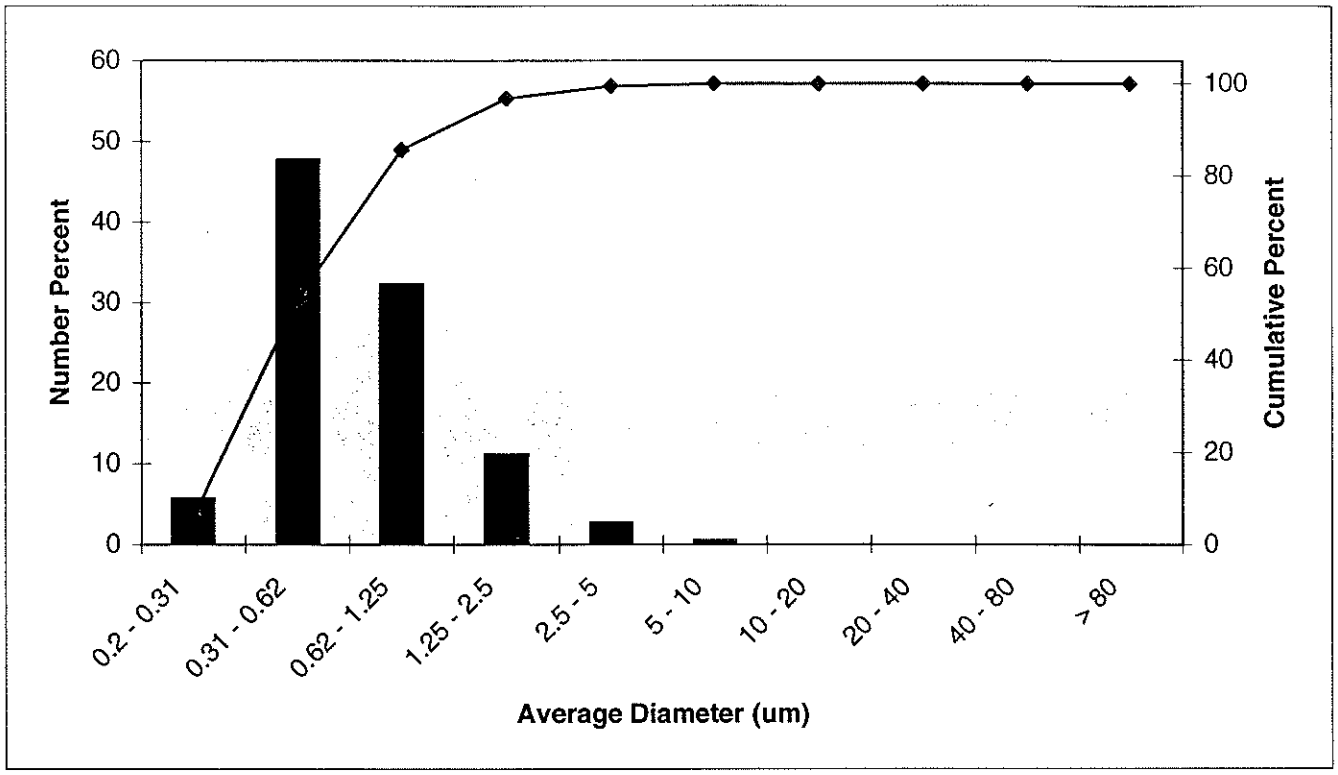
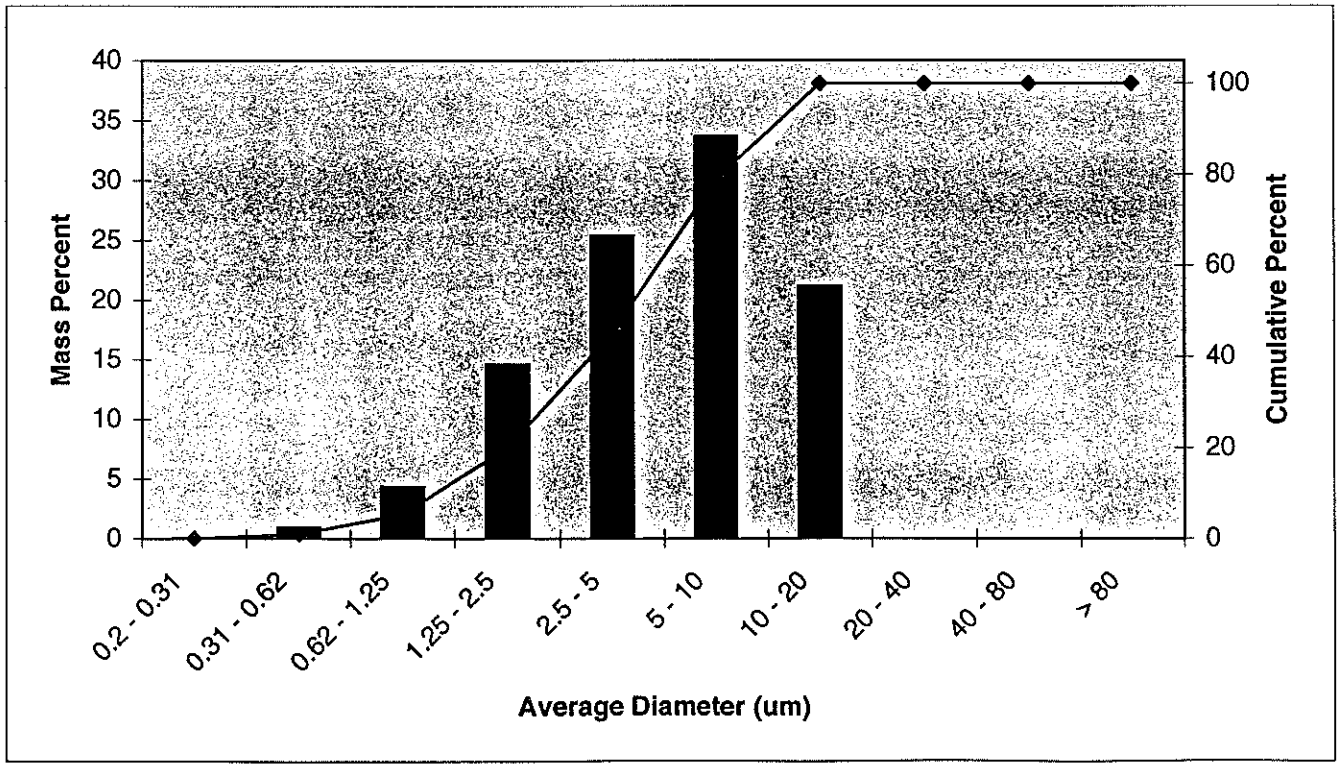
PH 724/325-1776 FAX 724/733-1799

Stack 1 Run 2, Beaker (617089)





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Client_Name	NPN ENVIRO
Client_Number	STACK 1 - 02
Project_Number	ESH004050
Sample_Number	617102
Comment	BEAKER

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb/Cl-rich	161	4.07	33.40
C-rich	388	66.96	24.92
Pb-rich	149	17.19	15.81
Si/Al-rich	17	0.23	8.88
Pb/Cl/Sn-rich	33	0.46	6.71
Al-rich	25	3.59	2.51
Zn/Cl-rich	37	3.41	2.48
Zn/S-rich	22	1.42	1.84
Misc.	19	0.04	1.19
Sn/Pb-rich	8	0.02	0.63
Zn/Sn-rich	2	0.00	0.51
Al/S-rich	11	1.20	0.33
Zn-rich	8	1.39	0.31
Si-rich	3	0.01	0.24
Cu/Sn-rich	1	0.00	0.13
Sn-rich	1	0.00	0.04
Fe-rich	1	0.00	0.03
Si/Mg-rich	1	0.00	0.02
Totals	887	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	4.1	0.0	19.5	43.9	33.2	2.9	0.5	0.0	0.0	0.0	0.0
C-rich	67.0	5.9	64.0	27.8	2.2	0.1	0.0	0.0	0.0	0.0	0.0
Pb-rich	17.2	1.2	43.8	48.5	6.2	0.3	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.2	0.0	0.0	85.5	1.8	5.4	6.3	0.9	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.5	0.0	0.0	43.0	48.9	6.8	1.4	0.0	0.0	0.0	0.0
Al-rich	3.6	0.0	38.7	49.8	11.4	0.1	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	3.4	0.0	52.3	46.5	0.8	0.3	0.1	0.0	0.0	0.0	0.0
Zn/S-rich	1.4	0.0	83.8	0.0	15.3	0.9	0.0	0.0	0.0	0.0	0.0
Misc.	0.0	0.0	0.0	0.0	57.9	36.8	5.3	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.0	0.0	0.0	0.0	62.5	37.5	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	1.2	0.0	66.1	33.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	1.4	0.0	99.8	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Si-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	4.2	57.7	32.9	4.8	0.3	0.1	0.0	0.0	0.0	0.0

RJ LeeGroup, Inc.

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Client_Name NPN ENVIRO
Client_Number STACK 1 - 02
Project_Number ESH004050
Sample_Number 617102
Comment BEAKER

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	33.4	0.0	0.6	6.4	28.6	27.9	36.5	0.0	0.0	0.0	0.0
C-rich	24.9	0.3	16.1	46.7	22.8	3.7	10.4	0.0	0.0	0.0	0.0
Pb-rich	15.8	0.0	7.8	41.1	30.1	17.6	3.3	0.0	0.0	0.0	0.0
Si/Al-rich	8.9	0.0	0.0	1.0	0.4	5.5	61.0	32.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	6.7	0.0	0.0	8.0	17.4	38.3	36.3	0.0	0.0	0.0	0.0
Al-rich	2.5	0.0	4.4	33.8	56.7	5.1	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	2.5	0.0	11.8	41.8	12.9	8.9	24.7	0.0	0.0	0.0	0.0
Zn/S-rich	1.8	0.0	7.6	0.0	76.3	16.0	0.0	0.0	0.0	0.0	0.0
Misc.	1.2	0.0	0.0	0.0	23.7	41.4	34.8	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.6	0.0	0.0	0.0	47.3	52.7	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.5	0.0	0.0	0.0	3.5	96.5	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.3	0.0	12.5	56.8	30.7	0.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.3	0.0	90.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
Si-rich	0.2	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.1	6.3	23.0	25.2	18.4	24.2	2.8	0.0	0.0	0.0

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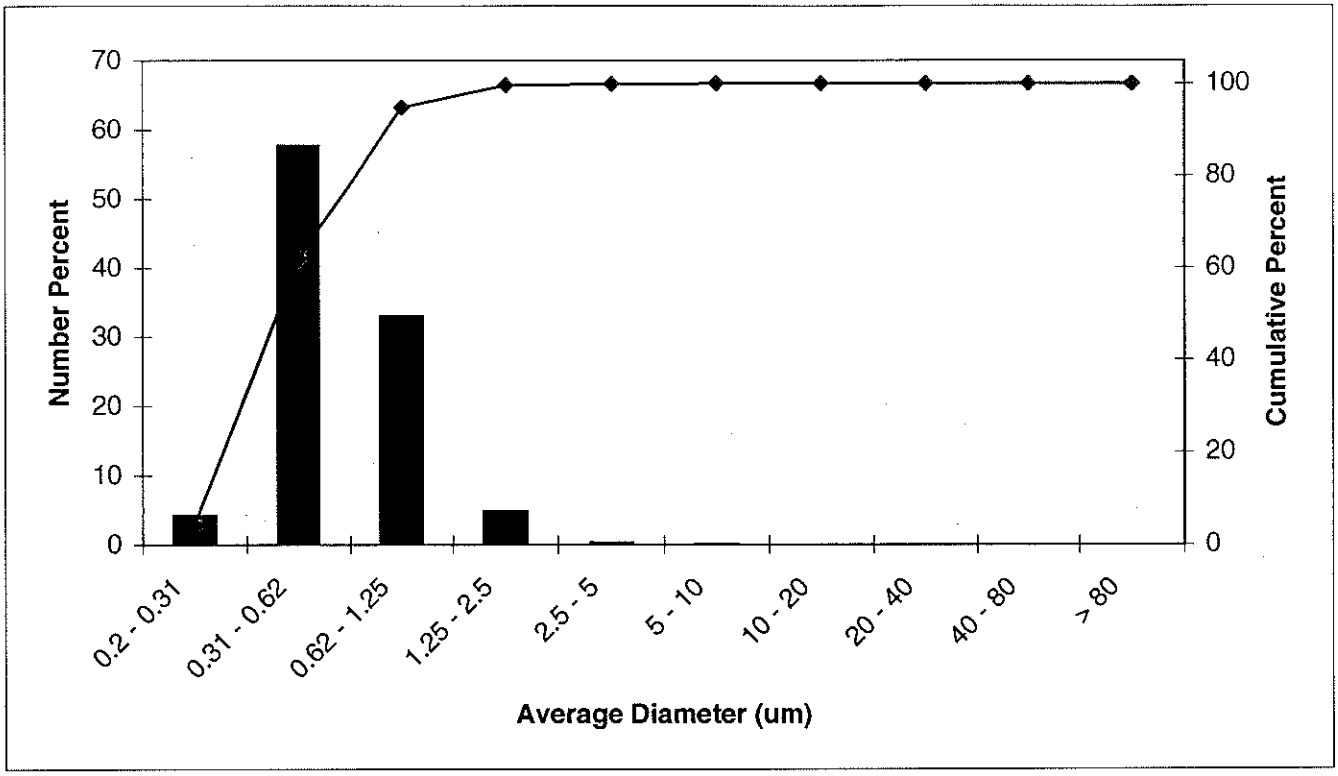
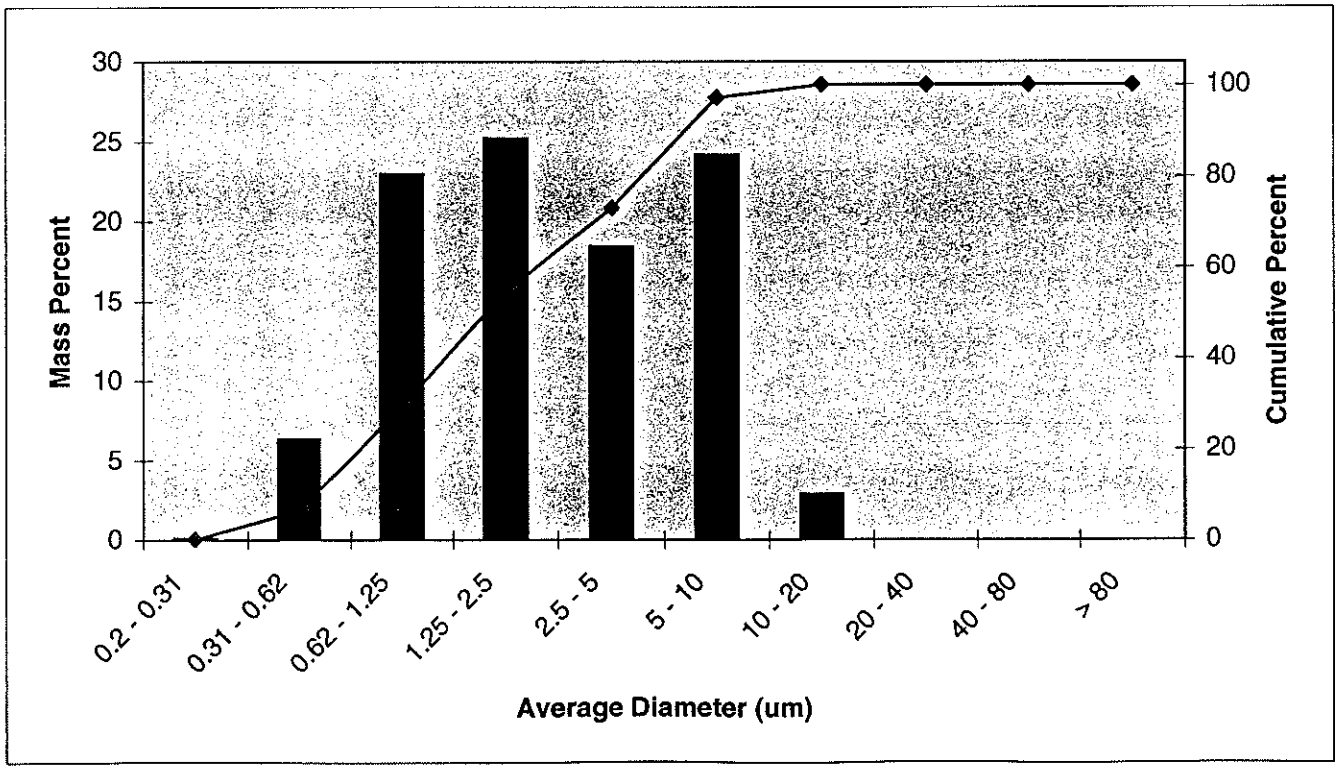
PH 724/325-1776 FAX 724/733-1799

Stack 1 - 02, Beaker (617102)





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Client_Name	NPN Environ
Client_Number	Stack 2 Run 1-1
Project_Number	ESH004050
Sample_Number	617094
Comment	Beaker

Table 1 - Abundance

Classes	#	Number %	Wt %
Na/S-rich	160	3.29	47.46
Pb/Cl-rich	90	4.44	18.23
Fe-rich	2	0.01	9.18
Zn/S-rich	59	1.63	5.05
Zn/Cl-rich	92	6.92	4.19
Na/Cl-rich	55	2.56	3.49
Al-rich	251	41.90	3.21
Pb-rich	42	3.63	3.14
Misc.	41	7.24	0.78
Na-rich	36	3.98	0.75
Zn/Sn-rich	13	0.83	0.75
C-rich	81	15.60	0.67
Al/S-rich	22	3.15	0.67
Zn-rich	25	3.35	0.66
Si-rich	3	0.02	0.59
Cu/S-rich	1	0.01	0.43
Cu/Sn-rich	10	0.24	0.34
Pb/Cl/Sn-rich	4	0.21	0.19
Si/Al-rich	3	0.21	0.13
Cu-rich	4	0.21	0.05
Sn/Pb-rich	1	0.01	0.02
Ca-rich	2	0.20	0.01
Sn-rich	2	0.39	0.01
Totals	999	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Na/S-rich	3.3	0.0	11.8	29.6	42.1	10.4	4.7	1.1	0.3	0.0	0.0
Pb/Cl-rich	4.4	0.0	4.4	56.9	33.9	4.0	0.6	0.2	0.0	0.0	0.0
Fe-rich	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0
Zn/S-rich	1.6	0.0	23.9	23.9	41.8	8.6	1.6	0.3	0.0	0.0	0.0
Zn/Cl-rich	6.9	5.6	31.0	47.8	13.6	1.6	0.3	0.1	0.0	0.0	0.0
Na/Cl-rich	2.6	0.0	30.4	22.8	42.7	3.0	1.0	0.0	0.0	0.0	0.0
Al-rich	41.9	8.9	54.4	32.5	4.0	0.2	0.0	0.0	0.0	0.0	0.0
Pb-rich	3.6	0.0	26.8	42.9	28.0	1.7	0.6	0.0	0.0	0.0	0.0
Misc.	7.2	2.9	61.9	21.5	13.5	0.2	0.0	0.0	0.0	0.0	0.0
Na-rich	4.0	0.0	34.3	53.9	10.7	1.2	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.8	0.0	47.2	23.6	26.7	1.9	0.6	0.0	0.0	0.0	0.0
C-rich	15.6	6.4	63.6	28.7	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	3.1	12.4	30.9	30.9	25.4	0.3	0.0	0.0	0.0	0.0	0.0
Zn-rich	3.4	5.8	23.2	58.1	12.2	0.6	0.0	0.0	0.0	0.0	0.0
Si-rich	0.0	0.0	0.0	0.0	0.0	33.3	66.7	0.0	0.0	0.0	0.0
Cu/S-rich	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.2	0.0	0.0	80.7	8.6	10.7	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.2	0.0	0.0	0.0	95.1	4.9	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.2	0.0	0.0	95.0	2.5	2.5	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.2	0.0	92.6	0.0	4.9	2.5	0.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.2	0.0	97.4	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.4	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	5.9	46.3	34.7	11.6	1.1	0.3	0.1	0.0	0.0	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name NPN Environ
Client_Number Stack 2 Run 1-1
Project_Number ESH004050
Sample_Number 617094
Comment Beaker

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Na/S-rich	47.5	0.0	0.0	0.1	2.1	4.2	14.2	19.4	60.0	0.0	0.0
Pb/Cl-rich	18.2	0.0	0.1	3.1	11.6	9.7	15.9	59.7	0.0	0.0	0.0
Fe-rich	9.2	0.0	0.0	0.0	0.0	0.7	0.0	99.3	0.0	0.0	0.0
Zn/S-rich	5.0	0.0	0.1	1.2	12.2	21.5	50.9	14.2	0.0	0.0	0.0
Zn/Cl-rich	4.2	0.0	1.3	11.9	19.3	13.4	23.8	30.3	0.0	0.0	0.0
Na/Cl-rich	3.5	0.0	0.3	2.0	27.6	12.8	57.3	0.0	0.0	0.0	0.0
Al-rich	3.2	0.3	12.9	41.0	34.2	11.5	0.0	0.0	0.0	0.0	0.0
Pb-rich	3.1	0.0	1.2	9.0	38.5	19.7	31.7	0.0	0.0	0.0	0.0
Misc.	0.8	0.0	10.5	23.4	56.6	9.4	0.0	0.0	0.0	0.0	0.0
Na-rich	0.8	0.0	2.9	28.2	28.9	40.0	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.7	0.0	0.6	6.5	31.6	43.0	18.3	0.0	0.0	0.0	0.0
C-rich	0.7	0.5	21.4	67.5	8.7	1.9	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.7	0.2	3.3	9.6	82.1	4.8	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.7	0.1	2.3	30.6	29.5	37.5	0.0	0.0	0.0	0.0	0.0
Si-rich	0.6	0.0	0.0	0.0	0.0	5.7	94.3	0.0	0.0	0.0	0.0
Cu/S-rich	0.4	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.3	0.0	0.0	7.8	17.0	75.2	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.2	0.0	0.0	0.0	62.2	37.8	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.1	0.0	0.0	39.7	8.1	52.1	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.1	0.0	4.8	0.0	59.9	35.3	0.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.0	0.0	37.2	0.0	62.8	0.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.8	4.1	9.7	8.3	17.3	31.2	28.5	0.0	0.0

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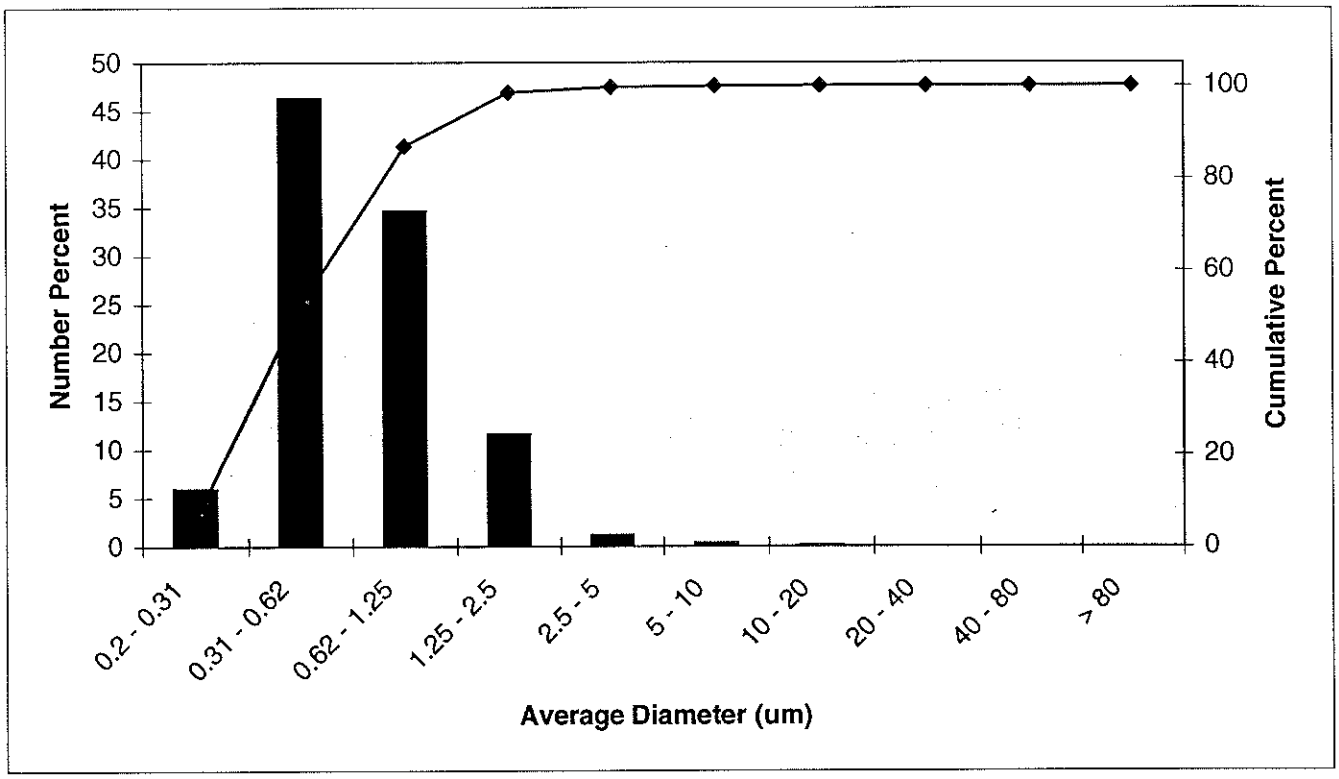
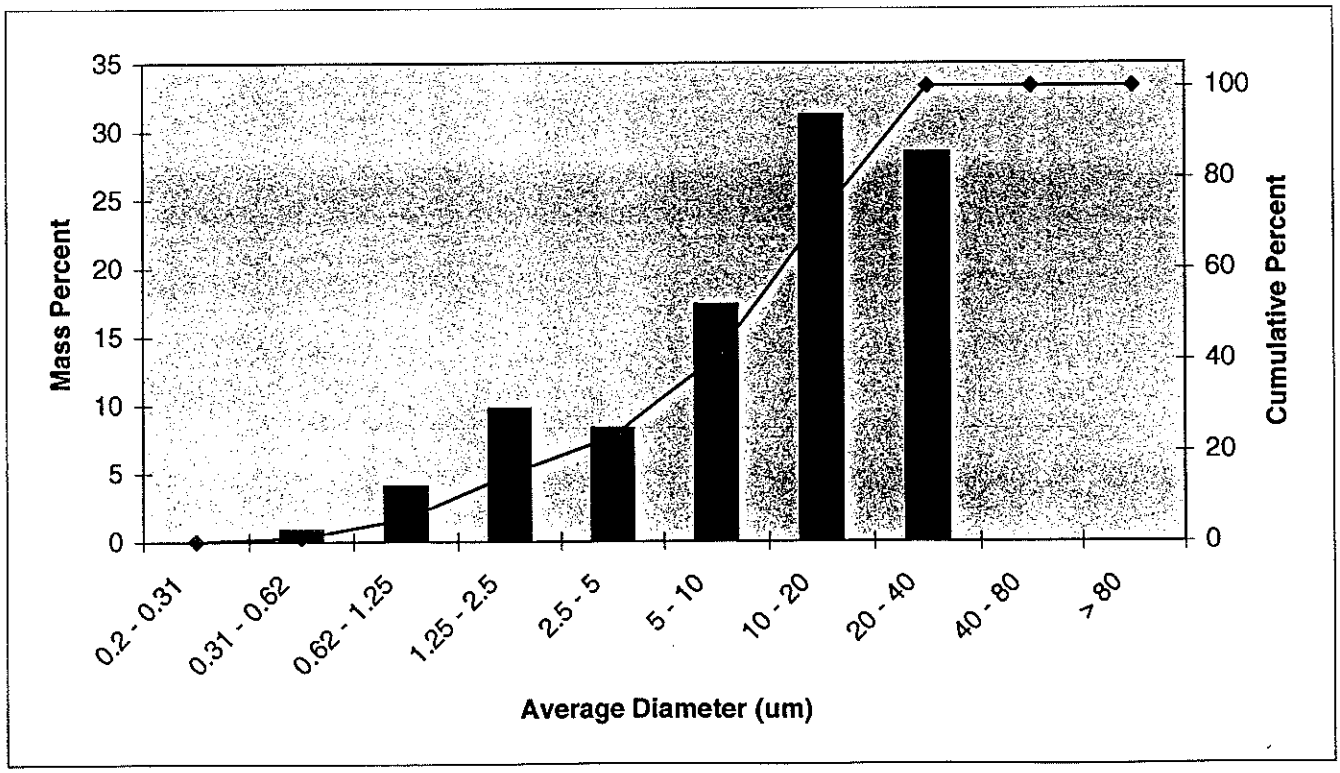
PH 724/325-1776 FAX 724/733-1799

Stack 2 Run 1-1, Beaker (617094)





RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name	NPN Environ
Client_Number	Stack 2 Run 1-2
Project_Number	ESH004050
Sample_Number	617095
Comment	Beaker

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb-rich	151	12.15	24.81
Pb/Cl-rich	81	6.67	20.40
Sn/Pb-rich	12	0.51	16.44
Na/S-rich	20	0.26	7.30
Zn/Cl-rich	58	4.09	6.47
Cu/Sn-rich	29	0.73	4.13
Na/Cl-rich	49	5.02	3.63
Al-rich	71	8.81	3.37
Pb/Cl/Sn-rich	16	0.91	3.06
Si/Al-rich	44	2.16	2.51
C-rich	304	51.27	2.12
Zn-rich	33	3.26	1.33
Cu-rich	4	0.23	1.18
Si-rich	14	0.36	1.02
Zn/Sn-rich	9	0.64	0.78
Misc.	26	1.39	0.62
Zn/S-rich	2	0.03	0.35
Fe-rich	7	0.62	0.12
Ca-rich	5	0.24	0.11
Na-rich	2	0.20	0.11
Al/S-rich	4	0.23	0.11
Sn-rich	2	0.20	0.02
Si/Mg-rich	1	0.01	0.02
Totals	944	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb-rich	12.1	0.0	31.0	40.3	21.6	5.8	1.0	0.3	0.0	0.0	0.0
Pb/Cl-rich	6.7	0.0	8.5	70.5	13.9	5.0	1.8	0.4	0.0	0.0	0.0
Sn/Pb-rich	0.5	0.0	37.0	37.0	5.2	7.8	7.8	5.2	0.0	0.0	0.0
Na/S-rich	0.3	0.0	0.0	0.0	10.0	45.0	35.0	5.0	5.0	0.0	0.0
Zn/Cl-rich	4.1	4.6	46.0	36.8	3.2	8.1	0.6	0.6	0.0	0.0	0.0
Cu/Sn-rich	0.7	0.0	0.0	25.7	43.7	21.6	9.0	0.0	0.0	0.0	0.0
Na/Cl-rich	5.0	15.0	71.2	7.5	1.1	3.7	1.3	0.3	0.0	0.0	0.0
Al-rich	8.8	10.7	40.6	42.7	3.2	2.1	0.6	0.2	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.9	0.0	20.6	61.9	7.3	5.8	4.4	0.0	0.0	0.0	0.0
Si/Al-rich	2.2	0.0	26.2	17.5	42.3	10.4	3.7	0.0	0.0	0.0	0.0
C-rich	51.3	5.9	63.5	25.3	4.8	0.5	0.0	0.0	0.0	0.0	0.0
Zn-rich	3.3	6.4	46.3	34.7	7.8	3.2	1.6	0.0	0.0	0.0	0.0
Cu-rich	0.2	0.0	82.6	0.0	0.0	5.8	11.6	0.0	0.0	0.0	0.0
Si-rich	0.4	0.0	0.0	52.3	14.7	25.7	7.3	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.6	0.0	58.5	29.2	0.0	10.3	2.1	0.0	0.0	0.0	0.0
Misc.	1.4	0.0	13.5	54.0	21.1	11.4	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0	0.0
Fe-rich	0.6	0.0	30.5	61.0	6.4	2.1	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.2	0.0	78.1	0.0	5.5	16.5	0.0	0.0	0.0	0.0	0.0
Na-rich	0.2	0.0	0.0	0.0	93.4	6.6	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.2	0.0	0.0	82.6	5.8	11.6	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.2	93.4	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	5.3	49.5	32.4	8.7	3.1	0.8	0.2	0.0	0.0	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

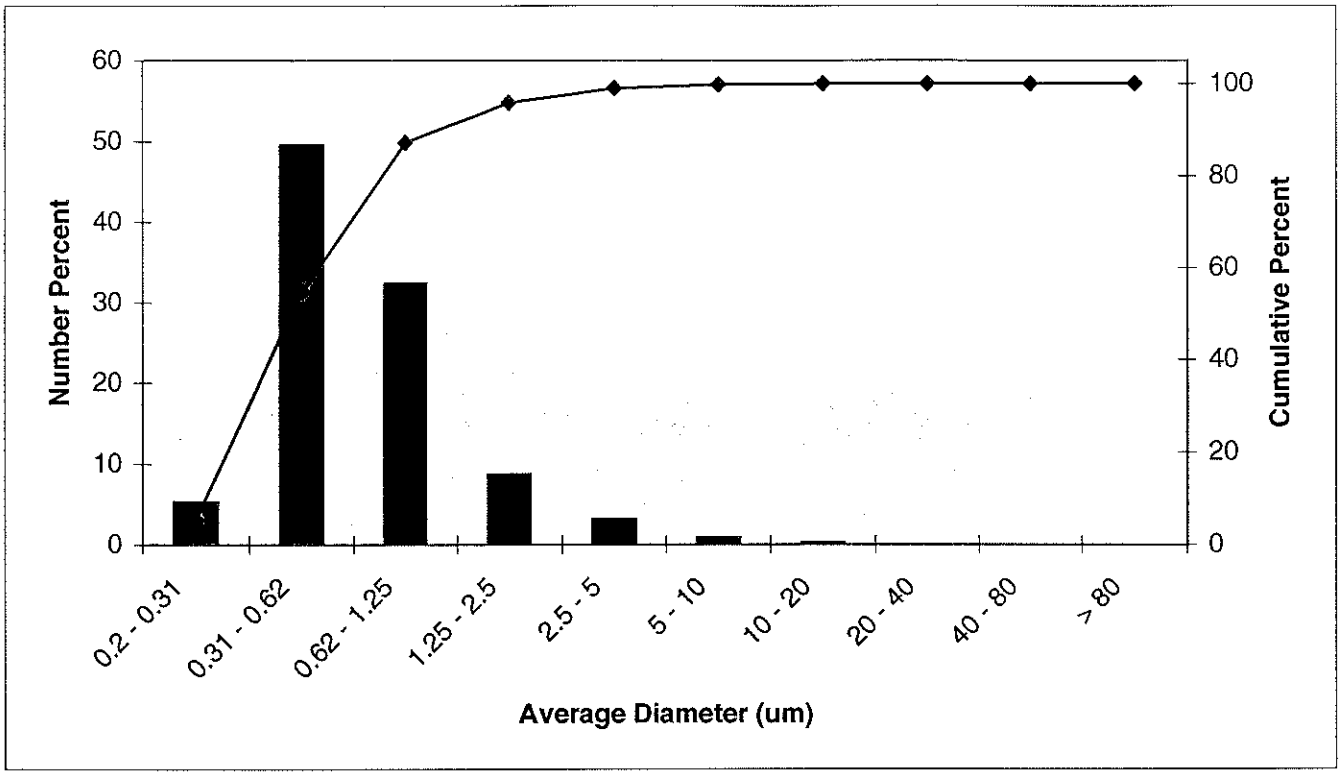
Client_Name	NPN Environ
Client_Number	Stack 2 Run 1-2
Project_Number	ESH004050
Sample_Number	617095
Comment	Beaker

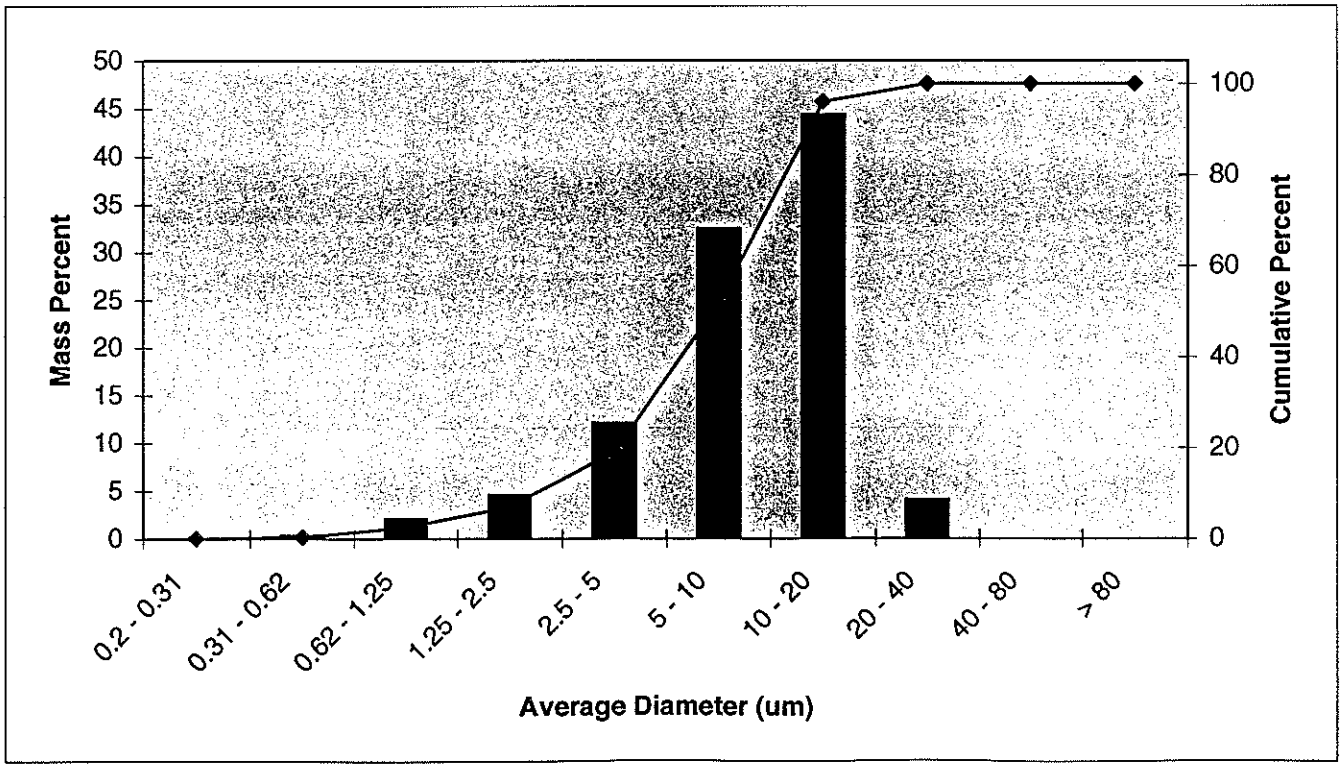
Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb-rich	24.8	0.0	0.2	1.9	7.0	13.2	22.2	55.3	0.0	0.0	0.0
Pb/Cl-rich	20.4	0.0	0.0	2.4	2.8	9.8	39.7	45.2	0.0	0.0	0.0
Sn/Pb-rich	16.4	0.0	0.0	0.0	0.3	1.9	16.1	81.7	0.0	0.0	0.0
Na/S-rich	7.3	0.0	0.0	0.0	0.2	4.3	20.6	19.1	55.8	0.0	0.0
Zn/Cl-rich	6.5	0.0	0.2	1.5	2.1	20.8	10.1	65.3	0.0	0.0	0.0
Cu/Sn-rich	4.1	0.0	0.0	0.5	6.2	15.9	77.4	0.0	0.0	0.0	0.0
Na/Cl-rich	3.6	0.0	0.5	0.2	1.0	10.9	56.1	31.3	0.0	0.0	0.0
Al-rich	3.4	0.0	0.8	4.0	5.1	18.3	35.5	36.1	0.0	0.0	0.0
Pb/Cl/Sn-rich	3.1	0.0	0.1	1.4	2.6	10.4	85.6	0.0	0.0	0.0	0.0
Si/Al-rich	2.5	0.0	0.1	0.5	13.3	24.7	61.3	0.0	0.0	0.0	0.0
C-rich	2.1	0.2	8.7	28.8	34.3	28.1	0.0	0.0	0.0	0.0	0.0
Zn-rich	1.3	0.0	1.0	2.9	7.6	26.1	62.4	0.0	0.0	0.0	0.0
Cu-rich	1.2	0.0	0.0	0.0	0.0	5.0	95.0	0.0	0.0	0.0	0.0
Si-rich	1.0	0.0	0.0	0.2	3.0	27.6	69.2	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.8	0.0	0.3	4.2	0.0	31.7	63.8	0.0	0.0	0.0	0.0
Misc.	0.6	0.0	0.1	5.2	27.2	67.5	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	0.4	0.0	0.0	0.0	3.1	0.0	96.9	0.0	0.0	0.0	0.0
Fe-rich	0.1	0.0	0.4	32.6	39.7	27.3	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.1	0.0	1.4	0.0	11.0	87.6	0.0	0.0	0.0	0.0	0.0
Na-rich	0.1	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.1	0.0	0.0	5.3	8.7	86.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.0	2.6	0.0	0.0	0.0	97.4	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.3	2.1	4.6	12.1	32.5	44.4	4.1	0.0	0.0

RJ Lee *Group*, Inc
350 Hochberg Road, Monroeville, PA 15146
PH 724/325-1776 FAX 724/733-1799

Stack 2 Run 1-2, Beaker (617095)





RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name	NPN Environ
Client_Number	Stack 2 Run 1
Project_Number	ESH004050
Sample_Number	617105
Comment	Filter

Table 1 - Abundance

Classes	#	Number %	Wt %
Al-rich	481	60.97	38.93
Pb/Cl-rich	113	3.37	33.52
Na/Cl-rich	178	5.58	15.72
Pb-rich	43	4.57	3.43
Zn/Cl-rich	46	3.32	3.14
Misc.	33	5.58	1.96
C-rich	73	13.95	1.23
Al/S-rich	24	2.22	0.99
Zn-rich	2	0.20	0.73
Zn/S-rich	4	0.04	0.18
Si/Al-rich	1	0.19	0.07
Fe-rich	1	0.01	0.06
Sn/Pb-rich	1	0.01	0.03
Totals	1000	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Al-rich	61.0	2.9	33.5	50.4	12.0	1.0	0.1	0.0	0.0	0.0	0.0
Pb/Cl-rich	3.4	0.0	11.3	39.7	35.8	11.6	0.8	0.8	0.0	0.0	0.0
Na/Cl-rich	5.6	6.8	17.1	27.4	36.5	10.8	1.4	0.0	0.0	0.0	0.0
Pb-rich	4.6	0.0	8.4	62.7	27.4	1.5	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	3.3	0.0	11.5	40.3	43.5	4.5	0.3	0.0	0.0	0.0	0.0
Misc.	5.6	0.0	37.7	44.5	17.3	0.3	0.2	0.0	0.0	0.0	0.0
C-rich	13.9	2.7	50.7	43.8	2.7	0.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	2.2	0.0	25.9	51.7	19.6	2.8	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.2	0.0	0.0	0.0	95.6	0.0	4.4	0.0	0.0	0.0	0.0
Zn/S-rich	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.2	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	2.5	32.3	47.8	15.3	1.9	0.2	0.0	0.0	0.0	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

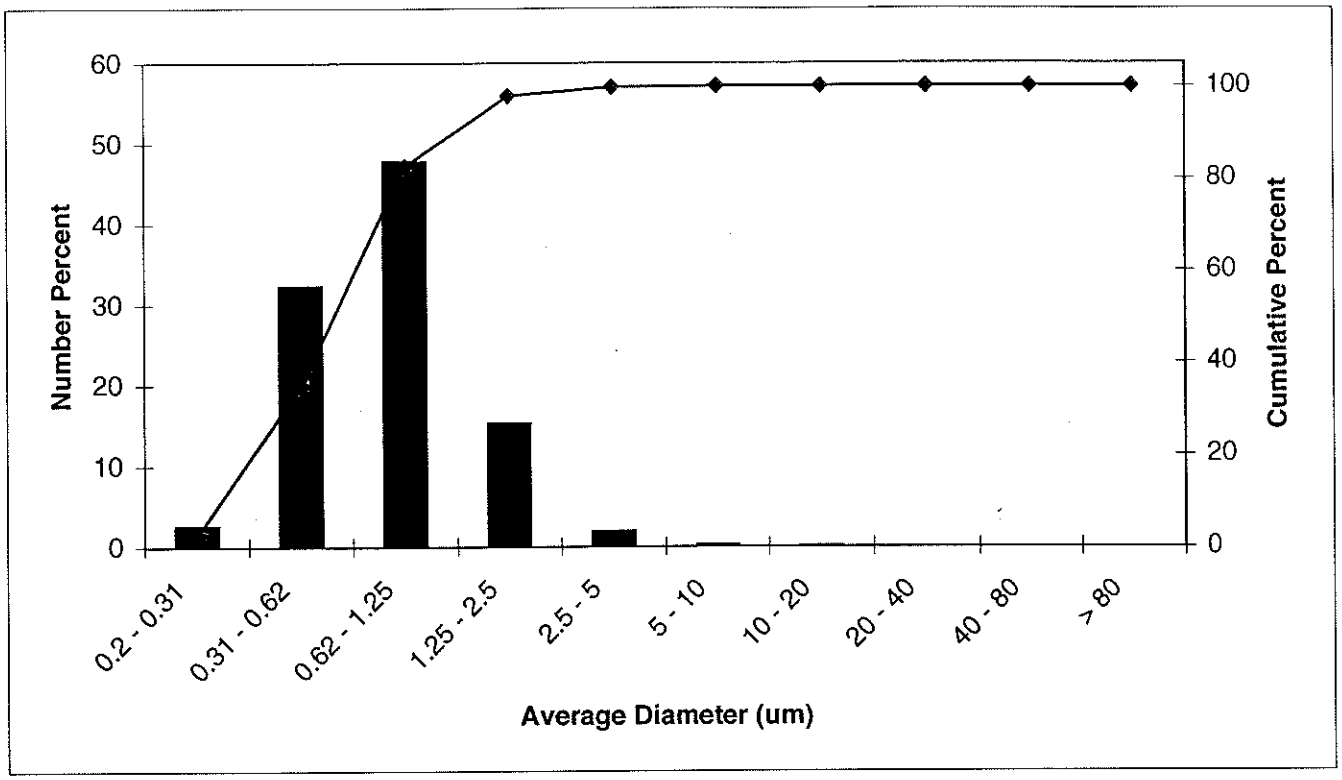
Client_Name NPN Environ
Client_Number Stack 2 Run 1
Project_Number ESH004050
Sample_Number 617105
Comment Filter

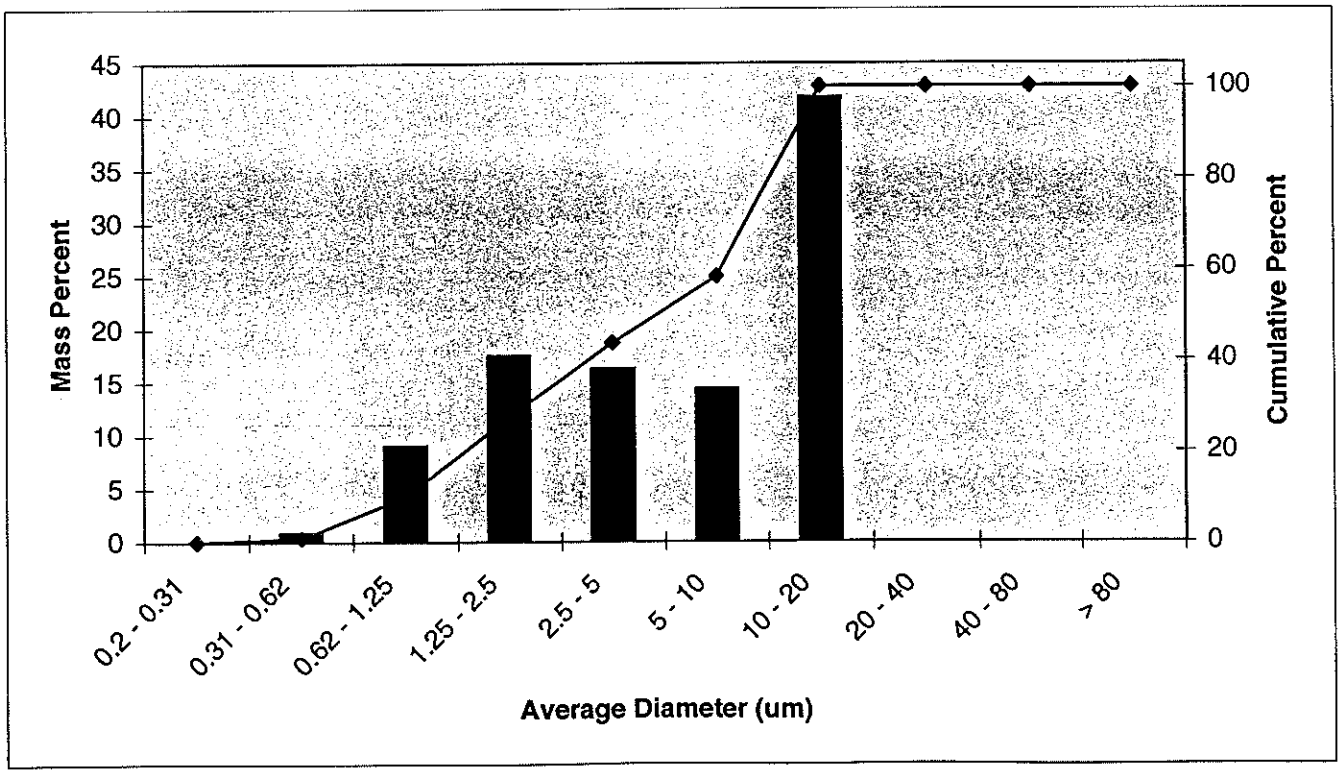
Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Al-rich	38.9	0.0	1.3	13.5	17.5	10.7	5.4	51.6	0.0	0.0	0.0
Pb/Cl-rich	33.5	0.0	0.0	1.4	7.9	14.5	11.4	64.8	0.0	0.0	0.0
Na/Cl-rich	15.7	0.0	0.1	2.8	19.1	30.6	47.3	0.0	0.0	0.0	0.0
Pb-rich	3.4	0.0	0.3	27.2	57.2	15.3	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	3.1	0.0	0.2	7.8	45.8	40.1	6.2	0.0	0.0	0.0	0.0
Misc.	2.0	0.0	2.7	29.9	44.9	10.6	12.0	0.0	0.0	0.0	0.0
C-rich	1.2	0.2	15.9	73.6	10.2	0.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	1.0	0.0	1.8	16.1	43.8	38.3	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.7	0.0	0.0	0.0	9.5	0.0	90.5	0.0	0.0	0.0	0.0
Zn/S-rich	0.2	0.0	0.0	0.0	30.4	69.6	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-rich	0.1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.8	9.1	17.5	16.3	14.4	41.8	0.0	0.0	0.0

RJ Lee *Group*, Inc
350 Hochberg Road, Monroeville, PA 15146
PH 724/325-1776 FAX 724/733-1799

Stack 2 Run 1, Filter (617105)





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724/325-1776 • 724/733-1799-FAX

Client_Name	NPN ENVIRO
Client_Number	Stack 2 Run 2
Project_Number	ESH004050
Sample_Number	617096
Comment	Beaker

Table 1 - Abundance

Classes	#	Number %	Wt %
Si-rich	53	4.27	49.02
Na/S-rich	52	2.53	34.76
Na/Cl-rich	33	7.48	3.29
Si/Al-rich	56	7.05	2.80
Fe/Cr-rich	2	0.31	2.53
C-rich	131	23.78	1.75
Zn-rich	16	0.55	1.71
Pb-rich	31	5.95	1.00
Zn/Sn-rich	2	0.07	0.73
Zn/S-rich	2	0.07	0.46
Al-rich	96	25.27	0.43
Ca-rich	30	4.69	0.31
Zn/Cl-rich	2	0.31	0.23
Misc.	21	4.63	0.22
Pb/Cl/Sn-rich	1	0.03	0.22
Fe-rich	22	4.66	0.20
Pb/Cl-rich	2	0.31	0.09
Na-rich	4	0.38	0.09
Sn-rich	7	1.95	0.07
Cu-rich	4	0.87	0.04
Al/S-rich	18	4.77	0.02
Si/Mg-rich	2	0.07	0.02
Totals	587	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Si-rich	4.3	0.0	6.5	13.0	52.9	16.2	7.3	2.4	1.6	0.0	0.0
Na/S-rich	2.5	0.0	0.0	33.0	12.3	26.0	19.1	6.8	2.7	0.0	0.0
Na/Cl-rich	7.5	3.7	85.6	7.4	0.5	1.4	0.9	0.5	0.0	0.0	0.0
Si/Al-rich	7.1	0.0	27.6	31.6	29.6	8.3	2.4	0.5	0.0	0.0	0.0
Fe/Cr-rich	0.3	0.0	0.0	89.0	0.0	0.0	0.0	11.0	0.0	0.0	0.0
C-rich	23.8	4.7	46.8	26.9	16.2	3.9	1.5	0.0	0.0	0.0	0.0
Zn-rich	0.6	0.0	0.0	0.0	18.8	50.0	31.3	0.0	0.0	0.0	0.0
Pb-rich	5.9	4.7	42.1	37.4	10.5	4.1	1.2	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Zn/S-rich	0.1	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0
Al-rich	25.3	12.2	65.0	19.8	2.5	0.4	0.1	0.0	0.0	0.0	0.0
Ca-rich	4.7	0.0	29.7	59.3	2.9	8.1	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.3	89.0	0.0	0.0	0.0	0.0	11.0	0.0	0.0	0.0	0.0
Misc.	4.6	0.0	66.2	24.1	6.8	3.0	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Fe-rich	4.7	6.0	65.7	23.9	1.5	3.0	0.0	0.0	0.0	0.0	0.0
Pb/Cl-rich	0.3	0.0	0.0	89.0	0.0	11.0	0.0	0.0	0.0	0.0	0.0
Na-rich	0.4	0.0	0.0	72.9	18.1	9.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	1.9	0.0	42.9	42.9	14.3	0.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.9	0.0	64.0	32.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	4.8	0.0	87.6	11.7	0.0	0.7	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.1	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	5.3	51.8	25.3	10.8	4.5	1.8	0.4	0.1	0.0	0.0

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Client_Name	NPN ENVIRO
Client_Number	Stack 2 Run 2
Project_Number	ESH004050
Sample_Number	617096
Comment	Beaker

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Si-rich	49.0	0.0	0.0	0.0	0.3	0.9	3.4	10.3	85.0	0.0	0.0
Na/S-rich	34.8	0.0	0.0	0.0	0.2	1.7	9.1	13.2	75.8	0.0	0.0
Na/Cl-rich	3.3	0.0	0.3	0.2	0.2	2.2	7.6	89.5	0.0	0.0	0.0
Si/Al-rich	2.8	0.0	0.1	1.1	7.8	14.5	46.2	30.4	0.0	0.0	0.0
Fe/Cr-rich	2.5	0.0	0.0	0.1	0.0	0.0	0.0	99.9	0.0	0.0	0.0
C-rich	1.8	0.0	1.2	4.2	15.4	31.6	47.6	0.0	0.0	0.0	0.0
Zn-rich	1.7	0.0	0.0	0.0	1.6	14.7	83.7	0.0	0.0	0.0	0.0
Pb-rich	1.0	0.0	0.8	6.4	9.2	32.0	51.6	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.7	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Zn/S-rich	0.5	0.0	0.0	0.0	0.0	2.5	97.5	0.0	0.0	0.0	0.0
Al-rich	0.4	0.3	8.0	9.0	11.2	11.1	60.3	0.0	0.0	0.0	0.0
Ca-rich	0.3	0.0	0.8	8.4	9.9	80.8	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.2	0.1	0.0	0.0	0.0	0.0	99.9	0.0	0.0	0.0	0.0
Misc.	0.2	0.0	4.3	4.6	23.7	67.5	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.2	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Fe-rich	0.2	0.1	3.3	13.7	9.6	73.4	0.0	0.0	0.0	0.0	0.0
Pb/Cl-rich	0.1	0.0	0.0	15.2	0.0	84.8	0.0	0.0	0.0	0.0	0.0
Na-rich	0.1	0.0	0.0	1.4	17.2	81.4	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.1	0.0	2.9	20.4	76.7	0.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.0	0.0	6.1	29.4	0.0	64.5	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.0	0.0	27.7	29.4	0.0	42.9	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	59.3	40.7	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.1	0.3	1.1	3.5	11.1	16.0	68.0	0.0	0.0

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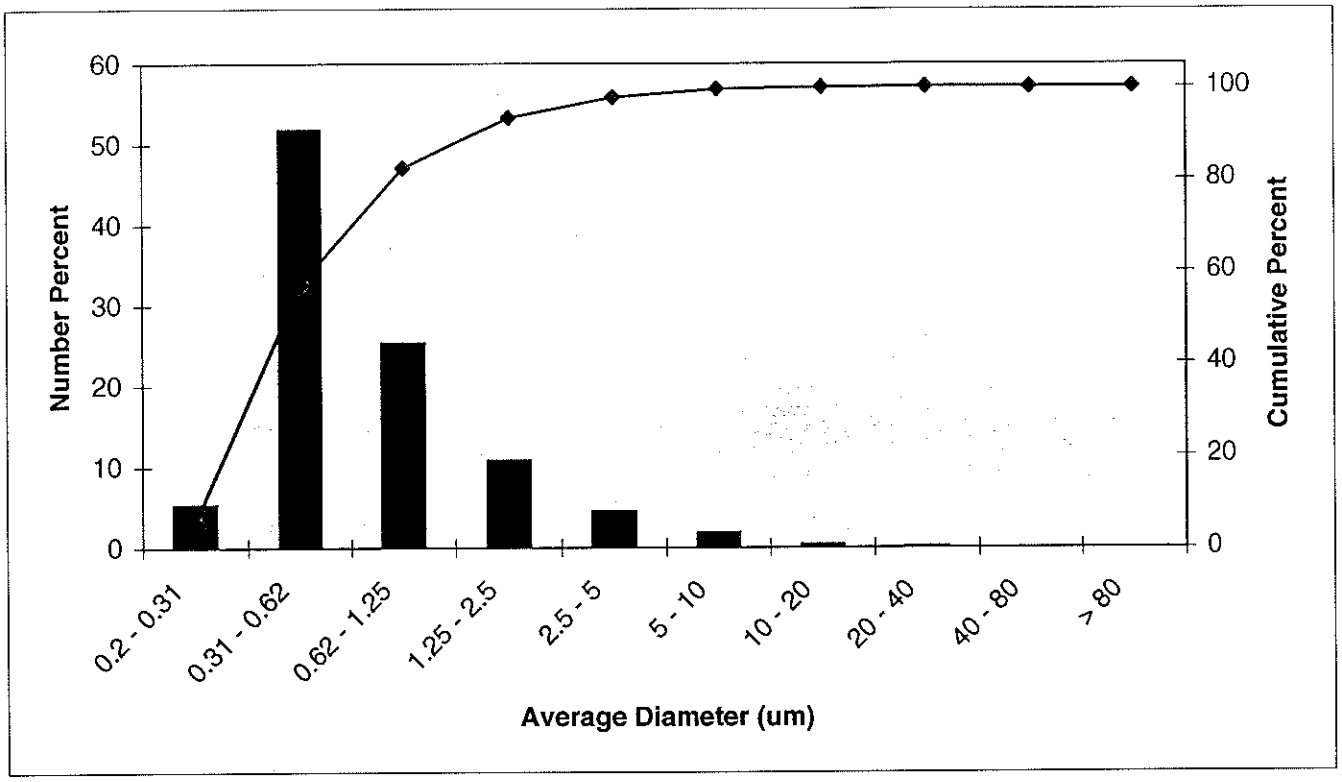
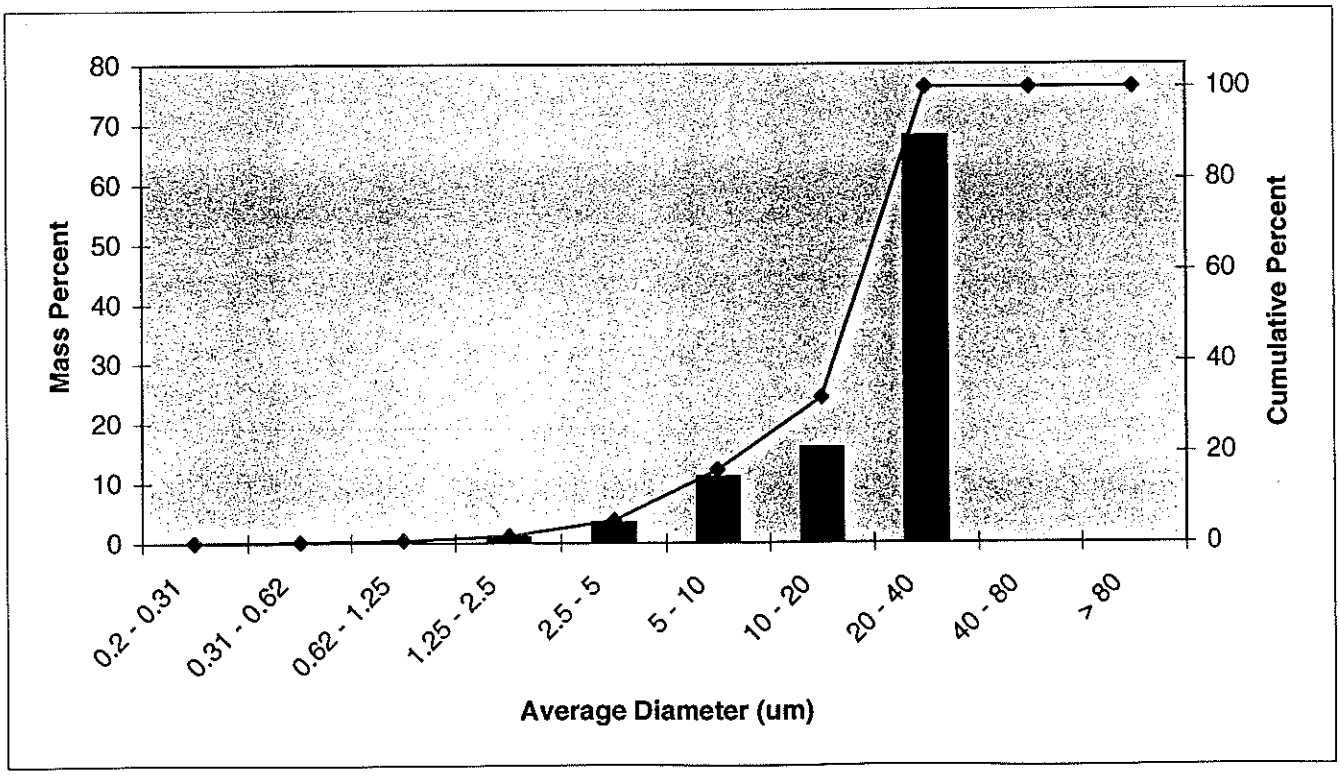
Stack 2 Run 2, Beaker (617096)





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Client_Name	NPN ENVIRO
Client_Number	Stack 2 Run 2
Project_Number	ESH004050
Sample_Number	617106
Comment	Filter

Table 1 - Abundance

Classes	#	Number %	Wt %
Sn/Pb-rich	79	2.54	56.10
Pb/Cl/Sn-rich	157	4.29	31.25
Pb-rich	203	25.69	4.40
Pb/Cl-rich	99	10.43	3.21
C-rich	277	51.72	1.96
Si/Al-rich	9	0.02	1.61
Misc.	19	1.22	0.45
Si-rich	7	0.02	0.30
Na/Cl-rich	15	0.82	0.15
Al-rich	18	2.39	0.15
Zn/Sn-rich	9	0.02	0.12
Zn/Cl-rich	7	0.02	0.12
Na/S-rich	8	0.02	0.10
Na-rich	6	0.01	0.04
Al/S-rich	5	0.79	0.02
Cu/Sn-rich	1	0.00	0.01
Sn-rich	1	0.00	0.01
Ca-rich	1	0.00	0.00
Totals	921	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Sn/Pb-rich	2.5	0.0	54.6	31.2	10.2	3.4	0.6	0.0	0.1	0.0	0.0
Pb/Cl/Sn-rich	4.3	4.6	23.0	46.1	21.6	3.8	0.6	0.2	0.0	0.0	0.0
Pb-rich	25.7	8.5	57.7	30.8	2.7	0.3	0.0	0.0	0.0	0.0	0.0
Pb/Cl-rich	10.4	13.6	43.6	39.8	2.5	0.5	0.0	0.0	0.0	0.0	0.0
C-rich	51.7	21.2	65.7	11.5	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.0	0.0	0.0	0.0	33.3	33.3	22.2	11.1	0.0	0.0	0.0
Misc.	1.2	16.2	48.7	0.0	33.7	1.4	0.0	0.0	0.0	0.0	0.0
Si-rich	0.0	0.0	0.0	0.0	0.0	71.4	28.6	0.0	0.0	0.0	0.0
Na/Cl-rich	0.8	0.0	72.5	24.2	2.7	0.6	0.0	0.0	0.0	0.0	0.0
Al-rich	2.4	49.7	33.1	16.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.0	0.0	0.0	0.0	22.2	77.8	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.0	0.0	0.0	0.0	57.1	42.9	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Na-rich	0.0	0.0	0.0	0.0	83.3	16.7	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.8	24.9	74.8	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	16.3	58.3	21.4	3.4	0.5	0.1	0.0	0.0	0.0	0.0

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Client_Name	NPN ENVIRO
Client_Number	Stack 2 Run 2
Project_Number	ESH004050
Sample_Number	617106
Comment	Filter

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Sn/Pb-rich	56.1	0.0	0.1	0.6	0.8	2.8	3.3	0.0	92.4	0.0	0.0
Pb/Cl/Sn-rich	31.3	0.0	0.2	2.1	5.5	10.4	10.2	71.6	0.0	0.0	0.0
Pb-rich	4.4	0.3	10.2	35.2	28.7	21.6	4.0	0.0	0.0	0.0	0.0
Pb/Cl-rich	3.2	0.2	5.8	32.6	26.0	28.2	7.2	0.0	0.0	0.0	0.0
C-rich	2.0	2.5	29.1	34.0	27.7	6.8	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	1.6	0.0	0.0	0.0	0.8	5.1	24.2	69.9	0.0	0.0	0.0
Misc.	0.5	0.2	3.8	0.0	71.5	24.5	0.0	0.0	0.0	0.0	0.0
Si-rich	0.3	0.0	0.0	0.0	0.0	16.9	83.1	0.0	0.0	0.0	0.0
Na/Cl-rich	0.1	0.0	3.5	29.0	29.3	38.2	0.0	0.0	0.0	0.0	0.0
Al-rich	0.1	4.0	10.8	38.3	25.3	21.7	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.1	0.0	0.0	0.0	8.6	91.4	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.1	0.0	0.0	0.0	17.3	82.7	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.1	0.0	0.0	0.0	20.8	79.2	0.0	0.0	0.0	0.0	0.0
Na-rich	0.0	0.0	0.0	0.0	69.9	30.1	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.0	3.5	54.9	0.0	41.6	0.0	0.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.1	1.4	4.4	5.3	7.5	6.1	23.5	51.8	0.0	0.0

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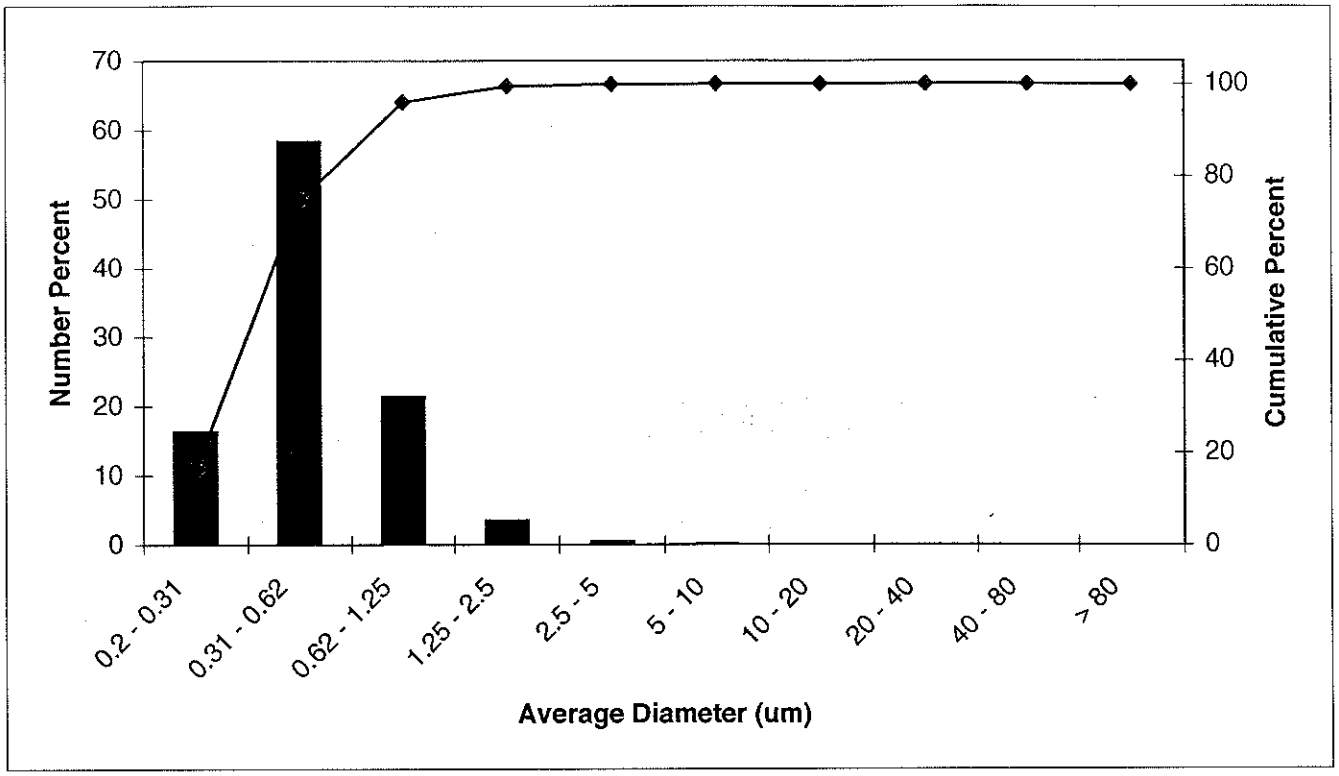
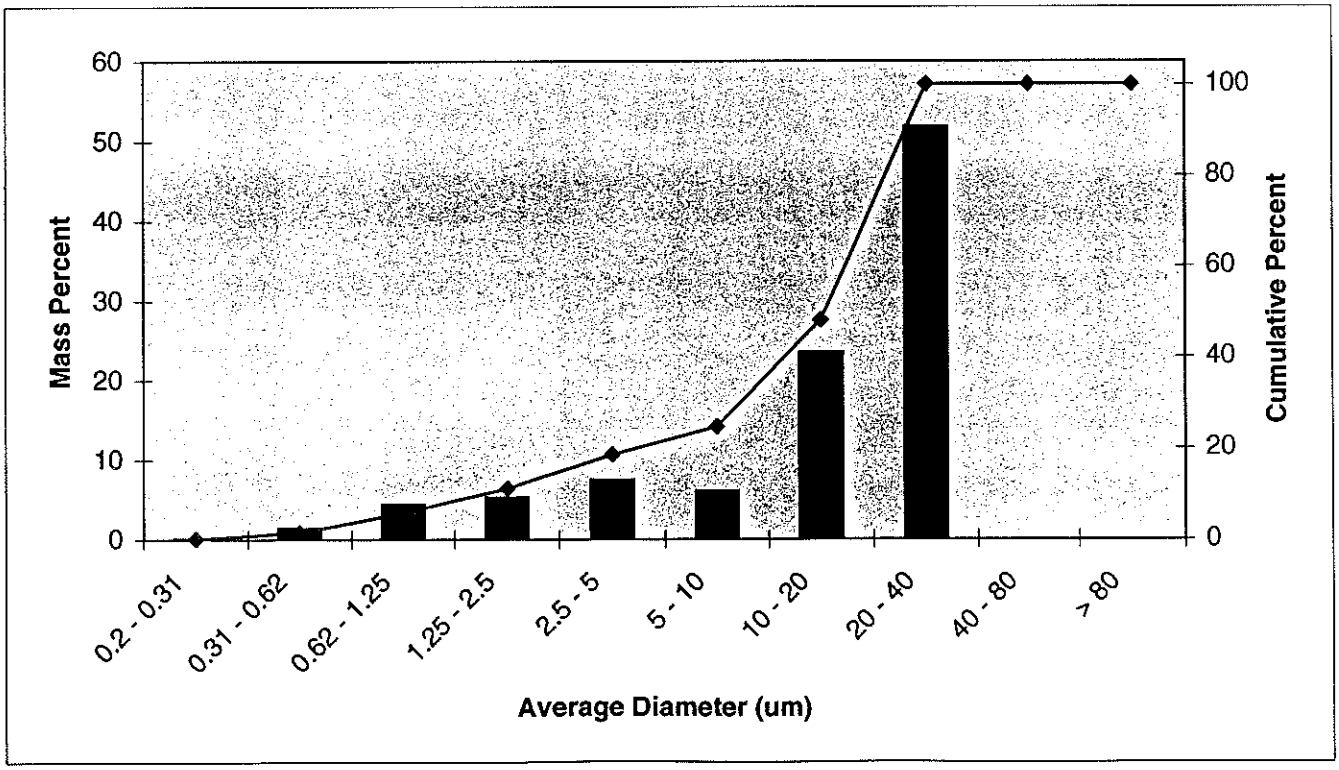
Stack 2 Run 2, Filter (617106)





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Client_Name	NPN Environ
Client_Number	Stack 3 Run 1
Project_Number	ESH004050
Sample_Number	617092
Comment	Beaker

Table 1 - Abundance

Classes	#	Number %	Wt %
Si/Al-rich	17	1.25	31.79
Pb/Cl-rich	224	11.98	20.78
Fe/Cr-rich	3	0.03	11.29
Pb/Cl/Sn-rich	80	2.08	10.11
Sn/Pb-rich	25	0.62	7.48
Zn/Cl-rich	95	7.96	5.29
Zn/S-rich	31	0.50	3.72
Cu/Sn-rich	10	0.10	2.06
Pb-rich	70	8.42	1.53
C-rich	306	54.51	1.37
Zn/Sn-rich	30	1.03	1.26
Misc.	24	1.50	1.15
Si-rich	9	0.09	0.67
Cu/S-rich	1	0.01	0.65
Fe-rich	11	0.65	0.33
Al-rich	45	6.91	0.31
Al/S-rich	2	0.02	0.08
Ca-rich	4	0.22	0.06
Cu-rich	2	0.02	0.03
Zn-rich	8	1.51	0.03
Na/Cl-rich	3	0.57	0.01
Totals	1000	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Si/Al-rich	1.2	0.0	60.6	15.1	16.8	4.2	2.5	0.0	0.8	0.0	0.0
Pb/Cl-rich	12.0	0.0	17.4	50.5	22.5	7.7	1.8	0.1	0.0	0.0	0.0
Fe/Cr-rich	0.0	0.0	0.0	0.0	0.0	33.3	0.0	66.7	0.0	0.0	0.0
Pb/Cl/Sn-rich	2.1	0.0	27.3	27.3	20.1	17.4	8.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.6	0.0	30.7	0.0	37.4	21.9	6.7	3.4	0.0	0.0	0.0
Zn/Cl-rich	8.0	7.1	42.8	38.0	7.4	4.0	0.5	0.1	0.0	0.0	0.0
Zn/S-rich	0.5	0.0	0.0	37.8	26.9	29.0	4.1	2.1	0.0	0.0	0.0
Cu/Sn-rich	0.1	0.0	0.0	0.0	20.0	60.0	10.0	10.0	0.0	0.0	0.0
Pb-rich	8.4	2.2	31.5	51.7	13.2	1.4	0.0	0.0	0.0	0.0	0.0
C-rich	54.5	13.2	65.3	18.7	2.5	0.3	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	1.0	0.0	36.9	18.4	27.5	16.2	1.0	0.0	0.0	0.0	0.0
Misc.	1.5	12.6	37.8	25.2	17.4	4.8	2.1	0.0	0.0	0.0	0.0
Si-rich	0.1	0.0	0.0	0.0	33.3	44.4	22.2	0.0	0.0	0.0	0.0
Cu/S-rich	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Fe-rich	0.7	0.0	0.0	87.2	6.4	6.4	0.0	0.0	0.0	0.0	0.0
Al-rich	6.9	19.2	52.1	24.7	3.3	0.8	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.2	0.0	0.0	85.9	9.4	4.7	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	1.5	0.0	62.5	37.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.6	0.0	66.7	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	9.4	51.1	28.4	7.7	2.7	0.6	0.1	0.0	0.0	0.0

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Client_Name	NPN Environ
Client_Number	Stack 3 Run 1
Project_Number	ESH004050
Sample_Number	617092
Comment	Beaker

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Si/Al-rich	31.8	0.0	0.0	0.0	0.4	0.5	3.3	0.0	95.8	0.0	0.0
Pb/Cl-rich	20.8	0.0	0.2	2.9	9.8	25.9	44.6	16.7	0.0	0.0	0.0
Fe/Cr-rich	11.3	0.0	0.0	0.0	0.0	0.1	0.0	99.9	0.0	0.0	0.0
Pb/Cl/Sn-rich	10.1	0.0	0.1	0.5	5.2	25.8	68.4	0.0	0.0	0.0	0.0
Sn/Pb-rich	7.5	0.0	0.1	0.0	1.8	9.6	28.2	60.3	0.0	0.0	0.0
Zn/Cl-rich	5.3	0.0	0.5	3.3	7.8	23.2	20.8	44.2	0.0	0.0	0.0
Zn/S-rich	3.7	0.0	0.0	0.2	3.6	12.0	12.2	72.1	0.0	0.0	0.0
Cu/Sn-rich	2.1	0.0	0.0	0.0	1.7	11.3	6.9	80.1	0.0	0.0	0.0
Pb-rich	1.5	0.0	1.8	23.9	42.0	32.2	0.0	0.0	0.0	0.0	0.0
C-rich	1.4	0.7	15.1	31.2	27.1	26.0	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	1.3	0.0	0.3	0.7	18.3	58.3	22.5	0.0	0.0	0.0	0.0
Misc.	1.2	0.0	0.3	3.1	18.8	12.2	65.6	0.0	0.0	0.0	0.0
Si-rich	0.7	0.0	0.0	0.0	3.0	11.1	85.9	0.0	0.0	0.0	0.0
Cu/S-rich	0.6	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Fe-rich	0.3	0.0	0.0	10.0	12.8	77.2	0.0	0.0	0.0	0.0	0.0
Al-rich	0.3	0.7	6.9	34.8	21.2	36.3	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.1	0.0	0.0	0.0	9.8	90.2	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.1	0.0	0.0	28.5	35.7	35.7	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.0	0.0	0.0	0.0	30.8	69.2	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.0	0.0	18.9	81.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.0	0.0	37.5	62.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.4	1.9	5.0	13.1	23.3	25.9	30.5	0.0	0.0

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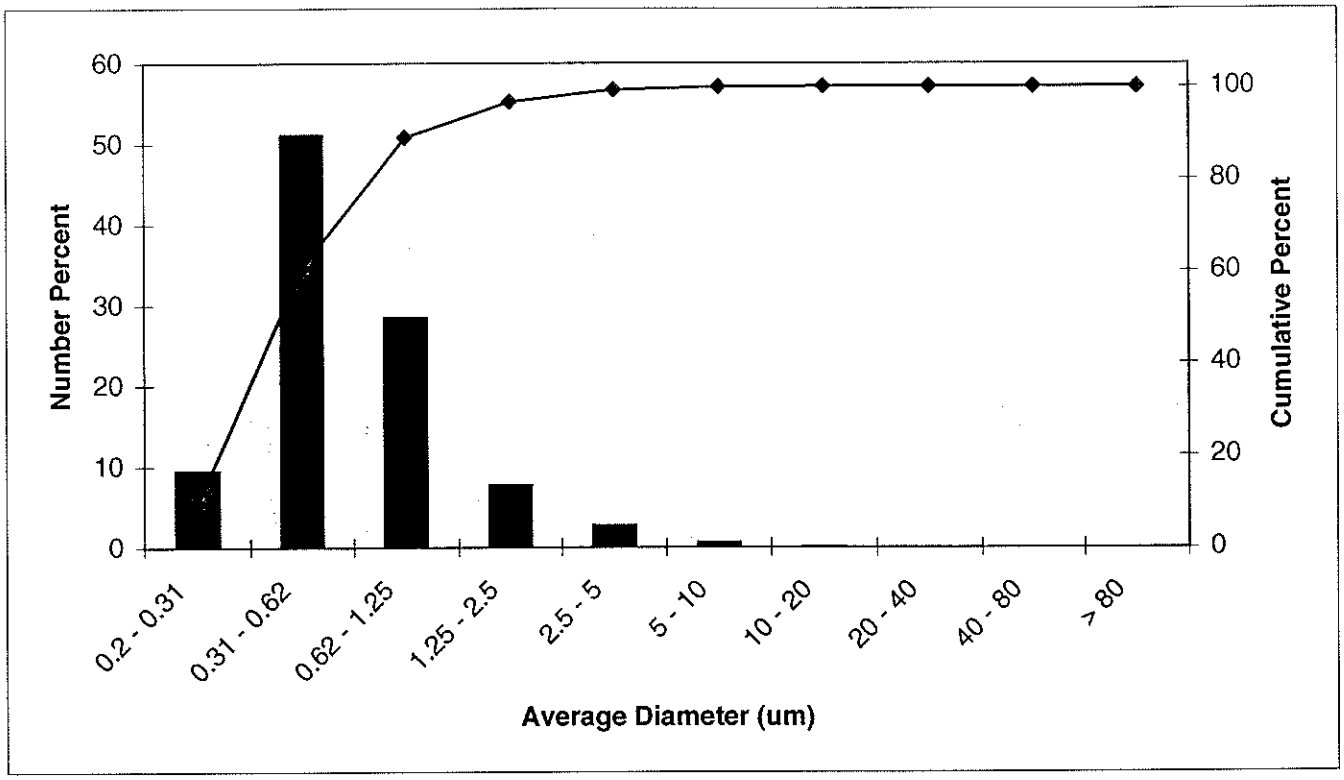
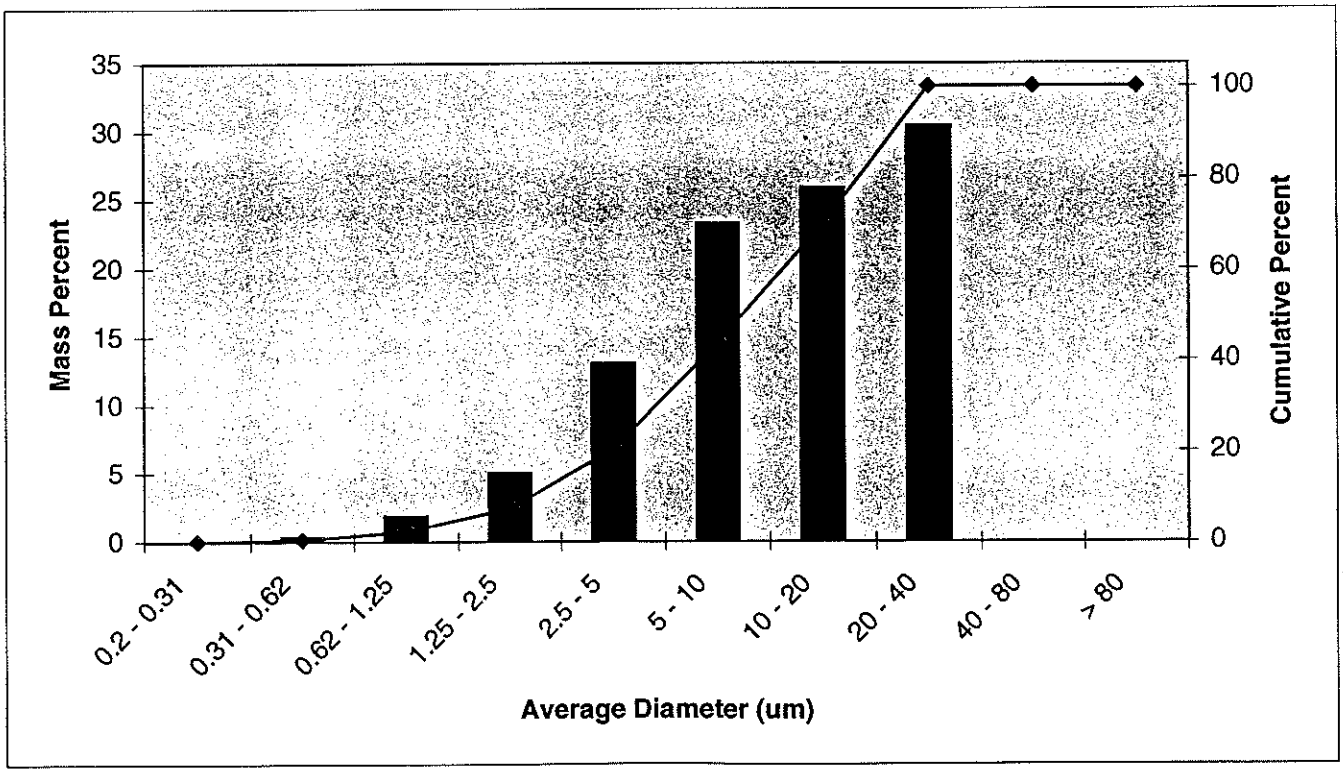
Stack 3 Run 1, Beaker (617092)





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Client_Name	NPN Environ
Client_Number	Stack 3 - 01
Project_Number	ESH004050
Sample_Number	617103
Comment	Filter

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb/Cl-rich	182	4.61	37.80
C-rich	394	73.62	18.77
Pb/Cl/Sn-rich	50	0.34	12.46
Pb-rich	83	9.78	11.72
Zn/Cl-rich	84	5.70	8.81
Zn/Sn-rich	14	0.24	3.65
Misc.	18	0.05	1.90
Al-rich	26	3.58	0.95
Cu/Sn-rich	8	0.02	0.90
Sn/Pb-rich	8	0.02	0.89
Si/Al-rich	12	0.23	0.84
Zn-rich	3	0.59	0.47
Zn/S-rich	8	0.02	0.41
Fe-rich	2	0.20	0.21
Al/S-rich	4	0.40	0.13
Na/Cl-rich	3	0.59	0.09
Totals	899	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	4.6	4.3	30.0	47.1	13.2	5.1	0.3	0.0	0.0	0.0	0.0
C-rich	73.6	8.4	70.1	19.3	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.3	0.0	0.0	58.4	17.0	19.5	5.1	0.0	0.0	0.0	0.0
Pb-rich	9.8	0.0	50.5	42.4	6.7	0.4	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	5.7	3.5	52.1	34.7	8.7	1.0	0.1	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.2	0.0	84.1	0.0	7.3	7.3	1.2	0.0	0.0	0.0	0.0
Misc.	0.1	0.0	0.0	0.0	55.6	38.9	5.6	0.0	0.0	0.0	0.0
Al-rich	3.6	16.6	60.7	22.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.0	0.0	0.0	0.0	12.5	87.5	0.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.0	0.0	0.0	0.0	62.5	37.5	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.2	0.0	0.0	86.2	6.3	7.5	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.6	0.0	33.3	33.3	33.3	0.0	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	0.0	0.0	0.0	0.0	62.5	37.5	0.0	0.0	0.0	0.0	0.0
Fe-rich	0.2	0.0	0.0	98.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.4	49.3	0.0	49.3	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.6	0.0	66.7	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	7.3	63.8	24.5	3.8	0.5	0.0	0.0	0.0	0.0	0.0

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Client_Name	NPN Environ
Client_Number	Stack 3 - 01
Project_Number	ESH004050
Sample_Number	617103
Comment	Filter

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	37.8	0.0	0.6	5.8	20.9	37.2	35.5	0.0	0.0	0.0	0.0
C-rich	18.8	0.6	25.3	41.8	30.9	1.4	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	12.5	0.0	0.0	4.5	9.5	29.9	56.1	0.0	0.0	0.0	0.0
Pb-rich	11.7	0.0	6.1	27.2	53.5	13.2	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	8.8	0.0	3.4	18.1	27.0	26.5	24.9	0.0	0.0	0.0	0.0
Zn/Sn-rich	3.6	0.0	0.7	0.0	7.7	21.0	70.5	0.0	0.0	0.0	0.0
Misc.	1.9	0.0	0.0	0.0	16.8	27.6	55.6	0.0	0.0	0.0	0.0
Al-rich	0.9	1.2	16.2	37.8	18.6	26.1	0.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.9	0.0	0.0	0.0	4.5	95.5	0.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.9	0.0	0.0	0.0	36.5	63.5	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.8	0.0	0.0	33.9	17.5	48.6	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.5	0.0	4.1	6.4	89.5	0.0	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	0.4	0.0	0.0	0.0	48.2	51.8	0.0	0.0	0.0	0.0	0.0
Fe-rich	0.2	0.0	0.0	84.8	15.2	0.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.1	1.2	0.0	37.4	61.4	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.1	0.0	52.6	47.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.1	6.2	16.3	25.6	25.5	26.2	0.0	0.0	0.0	0.0

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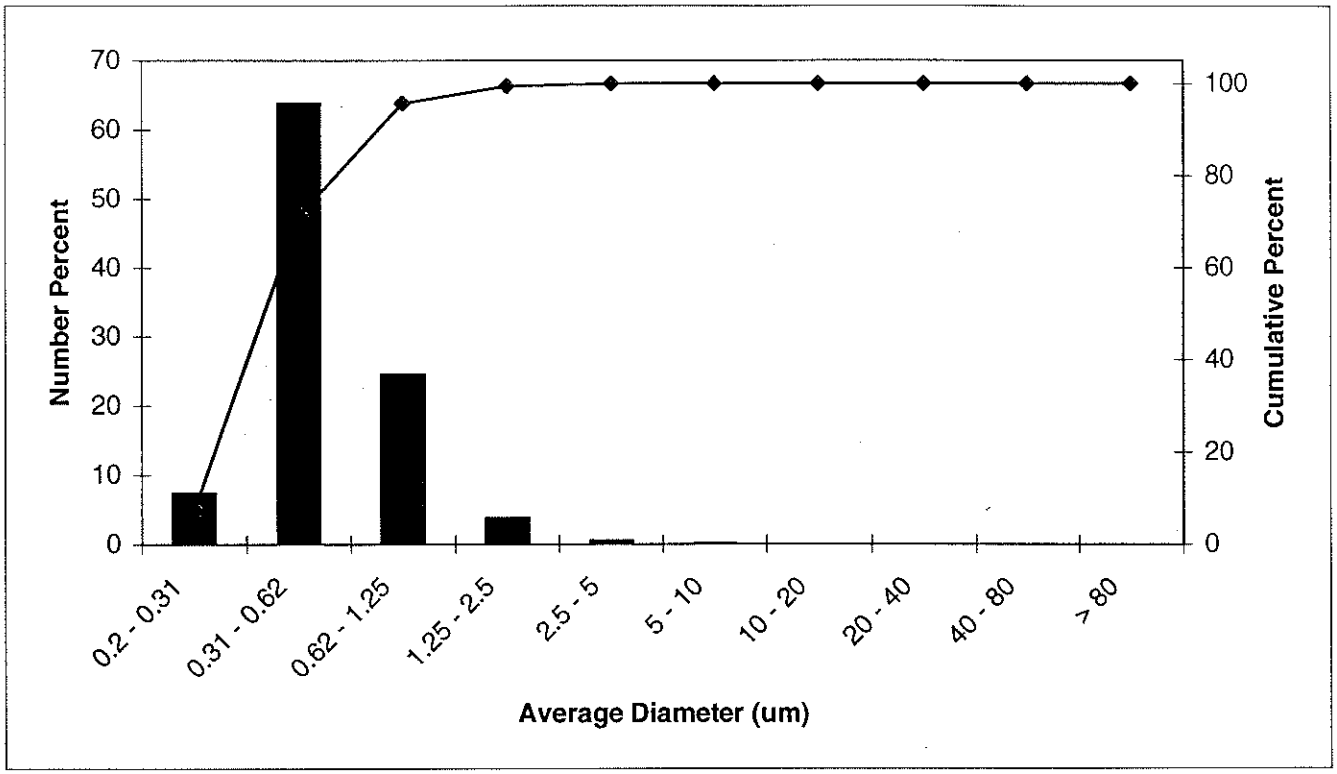
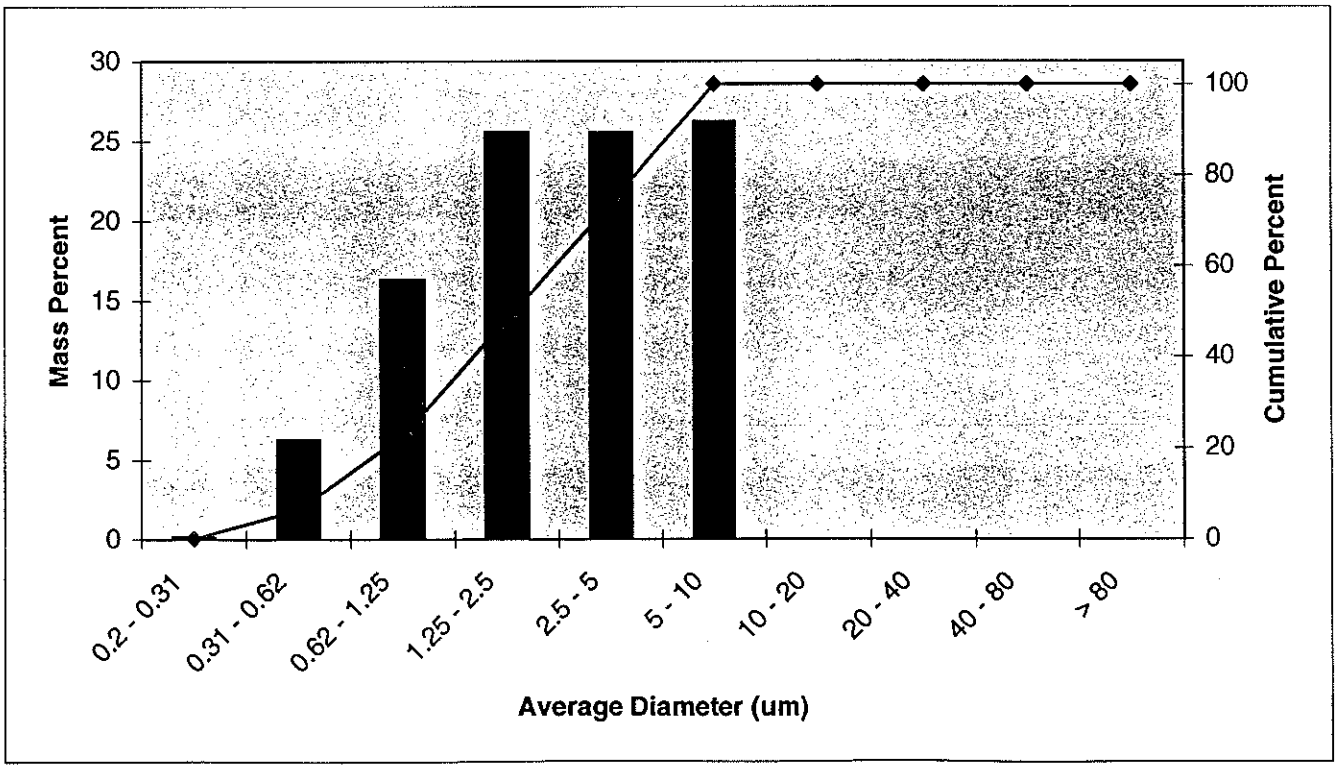
Stack 3 - 01, Filter (617103)





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Client_Name	NPN ENVIRO
Client_Number	STACK 3 RUN 2
Project_Number	ESH004050
Sample_Number	617093
Comment	BEAKER

Table 1 - Abundance

Classes	#	Number %	Wt %
Zn/S-rich	55	2.12	28.48
Pb/Cl-rich	175	11.06	16.19
Cu/Sn-rich	25	0.76	14.34
Pb-rich	70	7.60	9.09
Pb/Cl/Sn-rich	19	0.71	5.97
Zn/Cl-rich	65	3.68	5.33
Cu-rich	6	0.05	3.61
Ca-rich	3	0.02	3.14
C-rich	267	47.87	2.99
Si/Al-rich	10	0.08	2.82
Cu/S-rich	3	0.02	2.01
Zn/Sn-rich	13	0.66	1.35
Misc.	50	5.03	1.16
Sn/Pb-rich	8	0.07	1.14
Fe-rich	13	0.85	0.98
Na/Cl-rich	82	14.91	0.35
Al-rich	21	2.02	0.30
Si-rich	5	0.41	0.25
Zn-rich	8	0.25	0.25
Al/S-rich	15	1.42	0.11
Sn-rich	3	0.21	0.09
Si/Mg-rich	1	0.19	0.06
Totals	917	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Zn/S-rich	2.1	0.0	36.5	45.6	6.6	7.8	1.9	1.2	0.4	0.0	0.0
Pb/Cl-rich	11.1	0.0	31.4	54.1	7.9	4.9	1.6	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.8	0.0	50.8	25.4	8.7	5.4	3.3	6.5	0.0	0.0	0.0
Pb-rich	7.6	0.0	48.3	33.0	16.2	1.8	0.5	0.1	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.7	0.0	0.0	54.3	28.3	10.4	5.8	1.2	0.0	0.0	0.0
Zn/Cl-rich	3.7	5.2	42.0	26.2	20.7	4.3	1.1	0.4	0.0	0.0	0.0
Cu-rich	0.0	0.0	0.0	0.0	50.0	33.3	0.0	16.7	0.0	0.0	0.0
Ca-rich	0.0	0.0	0.0	0.0	33.3	0.0	33.3	33.3	0.0	0.0	0.0
C-rich	47.9	9.7	61.7	24.6	3.8	0.1	0.1	0.0	0.0	0.0	0.0
Si/Al-rich	0.1	0.0	0.0	0.0	10.0	50.0	20.0	20.0	0.0	0.0	0.0
Cu/S-rich	0.0	0.0	0.0	0.0	0.0	33.3	33.3	33.3	0.0	0.0	0.0
Zn/Sn-rich	0.7	0.0	0.0	0.0	92.5	5.0	2.5	0.0	0.0	0.0	0.0
Misc.	5.0	7.7	42.2	42.2	5.8	1.8	0.3	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.1	0.0	0.0	0.0	25.0	50.0	25.0	0.0	0.0	0.0	0.0
Fe-rich	0.8	0.0	45.6	22.8	22.8	6.8	1.9	0.0	0.0	0.0	0.0
Na/Cl-rich	14.9	1.3	71.2	27.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Al-rich	2.0	9.6	66.9	19.1	2.4	1.6	0.4	0.0	0.0	0.0	0.0
Si-rich	0.4	0.0	0.0	47.0	47.0	4.0	2.0	0.0	0.0	0.0	0.0
Zn-rich	0.3	0.0	77.0	0.0	9.9	9.9	3.3	0.0	0.0	0.0	0.0
Al/S-rich	1.4	13.6	54.5	27.2	2.9	1.7	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.2	92.1	0.0	0.0	0.0	7.9	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.2	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	6.0	54.8	30.1	6.7	1.6	0.5	0.2	0.0	0.0	0.0

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724/325-1776 • 724/733-1799-FAX

Client_Name	NPN ENVIRO
Client_Number	STACK 3 RUN 2
Project_Number	ESH004050
Sample_Number	617093
Comment	BEAKER

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Zn/S-rich	28.5	0.0	0.0	0.2	0.5	2.4	5.0	49.1	42.8	0.0	0.0
Pb/Cl-rich	16.2	0.0	0.4	3.8	5.7	26.3	63.8	0.0	0.0	0.0	0.0
Cu/Sn-rich	14.3	0.0	0.0	0.1	0.6	3.2	6.2	89.9	0.0	0.0	0.0
Pb-rich	9.1	0.0	0.4	2.1	8.7	10.6	15.1	63.1	0.0	0.0	0.0
Pb/Cl/Sn-rich	6.0	0.0	0.0	1.0	1.7	13.8	56.4	27.2	0.0	0.0	0.0
Zn/Cl-rich	5.3	0.0	0.5	1.9	7.4	15.6	28.5	46.0	0.0	0.0	0.0
Cu-rich	3.6	0.0	0.0	0.0	0.9	4.3	0.0	94.7	0.0	0.0	0.0
Ca-rich	3.1	0.0	0.0	0.0	0.3	0.0	7.6	92.0	0.0	0.0	0.0
C-rich	3.0	0.2	7.9	20.5	20.0	4.8	23.1	23.4	0.0	0.0	0.0
Si/Al-rich	2.8	0.0	0.0	0.0	0.2	5.1	11.7	82.9	0.0	0.0	0.0
Cu/S-rich	2.0	0.0	0.0	0.0	0.0	2.2	38.5	59.3	0.0	0.0	0.0
Zn/Sn-rich	1.4	0.0	0.0	0.0	22.7	9.9	67.4	0.0	0.0	0.0	0.0
Misc.	1.2	0.1	1.8	10.0	10.4	28.9	48.8	0.0	0.0	0.0	0.0
Sn/Pb-rich	1.1	0.0	0.0	0.0	2.5	32.5	65.0	0.0	0.0	0.0	0.0
Fe-rich	1.0	0.0	0.3	0.5	4.8	41.4	53.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.3	0.0	31.2	55.9	3.3	9.5	0.0	0.0	0.0	0.0	0.0
Al-rich	0.3	0.1	5.1	10.3	12.8	22.9	48.8	0.0	0.0	0.0	0.0
Si-rich	0.3	0.0	0.0	4.9	11.2	30.1	53.8	0.0	0.0	0.0	0.0
Zn-rich	0.2	0.0	0.4	0.0	7.6	54.5	37.6	0.0	0.0	0.0	0.0
Al/S-rich	0.1	0.3	6.3	23.1	25.3	45.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.1	0.8	0.0	0.0	0.0	99.2	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.5	2.0	3.8	10.2	24.1	47.2	12.2	0.0	0.0

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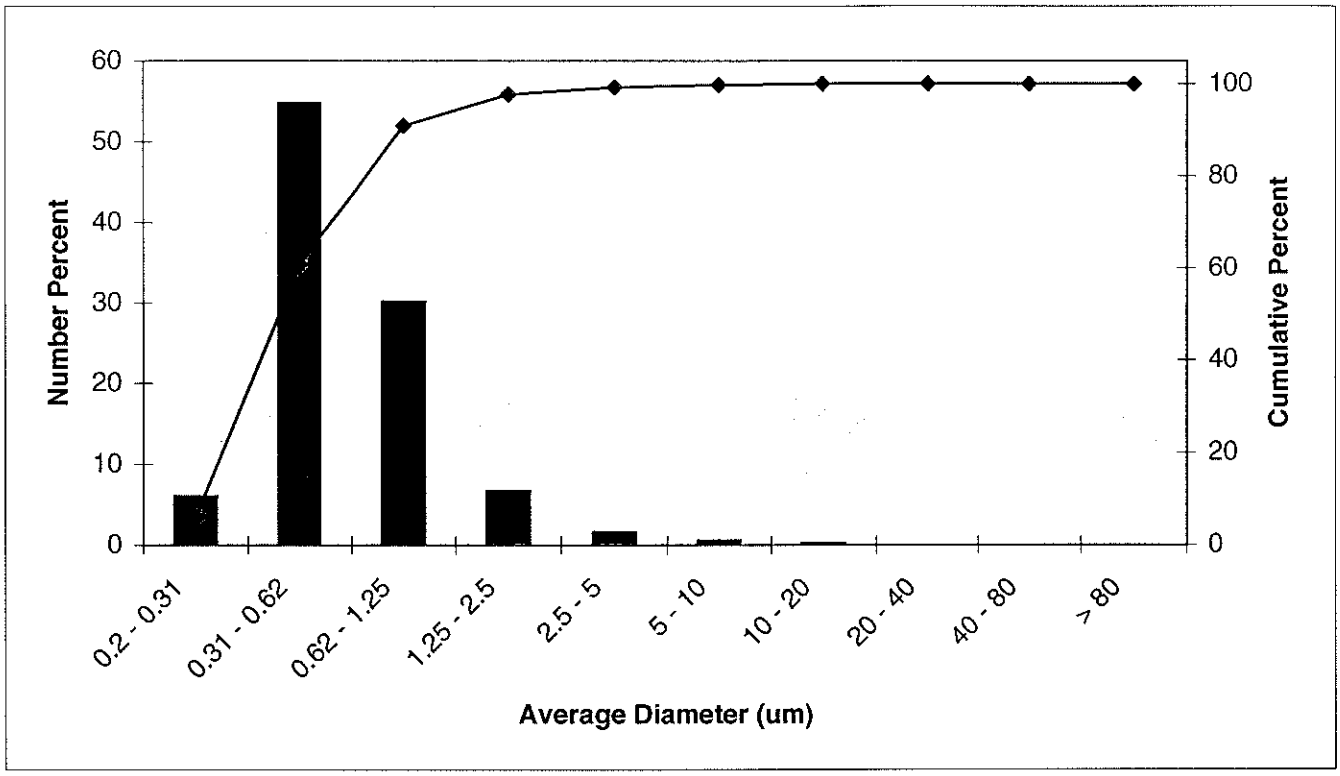
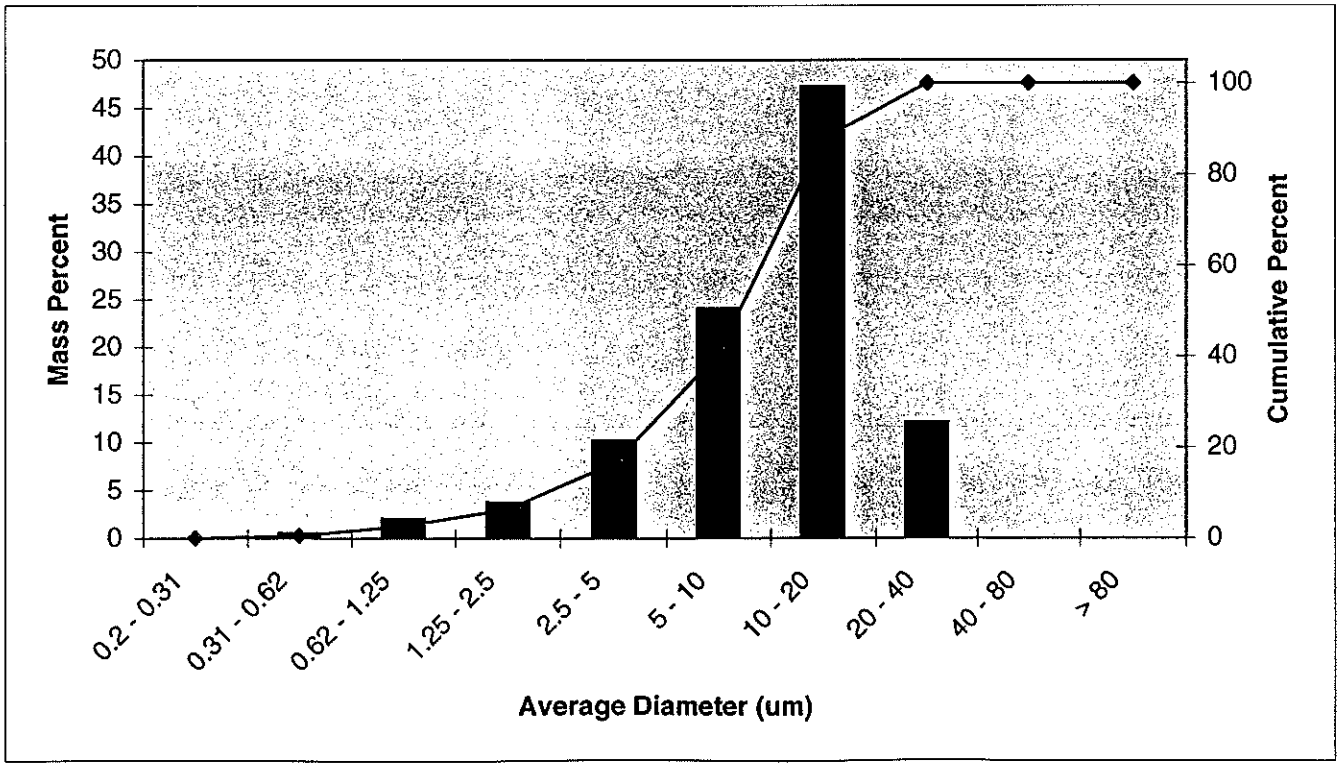
Stack 3 Run 2, Beaker (617093)





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Client_Name	NPN ENVIRO
Client_Number	STACK 3 - 02
Project_Number	ESH004050
Sample_Number	617104
Comment	FILTER

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb/Cl/Sn-rich	34	0.46	39.43
Pb/Cl-rich	183	4.11	27.80
Pb-rich	149	16.57	15.47
Cu/Sn-rich	26	0.06	6.93
C-rich	382	70.77	3.78
Zn/Cl-rich	61	2.28	1.47
Sn-rich	5	0.21	1.43
Zn/S-rich	22	1.03	0.97
Sn/Pb-rich	13	0.22	0.80
Zn/Sn-rich	17	0.04	0.76
Misc.	23	0.44	0.42
Fe-rich	8	0.02	0.25
Al-rich	17	2.19	0.16
Cu-rich	5	0.01	0.13
Zn-rich	7	0.60	0.08
Al/S-rich	4	0.60	0.03
Cu/S-rich	1	0.00	0.03
Si/Al-rich	1	0.00	0.02
Si-rich	1	0.00	0.01
Na/Cl-rich	1	0.20	0.00
Ca-rich	1	0.00	0.00
Na/S-rich	1	0.20	0.00
Totals	962	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl/Sn-rich	0.5	0.0	42.6	42.6	1.4	7.8	4.6	0.0	0.9	0.0	0.0
Pb/Cl-rich	4.1	0.0	28.9	43.3	22.5	4.2	0.9	0.2	0.0	0.0	0.0
Pb-rich	16.6	6.0	46.6	39.4	7.6	0.4	0.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.1	0.0	0.0	0.0	23.1	38.5	30.8	7.7	0.0	0.0	0.0
C-rich	70.8	11.6	68.5	17.9	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	2.3	0.0	52.0	26.0	19.8	2.2	0.1	0.0	0.0	0.0	0.0
Sn-rich	0.2	0.0	0.0	0.0	95.9	3.1	1.0	0.0	0.0	0.0	0.0
Zn/S-rich	1.0	0.0	57.9	38.6	0.8	2.3	0.4	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.2	0.0	0.0	88.5	3.8	6.7	1.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.0	0.0	0.0	0.0	35.3	52.9	11.8	0.0	0.0	0.0	0.0
Misc.	0.4	0.0	0.0	44.9	52.2	2.9	0.0	0.0	0.0	0.0	0.0
Fe-rich	0.0	0.0	0.0	0.0	62.5	25.0	12.5	0.0	0.0	0.0	0.0
Al-rich	2.2	9.0	54.2	36.2	0.3	0.3	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.6	0.0	65.7	32.9	0.4	1.1	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.6	0.0	66.4	33.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Si-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	9.6	61.5	23.7	4.6	0.5	0.1	0.0	0.0	0.0	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name	NPN ENVIRO
Client_Number	STACK 3 - 02
Project_Number	ESH004050
Sample_Number	617104
Comment	FILTER

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl/Sn-rich	39.4	0.0	0.0	0.2	0.1	1.9	9.5	0.0	88.3	0.0	0.0
Pb/Cl-rich	27.8	0.0	0.2	1.6	5.7	11.4	21.8	59.5	0.0	0.0	0.0
Pb-rich	15.5	0.0	1.9	8.4	12.4	4.7	0.0	0.0	72.6	0.0	0.0
Cu/Sn-rich	6.9	0.0	0.0	0.0	0.7	3.5	27.6	68.3	0.0	0.0	0.0
C-rich	3.8	1.0	26.5	37.9	30.7	2.3	1.6	0.0	0.0	0.0	0.0
Zn/Cl-rich	1.5	0.0	1.7	8.3	39.2	42.5	8.3	0.0	0.0	0.0	0.0
Sn-rich	1.4	0.0	0.0	0.0	45.2	9.3	45.5	0.0	0.0	0.0	0.0
Zn/S-rich	1.0	0.0	1.5	6.6	2.7	40.9	48.2	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.8	0.0	0.0	3.2	4.0	63.8	29.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.8	0.0	0.0	0.0	5.6	37.2	57.2	0.0	0.0	0.0	0.0
Misc.	0.4	0.0	0.0	26.2	50.3	23.5	0.0	0.0	0.0	0.0	0.0
Fe-rich	0.3	0.0	0.0	0.0	12.3	24.9	62.8	0.0	0.0	0.0	0.0
Al-rich	0.2	0.6	18.2	37.8	11.0	32.5	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.1	0.0	8.4	22.6	8.9	60.1	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.0	0.0	25.6	57.8	16.6	0.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Si-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	1.4	3.6	6.3	7.4	13.8	21.3	46.1	0.0	0.0

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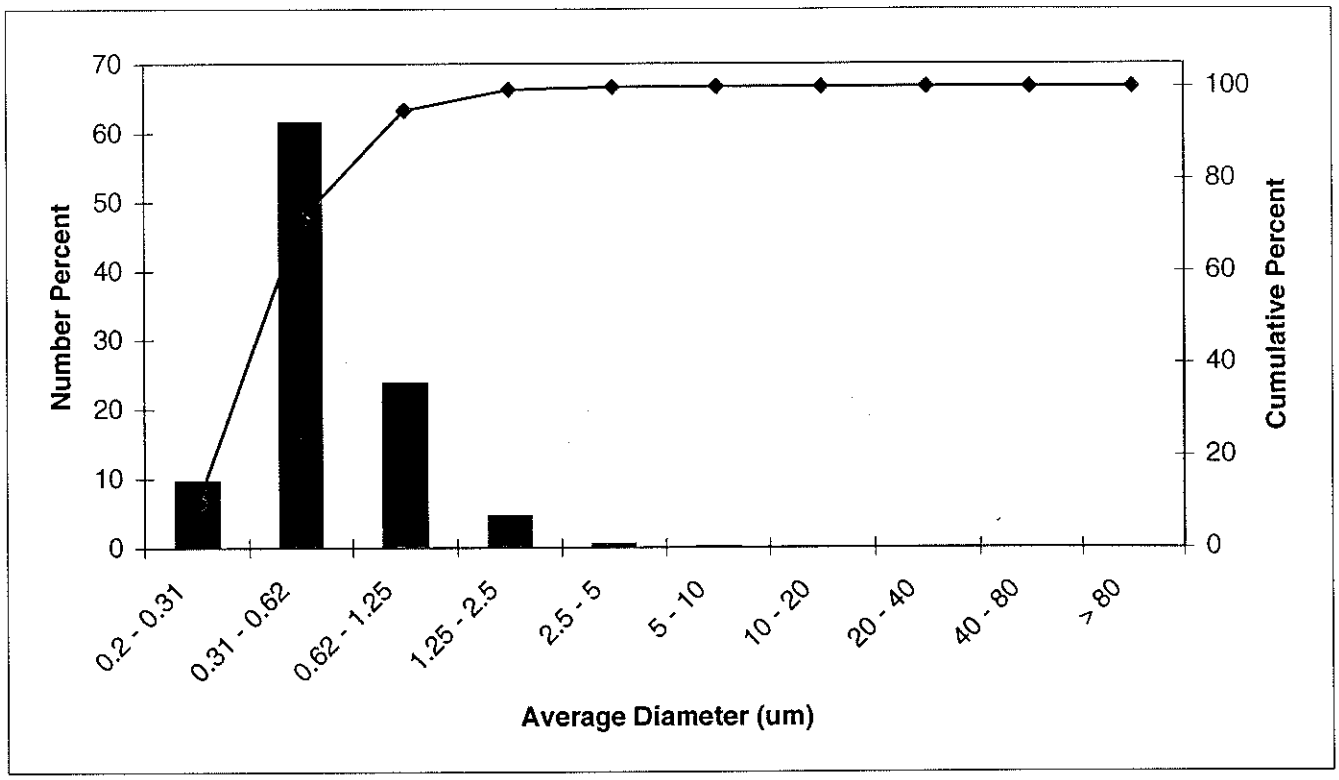
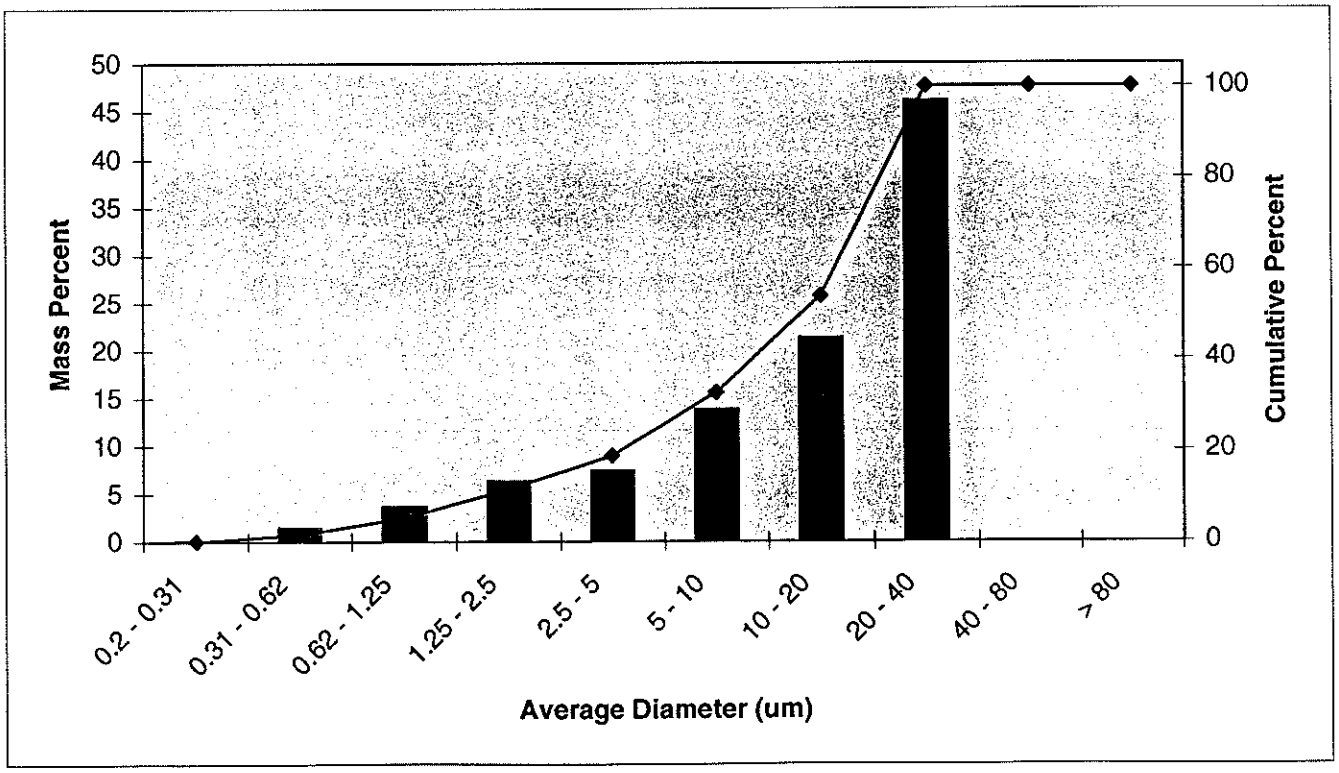
Stack 3 - 02, Filter (617104)





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Client_Name	NPN ENVIRO
Client_Number	Stack 4 Run 1
Project_Number	ESH004050
Sample_Number	617097
Comment	Beaker

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb/Cl-rich	148	8.72	33.58
Si/Al-rich	97	5.67	15.51
Pb-rich	163	17.67	11.98
Si-rich	37	2.22	8.39
Na/Cl-rich	4	0.41	5.94
Pb/Cl/Sn-rich	16	1.04	3.75
Cu-rich	20	1.45	2.96
Cu/Sn-rich	17	0.92	2.64
Sn/Pb-rich	12	0.78	2.64
Misc.	39	3.49	2.32
Zn/Cl-rich	18	1.71	1.66
Fe/Cr-rich	4	0.11	1.55
Na/S-rich	8	0.67	1.43
Zn-rich	5	0.59	1.13
C-rich	262	43.70	1.10
Cu/S-rich	5	0.13	0.93
Fe-rich	13	1.57	0.75
Al-rich	48	6.03	0.52
Zn/S-rich	7	0.49	0.49
Zn/Sn-rich	6	0.31	0.30
Ca-rich	9	0.85	0.26
Al/S-rich	12	1.39	0.09
Sn-rich	2	0.05	0.06
Totals	952	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	8.7	2.1	18.5	26.8	23.0	17.9	8.6	3.1	0.0	0.0	0.0
Si/Al-rich	5.7	0.0	12.7	34.9	22.5	20.4	6.7	2.4	0.5	0.0	0.0
Pb-rich	17.7	2.0	30.5	43.7	15.4	5.0	3.0	0.3	0.0	0.0	0.0
Si-rich	2.2	0.0	8.1	16.2	50.2	10.9	6.1	8.5	0.0	0.0	0.0
Na/Cl-rich	0.4	0.0	87.0	0.0	0.0	0.0	0.0	13.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	1.0	0.0	0.0	51.7	22.4	12.9	12.9	0.0	0.0	0.0	0.0
Cu-rich	1.5	0.0	12.3	37.0	32.1	9.3	7.4	1.9	0.0	0.0	0.0
Cu/Sn-rich	0.9	0.0	19.6	19.6	25.5	20.6	11.8	2.9	0.0	0.0	0.0
Sn/Pb-rich	0.8	0.0	23.0	23.0	26.4	6.9	20.7	0.0	0.0	0.0	0.0
Misc.	3.5	0.0	30.9	25.7	33.4	8.5	0.8	0.8	0.0	0.0	0.0
Zn/Cl-rich	1.7	10.5	31.6	21.1	22.6	11.0	1.6	1.6	0.0	0.0	0.0
Fe/Cr-rich	0.1	0.0	0.0	0.0	75.0	0.0	0.0	25.0	0.0	0.0	0.0
Na/S-rich	0.7	0.0	80.0	0.0	0.0	8.0	8.0	4.0	0.0	0.0	0.0
Zn-rich	0.6	0.0	60.6	30.3	4.5	0.0	0.0	4.5	0.0	0.0	0.0
C-rich	43.7	6.6	49.7	32.5	10.4	0.7	0.1	0.0	0.0	0.0	0.0
Cu/S-rich	0.1	0.0	0.0	0.0	0.0	60.0	40.0	0.0	0.0	0.0	0.0
Fe-rich	1.6	0.0	34.3	34.3	24.6	3.4	3.4	0.0	0.0	0.0	0.0
Al-rich	6.0	3.0	44.7	35.8	11.6	4.5	0.4	0.0	0.0	0.0	0.0
Zn/S-rich	0.5	0.0	36.4	36.4	0.0	10.9	16.4	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.3	0.0	0.0	57.2	0.0	42.8	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.9	0.0	63.2	0.0	27.4	6.3	3.2	0.0	0.0	0.0	0.0
Al/S-rich	1.4	12.9	25.8	38.7	14.8	7.7	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	4.0	37.4	33.1	16.0	6.0	2.7	0.9	0.0	0.0	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name	NPN ENVIRO
Client_Number	Stack 4 Run 1
Project_Number	ESH004050
Sample_Number	617097
Comment	Beaker

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 – 0.3	0.3 – 0.6	0.6 – 1.3	1.3 – 2.5	2.5 – 5.0	5.0 – 10.0	10.0 – 20.0	20.0 – 40.0	40.0 – 80.0	>>>
Pb/Cl-rich	33.6	0.0	0.0	0.2	1.3	8.4	31.2	58.9	0.0	0.0	0.0
Si/Al-rich	15.5	0.0	0.0	0.1	1.0	6.0	14.6	57.2	21.1	0.0	0.0
Pb-rich	12.0	0.0	0.1	1.3	4.6	8.5	55.2	30.3	0.0	0.0	0.0
Si-rich	8.4	0.0	0.0	0.0	1.1	3.2	9.9	85.8	0.0	0.0	0.0
Na/Cl-rich	5.9	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	3.8	0.0	0.0	0.5	1.3	7.0	91.2	0.0	0.0	0.0	0.0
Cu-rich	3.0	0.0	0.0	0.4	2.2	4.2	55.8	37.5	0.0	0.0	0.0
Cu/Sn-rich	2.6	0.0	0.0	0.1	1.5	12.0	55.0	31.4	0.0	0.0	0.0
Sn/Pb-rich	2.6	0.0	0.0	0.2	1.6	5.7	92.5	0.0	0.0	0.0	0.0
Misc.	2.3	0.0	0.1	0.9	7.5	10.8	11.4	69.2	0.0	0.0	0.0
Zn/Cl-rich	1.7	0.0	0.1	0.4	2.7	15.9	8.9	71.9	0.0	0.0	0.0
Fe/Cr-rich	1.6	0.0	0.0	0.0	1.4	0.0	0.0	98.6	0.0	0.0	0.0
Na/S-rich	1.4	0.0	0.0	0.0	0.0	8.1	32.9	59.0	0.0	0.0	0.0
Zn-rich	1.1	0.0	0.1	0.2	0.6	0.0	0.0	99.1	0.0	0.0	0.0
C-rich	1.1	0.1	3.8	17.3	34.0	16.0	28.9	0.0	0.0	0.0	0.0
Cu/S-rich	0.9	0.0	0.0	0.0	0.0	19.0	81.0	0.0	0.0	0.0	0.0
Fe-rich	0.8	0.0	0.3	1.2	4.2	10.4	83.9	0.0	0.0	0.0	0.0
Al-rich	0.5	0.0	1.2	5.3	16.5	54.2	22.8	0.0	0.0	0.0	0.0
Zn/S-rich	0.5	0.0	0.1	0.2	0.0	5.4	94.4	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.3	0.0	0.0	2.7	0.0	97.3	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.3	0.0	0.7	0.0	7.2	30.4	61.7	0.0	0.0	0.0	0.0
Al/S-rich	0.1	0.1	1.2	6.0	20.5	72.3	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.1	0.6	2.2	7.7	32.5	53.6	3.3	0.0	0.0

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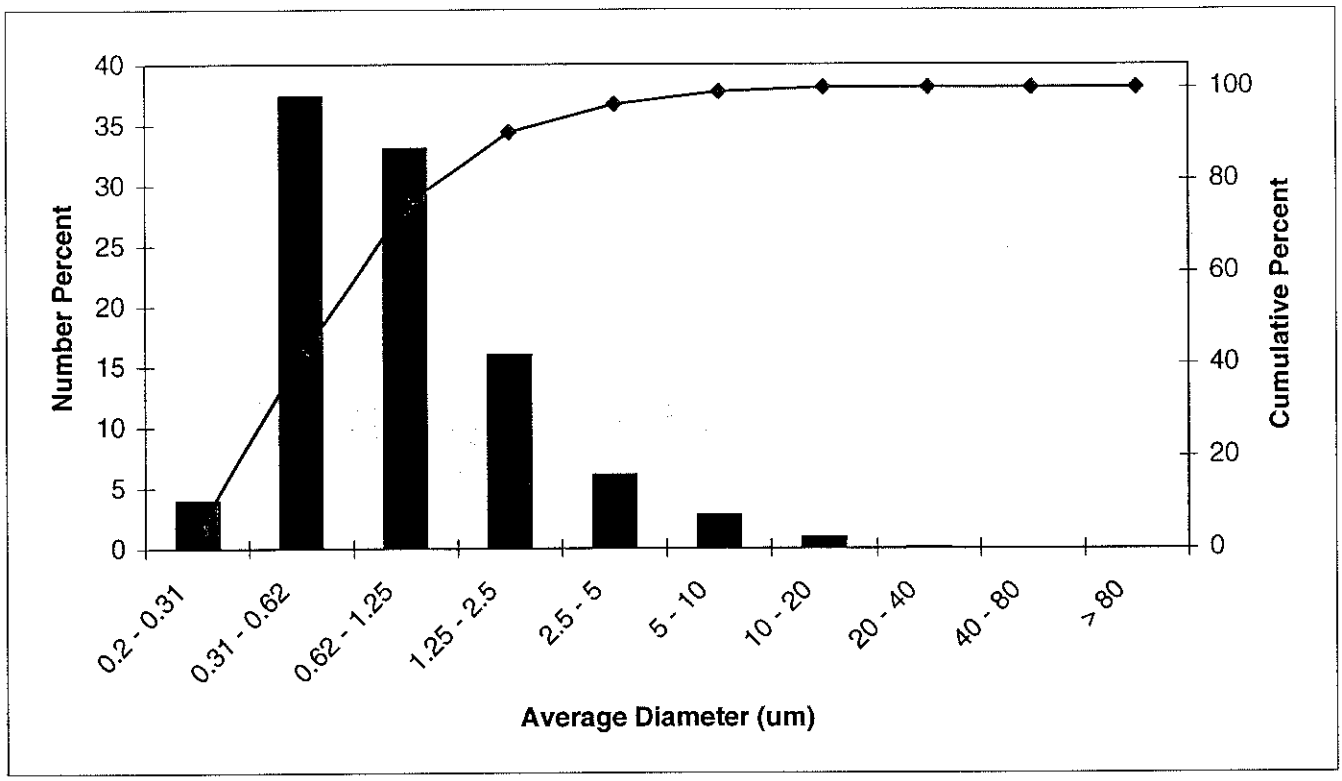
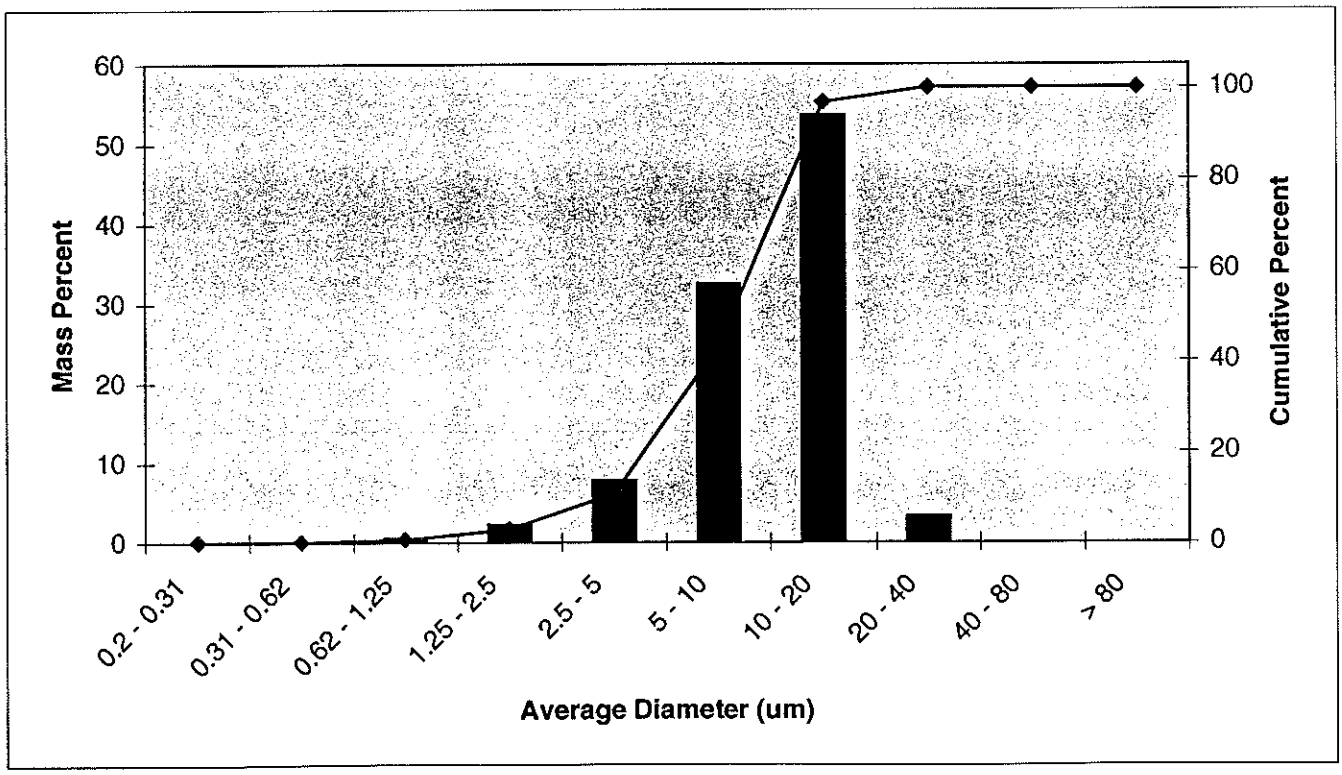
PH 724/325-1776 FAX 724/733-1799

Stack 4 Run 1, Beaker (617097)





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Client_Name	NPN ENVIRO
Client_Number	Stack 4-01
Project_Number	ESH004050
Sample_Number	617107
Comment	Filter

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb/Cl-rich	320	15.23	62.00
Pb-rich	109	4.36	14.57
Zn/Cl-rich	39	1.23	9.63
Al-rich	201	24.65	7.81
Zn/S-rich	8	0.06	2.74
C-rich	251	46.90	1.48
Misc.	22	2.38	0.69
Al/S-rich	36	3.41	0.64
Pb/Cl/Sn-rich	2	0.02	0.26
Cu-rich	5	0.96	0.09
Si/Al-rich	1	0.01	0.04
Fe-rich	1	0.01	0.02
Na/Cl-rich	2	0.38	0.02
Si-rich	1	0.01	0.01
Cu/S-rich	1	0.19	0.00
Zn-rich	1	0.19	0.00
Totals	1000	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	15.2	2.5	21.4	40.3	27.3	6.6	1.4	0.4	0.0	0.0	0.0
Pb-rich	4.4	0.0	39.6	35.2	14.3	8.5	2.2	0.2	0.0	0.0	0.0
Zn/Cl-rich	1.2	15.6	0.0	15.6	55.2	10.9	1.9	0.6	0.0	0.0	0.0
Al-rich	24.7	3.3	35.0	47.5	13.0	0.9	0.2	0.0	0.0	0.0	0.0
Zn/S-rich	0.1	0.0	0.0	0.0	12.5	50.0	25.0	12.5	0.0	0.0	0.0
C-rich	46.9	4.9	70.0	24.2	0.9	0.0	0.0	0.0	0.0	0.0	0.0
Misc.	2.4	0.0	8.1	56.4	33.9	1.7	0.0	0.0	0.0	0.0	0.0
Al/S-rich	3.4	0.0	33.7	56.2	7.7	2.3	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	1.0	0.0	20.0	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Fe-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.4	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	3.9	48.4	35.1	10.2	1.9	0.4	0.1	0.0	0.0	0.0

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Client_Name	NPN ENVIRO
Client_Number	Stack 4-01
Project_Number	ESH004050
Sample_Number	617107
Comment	Filter

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl-rich	62.0	0.0	0.1	1.8	6.8	12.2	27.4	51.7	0.0	0.0	0.0
Pb-rich	14.6	0.0	0.2	1.5	5.5	21.2	56.4	15.3	0.0	0.0	0.0
Zn/Cl-rich	9.6	0.0	0.0	0.1	4.1	9.7	21.4	64.8	0.0	0.0	0.0
Al-rich	7.8	0.0	1.5	12.4	22.3	15.3	24.4	24.1	0.0	0.0	0.0
Zn/S-rich	2.7	0.0	0.0	0.0	0.7	8.0	14.4	76.9	0.0	0.0	0.0
C-rich	1.5	0.3	25.8	55.8	18.1	0.0	0.0	0.0	0.0	0.0	0.0
Misc.	0.7	0.0	0.4	18.6	67.6	13.4	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.6	0.0	2.4	28.4	25.5	43.7	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.3	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.1	0.0	4.3	95.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Fe-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.0	0.0	22.4	77.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.6	3.5	8.1	13.7	29.6	44.5	0.0	0.0	0.0

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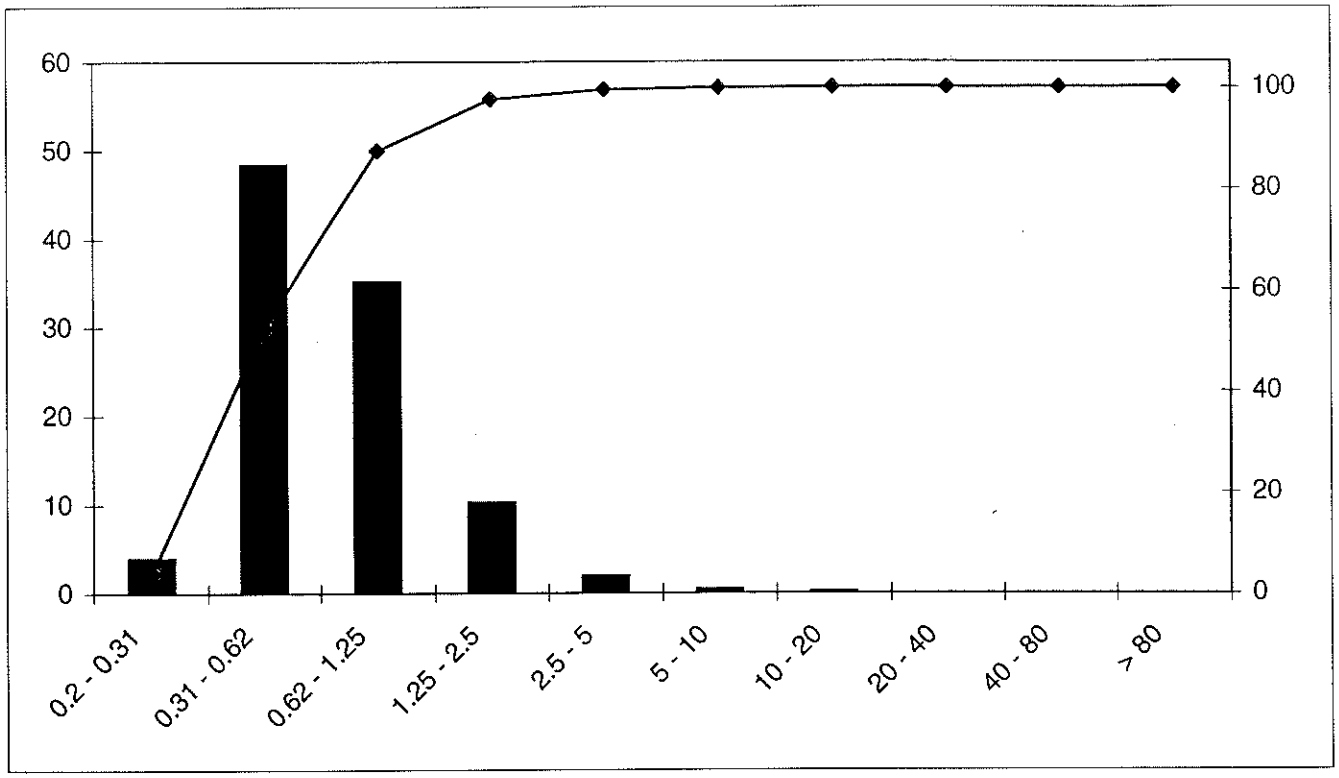
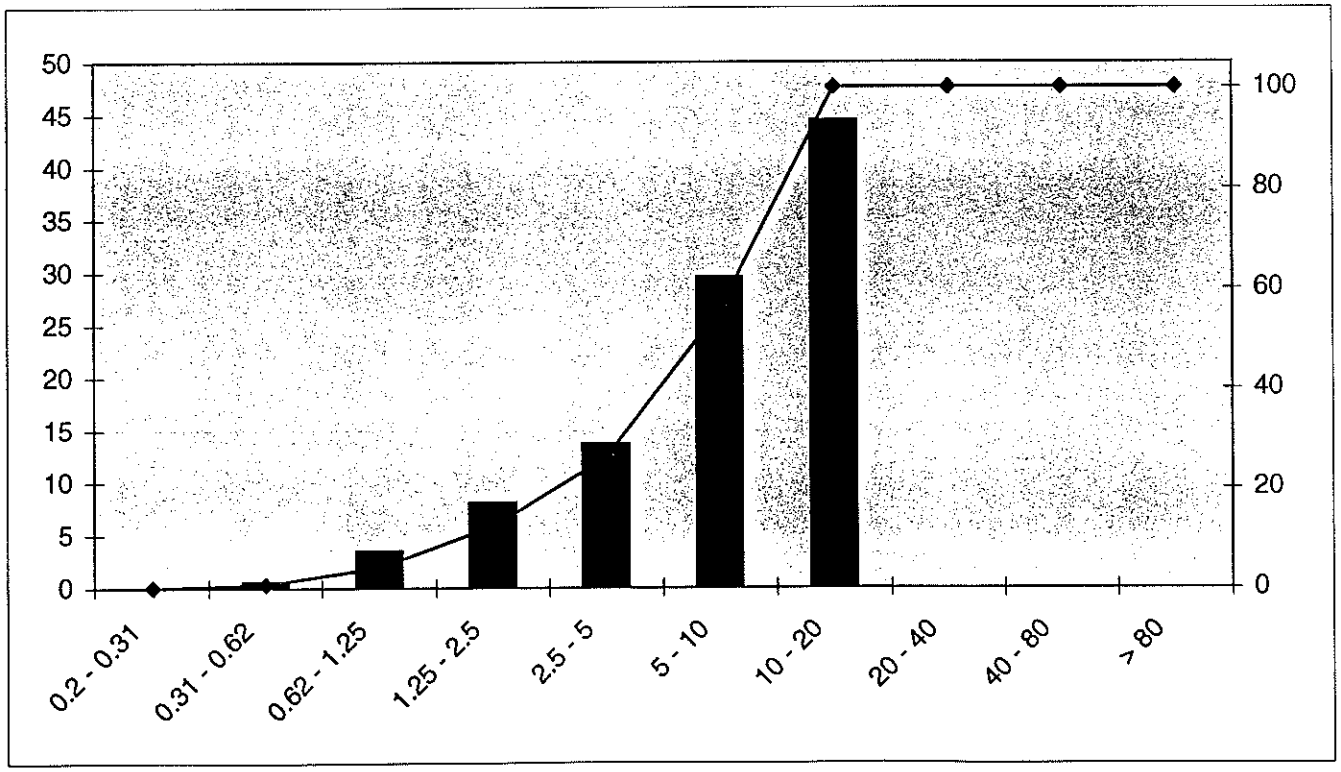
Stack 4-01, Filter (617107)





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Client_Name	NPN ENVIRO
Client_Number	STACK 4 RUN 2
Project_Number	ESH004050
Sample_Number	617098
Comment	BEAKER

Table 1 - Abundance

Classes	#	Number %	Wt %
Na/Cl-rich	5	0.04	25.86
Sn/Pb-rich	116	2.57	21.41
Si/Al-rich	29	0.60	18.66
Pb-rich	237	24.12	8.76
Zn/Sn-rich	12	0.28	6.12
Pb/Cl-rich	75	3.17	3.71
Ca-rich	11	0.27	3.57
Misc.	43	2.93	2.41
Zn/Cl-rich	14	1.03	2.15
Zn/S-rich	11	0.82	1.78
C-rich	316	55.24	1.74
Pb/Cl/Sn-rich	33	1.18	1.54
Fe-rich	18	0.88	0.78
Si-rich	17	0.32	0.70
Al-rich	20	2.96	0.44
Cu/Sn-rich	11	1.19	0.11
Zn-rich	11	1.01	0.11
Al/S-rich	9	0.62	0.10
Fe/Cr-rich	2	0.02	0.02
Sn-rich	3	0.58	0.01
Cu/S-rich	1	0.19	0.01
Cu-rich	1	0.01	0.00
Totals	995	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Na/Cl-rich	0.0	0.0	0.0	0.0	20.0	20.0	0.0	20.0	40.0	0.0	0.0
Sn/Pb-rich	2.6	0.0	0.0	22.4	56.4	15.0	4.3	1.8	0.0	0.0	0.0
Si/Al-rich	0.6	0.0	32.1	32.1	5.3	23.8	4.0	1.3	1.3	0.0	0.0
Pb-rich	24.1	5.6	44.5	36.6	11.2	1.7	0.3	0.1	0.0	0.0	0.0
Zn/Sn-rich	0.3	0.0	68.8	0.0	17.0	11.3	0.0	0.0	2.8	0.0	0.0
Pb/Cl-rich	3.2	0.0	24.2	42.4	24.2	7.2	1.7	0.2	0.0	0.0	0.0
Ca-rich	0.3	0.0	0.0	0.0	76.7	11.7	2.9	8.7	0.0	0.0	0.0
Misc.	2.9	7.0	52.4	19.7	16.6	3.8	0.3	0.3	0.0	0.0	0.0
Zn/Cl-rich	1.0	18.6	18.6	18.6	38.0	4.6	0.8	0.8	0.0	0.0	0.0
Zn/S-rich	0.8	0.0	46.6	46.6	1.9	2.9	1.0	0.0	1.0	0.0	0.0
C-rich	55.2	11.8	59.4	24.6	4.0	0.2	0.1	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	1.2	0.0	16.3	16.3	56.1	9.4	2.0	0.0	0.0	0.0	0.0
Fe-rich	0.9	0.0	43.7	43.7	4.5	6.3	1.8	0.0	0.0	0.0	0.0
Si-rich	0.3	0.0	0.0	0.0	77.7	14.9	5.0	2.5	0.0	0.0	0.0
Al-rich	3.0	14.5	32.4	38.9	13.2	0.5	0.5	0.0	0.0	0.0	0.0
Cu/Sn-rich	1.2	0.0	64.5	16.1	16.8	2.7	0.0	0.0	0.0	0.0	0.0
Zn-rich	1.0	0.0	95.3	0.0	2.4	2.4	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.6	0.0	61.6	0.0	35.9	2.5	0.0	0.0	0.0	0.0	0.0
Fe/Cr-rich	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.6	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.2	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	8.7	51.0	27.8	10.1	1.8	0.4	0.1	0.0	0.0	0.0

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Client_Name	NPN ENVIRO
Client_Number	STACK 4 RUN 2
Project_Number	ESH004050
Sample_Number	617098
Comment	BEAKER

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Na/Cl-rich	25.9	0.0	0.0	0.0	0.0	0.1	0.0	8.3	91.5	0.0	0.0
Sn/Pb-rich	21.4	0.0	0.0	0.1	3.1	7.7	19.3	69.8	0.0	0.0	0.0
Si/Al-rich	18.7	0.0	0.0	0.0	0.1	1.7	3.5	3.2	91.5	0.0	0.0
Pb-rich	8.8	0.0	1.0	5.4	11.8	13.2	26.4	42.1	0.0	0.0	0.0
Zn/Sn-rich	6.1	0.0	0.0	0.0	0.6	1.6	0.0	0.0	97.8	0.0	0.0
Pb/Cl-rich	3.7	0.0	0.2	4.0	10.6	19.5	44.1	21.7	0.0	0.0	0.0
Ca-rich	3.6	0.0	0.0	0.0	1.0	2.4	2.5	94.2	0.0	0.0	0.0
Misc.	2.4	0.0	0.3	1.0	5.7	12.4	2.3	78.3	0.0	0.0	0.0
Zn/Cl-rich	2.2	0.0	0.1	0.3	4.2	4.4	24.0	67.0	0.0	0.0	0.0
Zn/S-rich	1.8	0.0	0.1	0.6	0.3	3.0	5.8	0.0	90.3	0.0	0.0
C-rich	1.7	0.3	7.8	24.8	22.2	7.1	37.8	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	1.5	0.0	0.1	0.9	17.8	33.2	48.1	0.0	0.0	0.0	0.0
Fe-rich	0.8	0.0	0.5	1.5	4.0	26.4	67.6	0.0	0.0	0.0	0.0
Si-rich	0.7	0.0	0.0	0.0	9.9	12.3	9.8	68.0	0.0	0.0	0.0
Al-rich	0.4	0.0	0.6	16.1	44.1	6.9	32.2	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.1	0.0	6.0	4.2	35.2	54.6	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.1	0.0	6.1	0.0	13.9	80.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.1	0.0	2.5	0.0	58.5	39.0	0.0	0.0	0.0	0.0	0.0
Fe/Cr-rich	0.0	0.0	0.0	0.0	23.4	76.6	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.3	1.2	3.5	5.7	11.6	29.4	48.3	0.0	0.0

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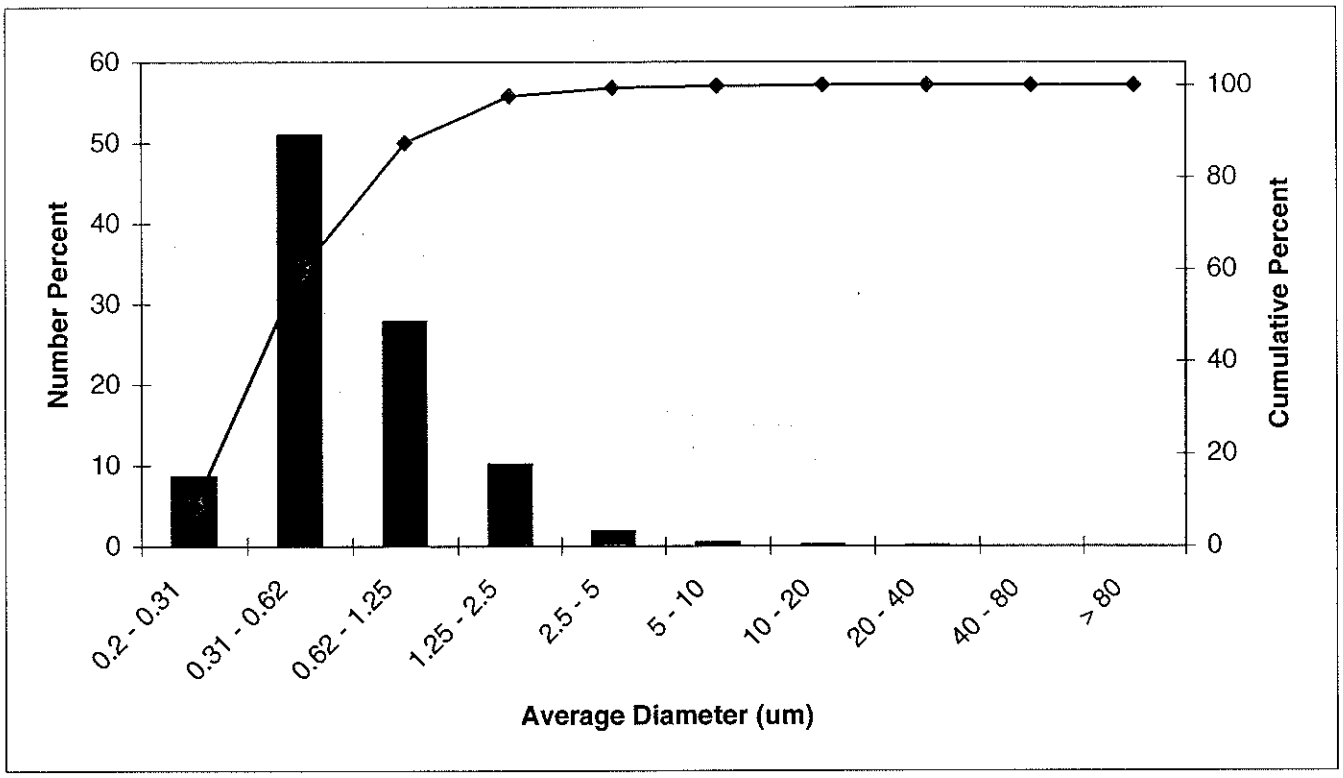
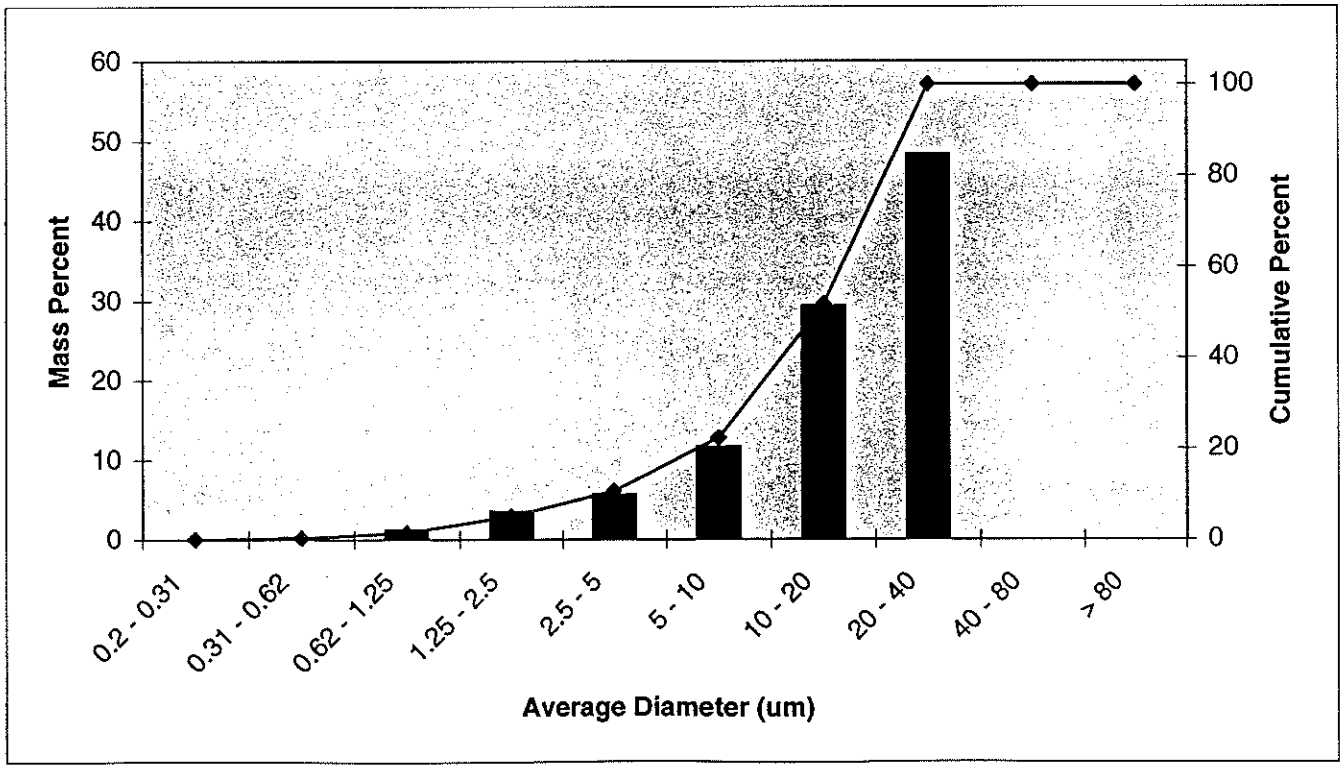
Stack 4 Run 2, Beaker (617098)





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Client_Name	NPN ENVIRO
Client_Number	STACK 4 - 02
Project_Number	ESH004050
Sample_Number	617108
Comment	FILTER

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb/Cl/Sn-rich	134	1.94	49.60
Pb-rich	145	20.13	21.11
Sn/Pb-rich	102	0.32	18.80
Si-rich	10	0.01	6.41
Pb/Cl-rich	73	4.24	1.83
C-rich	365	68.30	1.39
Misc.	54	3.03	0.44
Si/Al-rich	5	0.01	0.08
Cu/Sn-rich	1	0.00	0.07
Sn-rich	4	0.00	0.07
Zn/Cl-rich	5	0.20	0.07
Fe-rich	2	0.00	0.06
Al-rich	11	1.20	0.02
Ca-rich	4	0.00	0.01
Al/S-rich	4	0.60	0.01
Na/S-rich	1	0.00	0.01
Cu/S-rich	1	0.00	0.01
Fe/Cr-rich	1	0.00	0.00
Na/Cl-rich	1	0.00	0.00
Totals	923	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl/Sn-rich	1.9	0.0	61.5	20.5	13.0	3.8	0.8	0.3	0.1	0.0	0.0
Pb-rich	20.1	6.9	68.1	24.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.3	0.0	0.0	62.1	16.1	16.9	3.4	0.4	1.1	0.0	0.0
Si-rich	0.0	0.0	0.0	0.0	20.0	30.0	20.0	10.0	20.0	0.0	0.0
Pb/Cl-rich	4.2	4.7	42.2	42.2	10.1	0.6	0.1	0.0	0.0	0.0	0.0
C-rich	68.3	14.1	74.8	10.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Misc.	3.0	6.6	65.6	19.7	7.6	0.5	0.1	0.0	0.0	0.0	0.0
Si/Al-rich	0.0	0.0	0.0	0.0	20.0	60.0	20.0	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Sn-rich	0.0	0.0	0.0	0.0	25.0	50.0	25.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.2	0.0	97.6	0.0	0.6	1.2	0.6	0.0	0.0	0.0	0.0
Fe-rich	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0	0.0
Al-rich	1.2	16.6	82.9	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.0	0.0	0.0	0.0	75.0	25.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.6	0.0	66.5	33.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Fe/Cr-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	11.6	71.4	15.3	1.4	0.2	0.1	0.0	0.0	0.0	0.0

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Client_Name	NPN ENVIRO
Client_Number	STACK 4 - 02
Project_Number	ESH004050
Sample_Number	617108
Comment	FILTER

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb/Cl/Sn-rich	49.6	0.0	0.1	0.1	0.7	1.8	3.5	12.1	81.8	0.0	0.0
Pb-rich	21.1	0.0	1.4	3.6	0.4	1.0	1.1	0.0	92.5	0.0	0.0
Sn/Pb-rich	18.8	0.0	0.0	0.1	0.8	3.0	4.7	2.6	88.8	0.0	0.0
Si-rich	6.4	0.0	0.0	0.0	0.0	0.5	2.1	15.5	81.8	0.0	0.0
Pb/Cl-rich	1.8	0.0	2.6	14.1	21.6	9.3	22.9	29.4	0.0	0.0	0.0
C-rich	1.4	1.7	41.4	34.6	14.4	1.7	6.2	0.0	0.0	0.0	0.0
Misc.	0.4	0.2	11.0	8.1	51.9	14.1	14.8	0.0	0.0	0.0	0.0
Si/Al-rich	0.1	0.0	0.0	0.0	2.1	10.0	87.9	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Sn-rich	0.1	0.0	0.0	0.0	2.4	18.3	79.3	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.1	0.0	4.8	0.0	3.4	28.9	62.9	0.0	0.0	0.0	0.0
Fe-rich	0.1	0.0	0.0	0.0	4.3	0.0	95.7	0.0	0.0	0.0	0.0
Al-rich	0.0	3.8	38.1	0.0	17.0	41.1	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.0	0.0	0.0	0.0	60.3	39.7	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.0	0.0	40.9	50.3	8.8	0.0	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Fe/Cr-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	1.0	1.6	1.4	2.0	3.9	8.0	82.0	0.0	0.0

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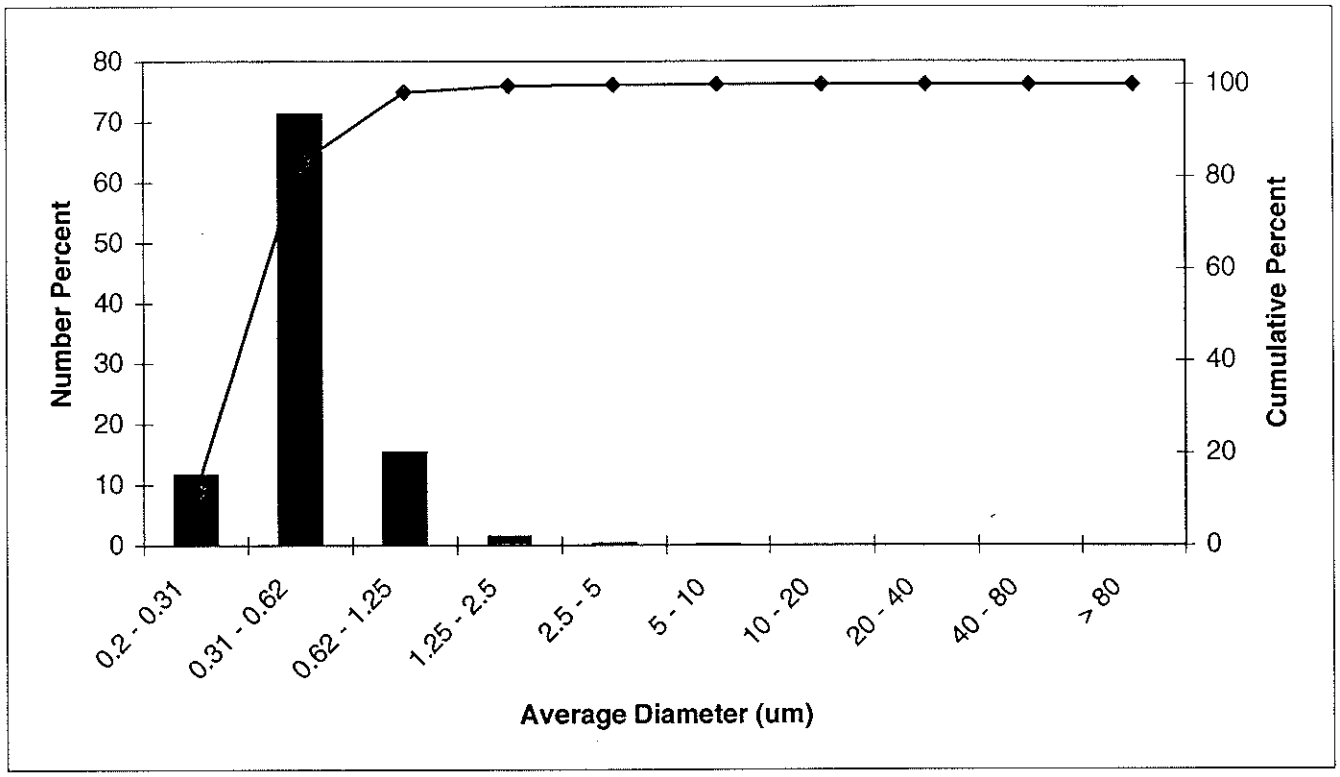
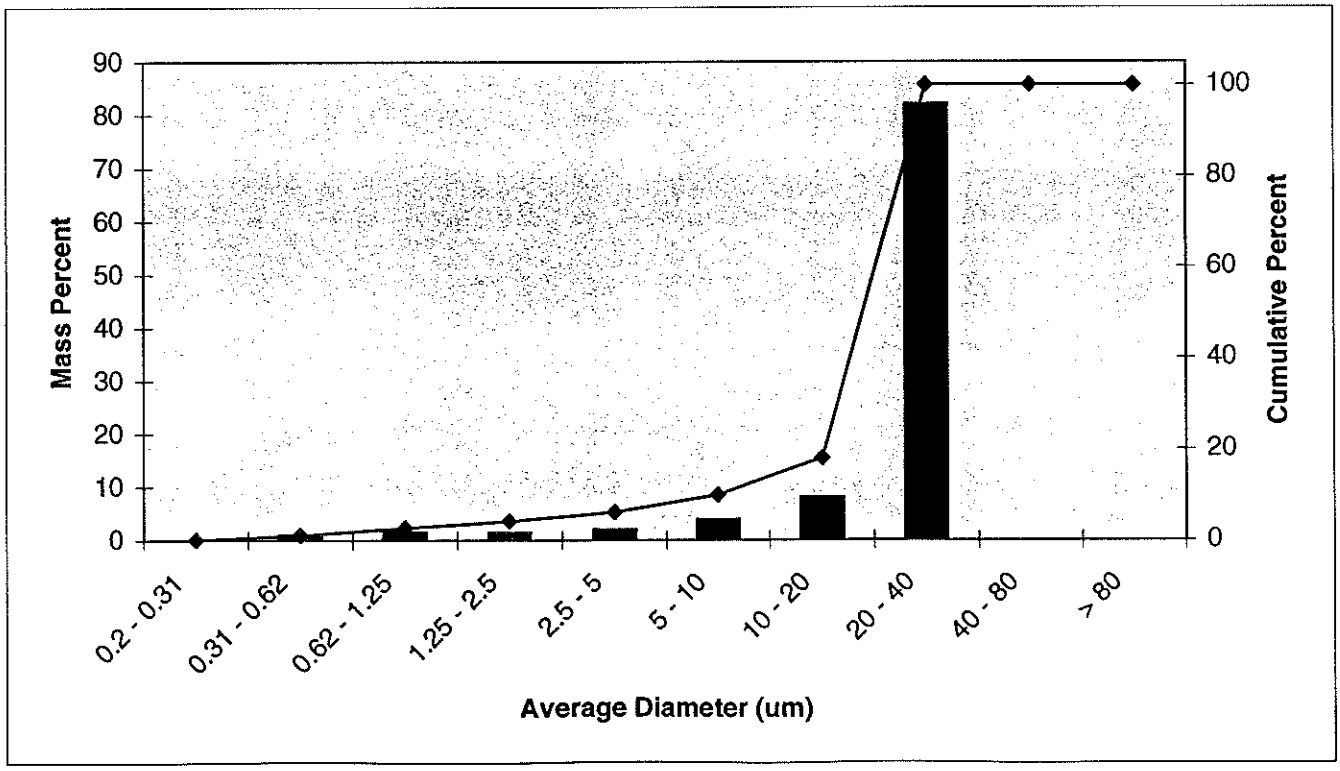
Stack 4 - 02, Filter (617108)





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Client_Name	NPN ENVIRO
Client_Number	INLET RUN 1-1
Project_Number	ESH004050
Sample_Number	617086
Comment	BEAKER

Table 1 - Abundance

Classes	#	Number %	Wt %
Al-rich	131	7.49	13.69
Na/S-rich	5	0.05	12.36
Na/Cl-rich	6	0.60	11.81
Si/Al-rich	40	2.40	11.70
Pb-rich	96	8.35	11.68
Pb/Cl-rich	64	2.84	8.67
Fe/Cr-rich	98	3.93	6.25
Sn/Pb-rich	16	0.53	4.65
Al/S-rich	17	1.25	4.12
Fe-rich	32	1.78	3.17
Misc.	54	4.51	2.94
Zn/Sn-rich	31	1.59	2.61
C-rich	301	54.40	1.61
Ca-rich	11	1.19	1.39
Zn-rich	26	2.60	0.93
Si-rich	14	0.69	0.87
Sn-rich	23	2.92	0.63
Cu/Sn-rich	15	0.52	0.46
Pb/Cl/Sn-rich	3	0.21	0.22
Zn/S-rich	8	1.33	0.15
Zn/Cl-rich	7	0.61	0.05
Cu-rich	1	0.19	0.03
Na-rich	1	0.01	0.01
Totals	1000	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Al-rich	7.5	0.0	20.2	50.5	19.5	7.5	1.8	0.6	0.0	0.0	0.0
Na/S-rich	0.1	0.0	0.0	0.0	0.0	40.0	20.0	20.0	20.0	0.0	0.0
Na/Cl-rich	0.6	0.0	94.5	0.0	0.0	1.8	0.0	1.8	1.8	0.0	0.0
Si/Al-rich	2.4	0.0	23.6	39.4	29.1	4.6	1.4	1.8	0.0	0.0	0.0
Pb-rich	8.4	0.0	54.3	27.2	13.8	2.8	1.6	0.4	0.0	0.0	0.0
Pb/Cl-rich	2.8	6.7	20.0	46.6	12.1	11.2	3.1	0.4	0.0	0.0	0.0
Fe/Cr-rich	3.9	0.0	4.8	38.5	43.8	11.2	1.4	0.3	0.0	0.0	0.0
Sn/Pb-rich	0.5	0.0	0.0	35.5	37.6	18.6	6.2	2.1	0.0	0.0	0.0
Al/S-rich	1.3	0.0	15.1	60.2	20.3	2.6	0.0	1.8	0.0	0.0	0.0
Fe-rich	1.8	0.0	53.2	21.3	16.2	8.0	0.6	0.6	0.0	0.0	0.0
Misc.	4.5	0.0	21.0	58.7	16.2	2.9	1.2	0.0	0.0	0.0	0.0
Zn/Sn-rich	1.6	0.0	0.0	83.4	5.5	9.7	1.4	0.0	0.0	0.0	0.0
C-rich	54.4	4.2	70.2	23.3	2.2	0.1	0.0	0.0	0.0	0.0	0.0
Ca-rich	1.2	0.0	15.9	31.8	49.5	1.8	0.0	0.9	0.0	0.0	0.0
Zn-rich	2.6	7.3	21.8	58.2	9.0	3.4	0.4	0.0	0.0	0.0	0.0
Si-rich	0.7	0.0	0.0	0.0	82.4	12.8	4.8	0.0	0.0	0.0	0.0
Sn-rich	2.9	0.0	25.9	64.7	7.2	1.9	0.4	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.5	0.0	0.0	72.6	10.5	16.9	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.2	0.0	0.0	89.6	0.0	10.4	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	1.3	0.0	42.5	42.5	14.2	0.8	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.6	0.0	61.9	30.9	5.4	1.8	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.2	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Na-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	2.6	50.7	32.9	10.2	2.7	0.6	0.2	0.0	0.0	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name NPN ENVIRO
Client_Number INLET RUN 1-1
Project_Number ESH004050
Sample_Number 617086
Comment BEAKER

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Al-rich	13.7	0.0	0.1	1.7	5.7	13.9	14.3	64.4	0.0	0.0	0.0
Na/S-rich	12.4	0.0	0.0	0.0	0.0	0.5	1.0	40.3	58.2	0.0	0.0
Na/Cl-rich	11.8	0.0	0.0	0.0	0.0	0.4	0.0	12.6	87.0	0.0	0.0
Si/Al-rich	11.7	0.0	0.0	0.3	2.2	3.9	2.6	90.9	0.0	0.0	0.0
Pb-rich	11.7	0.0	0.4	1.4	7.3	9.8	37.9	43.1	0.0	0.0	0.0
Pb/Cl-rich	8.7	0.0	0.1	2.8	4.3	33.2	35.1	24.6	0.0	0.0	0.0
Fe/Cr-rich	6.3	0.0	0.0	3.2	16.0	34.5	25.7	20.7	0.0	0.0	0.0
Sn/Pb-rich	4.6	0.0	0.0	0.4	1.9	13.9	27.4	56.4	0.0	0.0	0.0
Al/S-rich	4.1	0.0	0.0	0.7	3.0	2.3	0.0	94.0	0.0	0.0	0.0
Fe-rich	3.2	0.0	0.4	0.5	4.4	21.9	26.7	46.1	0.0	0.0	0.0
Misc.	2.9	0.0	0.2	5.9	11.8	16.4	65.7	0.0	0.0	0.0	0.0
Zn/Sn-rich	2.6	0.0	0.0	4.6	3.4	36.6	55.5	0.0	0.0	0.0	0.0
C-rich	1.6	0.2	18.1	33.3	18.6	9.4	20.3	0.0	0.0	0.0	0.0
Ca-rich	1.4	0.0	0.1	1.2	12.1	8.2	0.0	78.3	0.0	0.0	0.0
Zn-rich	0.9	0.0	0.4	10.7	8.0	42.2	38.7	0.0	0.0	0.0	0.0
Si-rich	0.9	0.0	0.0	0.0	21.4	28.7	49.9	0.0	0.0	0.0	0.0
Sn-rich	0.6	0.0	1.3	23.9	21.3	23.0	30.5	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.5	0.0	0.0	6.3	13.9	79.8	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.2	0.0	0.0	3.1	0.0	96.9	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	0.1	0.0	4.2	9.9	54.5	31.3	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.1	0.0	7.6	11.0	41.6	39.8	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Na-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.4	2.1	5.1	13.2	18.3	43.4	17.5	0.0	0.0

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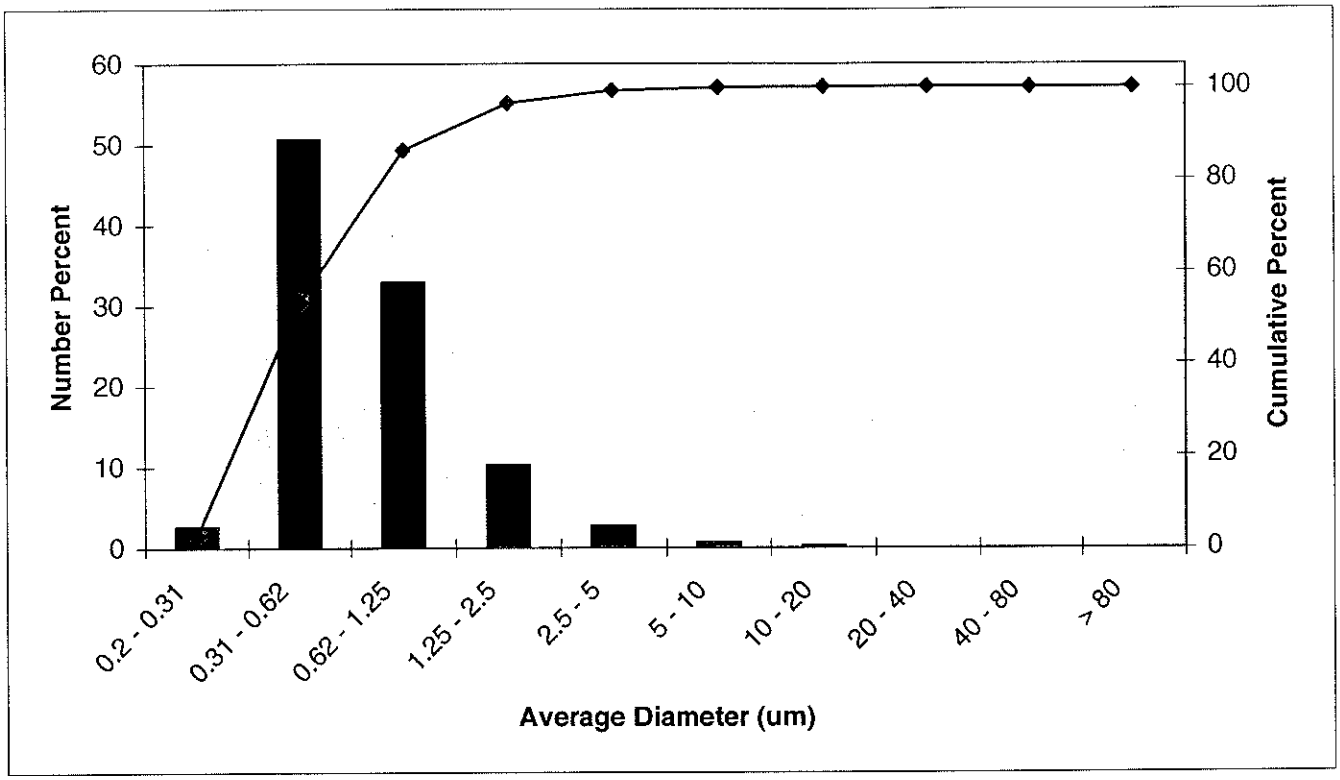
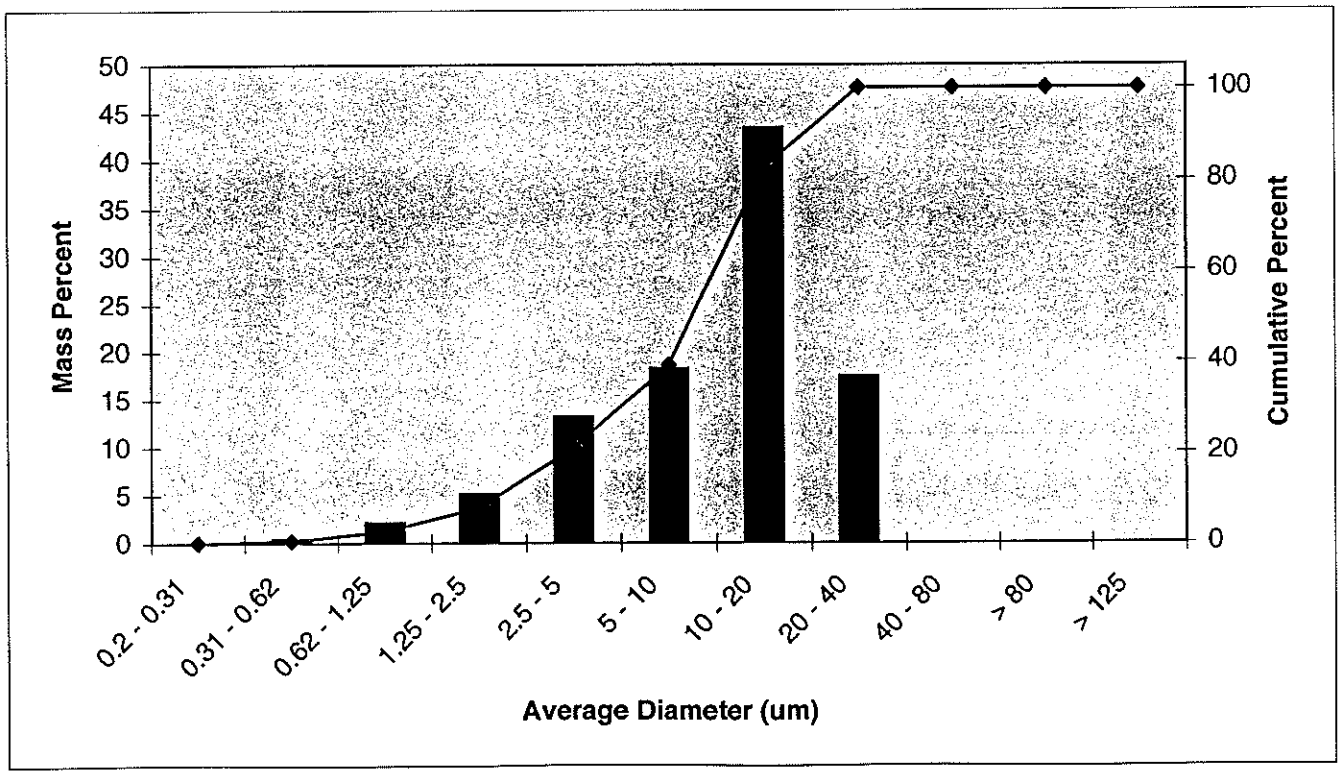
PH 724/325-1776 FAX 724/733-1799

Inlet Run 1-1, Beaker (617086)





RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name	NPN Environ
Client_Number	Inlet Run 1-2
Project_Number	ESH004050
Sample_Number	617087
Comment	Beaker

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb-rich	233	17.84	46.46
Zn/S-rich	158	24.47	20.88
Pb/Cl-rich	30	3.54	10.44
Zn/Cl-rich	16	3.86	7.53
Fe-rich	6	0.16	4.82
Si/Al-rich	23	2.33	2.04
Misc.	56	17.31	1.83
Al/S-rich	27	6.91	1.21
Zn/Sn-rich	31	3.57	1.08
Pb/Cl/Sn-rich	12	1.69	1.01
Ca-rich	5	0.48	0.89
Sn/Pb-rich	9	0.58	0.65
Cu/Sn-rich	4	0.11	0.27
Al-rich	18	5.64	0.23
Si-rich	5	0.13	0.22
Cu/S-rich	7	0.18	0.16
C-rich	17	6.30	0.12
Zn-rich	7	2.25	0.07
Sn-rich	2	0.40	0.05
Na/S-rich	3	0.77	0.02
Na/Cl-rich	4	1.48	0.01
Totals	673	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb-rich	17.8	2.1	10.4	35.3	32.9	16.4	2.7	0.3	0.0	0.0	0.0
Zn/S-rich	24.5	1.5	25.7	33.3	32.8	5.3	1.1	0.3	0.0	0.0	0.0
Pb/Cl-rich	3.5	0.0	10.5	41.8	35.1	9.7	1.5	1.5	0.0	0.0	0.0
Zn/Cl-rich	3.9	9.6	38.4	48.0	2.0	0.7	0.7	0.7	0.0	0.0	0.0
Fe-rich	0.2	0.0	0.0	0.0	16.7	66.7	0.0	16.7	0.0	0.0	0.0
Si/Al-rich	2.3	0.0	15.9	47.8	20.5	11.3	4.5	0.0	0.0	0.0	0.0
Misc.	17.3	2.1	42.8	38.5	15.1	0.8	0.6	0.0	0.0	0.0	0.0
Al/S-rich	6.9	0.0	53.6	32.2	11.9	1.5	0.8	0.0	0.0	0.0	0.0
Zn/Sn-rich	3.6	0.0	31.1	10.4	51.1	7.4	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	1.7	0.0	0.0	65.7	26.6	6.2	1.6	0.0	0.0	0.0	0.0
Ca-rich	0.5	0.0	77.9	0.0	5.5	5.5	11.1	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.6	0.0	63.8	0.0	13.6	18.1	4.5	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.1	0.0	0.0	0.0	25.0	75.0	0.0	0.0	0.0	0.0	0.0
Al-rich	5.6	6.6	32.9	52.6	7.0	0.9	0.0	0.0	0.0	0.0	0.0
Si-rich	0.1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.2	0.0	0.0	0.0	57.1	42.9	0.0	0.0	0.0	0.0	0.0
C-rich	6.3	5.9	41.2	47.1	5.9	0.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	2.2	0.0	16.5	82.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.4	0.0	93.4	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.8	0.0	48.3	48.3	3.4	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	1.5	25.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	2.6	30.0	37.4	22.5	6.1	1.2	0.2	0.0	0.0	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

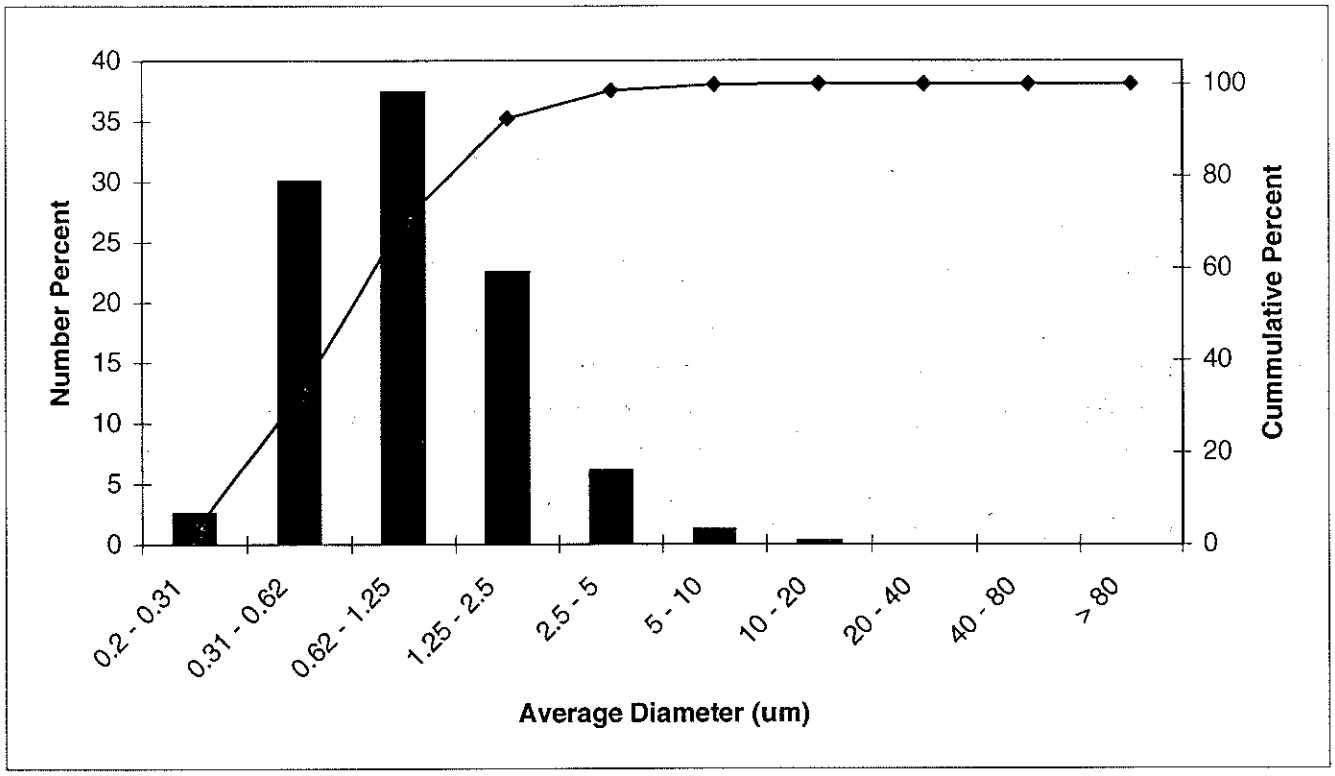
Client_Name	NPN Environ
Client_Number	Inlet Run 1-2
Project_Number	ESH004050
Sample_Number	617087
Comment	Beaker

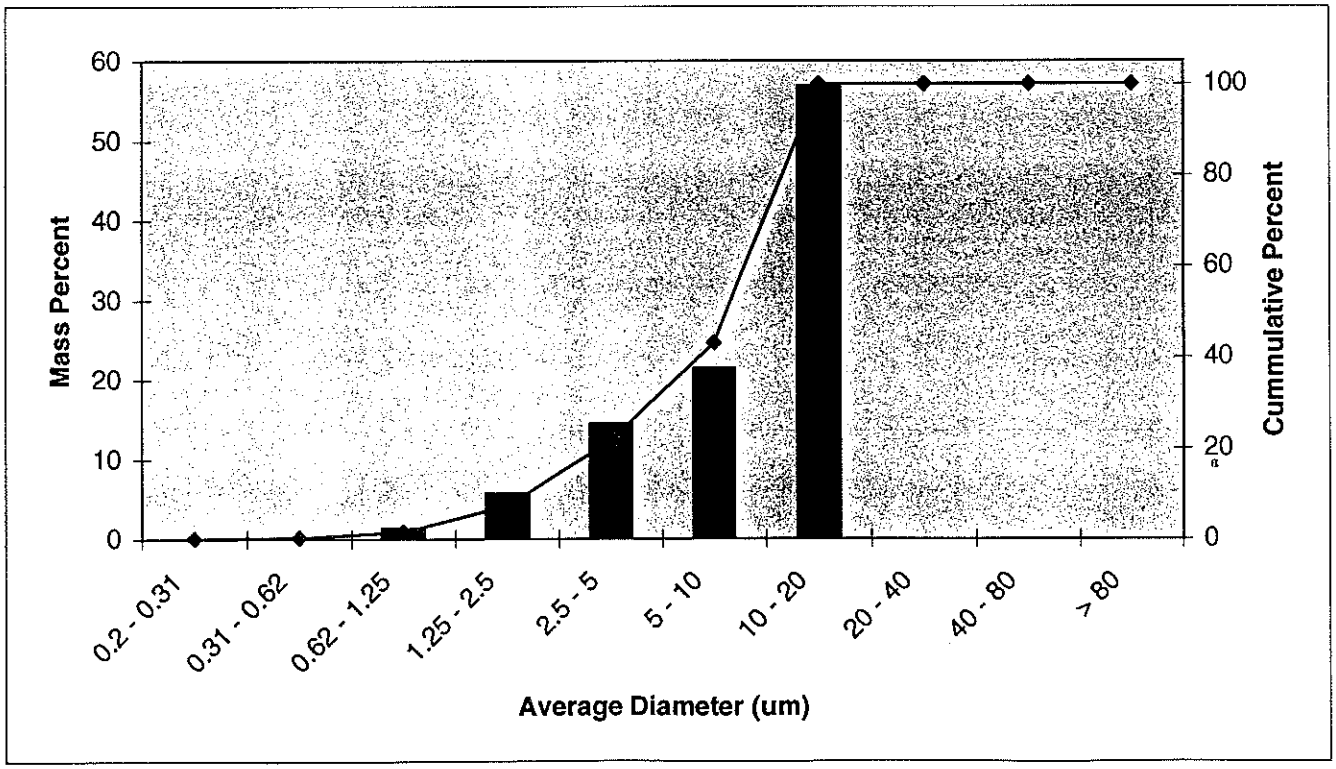
Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb-rich	46.5	0.0	0.0	0.6	4.6	18.4	26.5	49.8	0.0	0.0	0.0
Zn/S-rich	20.9	0.0	0.1	1.4	8.4	10.7	13.6	65.8	0.0	0.0	0.0
Pb/Cl-rich	10.4	0.0	0.0	1.1	3.2	8.0	10.3	77.5	0.0	0.0	0.0
Zn/Cl-rich	7.5	0.0	0.1	0.9	0.5	0.2	1.5	96.8	0.0	0.0	0.0
Fe-rich	4.8	0.0	0.0	0.0	0.2	4.0	0.0	95.8	0.0	0.0	0.0
Si/Al-rich	2.0	0.0	0.1	1.1	3.5	26.9	68.5	0.0	0.0	0.0	0.0
Misc.	1.8	0.0	1.7	13.8	18.3	6.8	59.3	0.0	0.0	0.0	0.0
Al/S-rich	1.2	0.0	1.6	4.3	12.1	9.1	72.9	0.0	0.0	0.0	0.0
Zn/Sn-rich	1.1	0.0	0.8	2.0	46.3	50.8	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	1.0	0.0	0.0	1.8	13.0	19.9	65.3	0.0	0.0	0.0	0.0
Ca-rich	0.9	0.0	0.2	0.0	0.9	13.3	85.5	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.6	0.0	0.4	0.0	13.5	39.6	46.5	0.0	0.0	0.0	0.0
Cu/Sn-rich	0.3	0.0	0.0	0.0	5.8	94.2	0.0	0.0	0.0	0.0	0.0
Al-rich	0.2	0.1	4.1	35.8	14.0	46.1	0.0	0.0	0.0	0.0	0.0
Si-rich	0.2	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.2	0.0	0.0	0.0	37.6	62.4	0.0	0.0	0.0	0.0	0.0
C-rich	0.1	0.4	13.2	60.1	26.3	0.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.1	0.0	2.3	72.8	24.9	0.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.1	0.0	2.6	0.0	0.0	97.4	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.0	0.0	3.8	39.0	57.2	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.0	7.1	92.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.2	1.3	5.7	14.5	21.4	56.9	0.0	0.0	0.0

RJ Lee *Group*, Inc
350 Hochberg Road, Monroeville, PA 15146
PH 724/325-1776 FAX 724/733-1799

Inlet Run 1-2, Beaker (617087)





RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name	NPN Environ
Client_Number	Inlet -01
Project_Number	ESH004050
Sample_Number	617099
Comment	Filter

Table 1 - Abundance

Classes	#	Number %	Wt %
Pb-rich	26	6.94	22.90
Zn/S-rich	40	15.09	18.74
Si/Al-rich	23	5.43	12.44
Pb/Cl-rich	8	1.17	10.07
Na/Cl-rich	18	3.13	9.61
Misc.	34	21.30	5.66
Zn/Cl-rich	5	2.96	4.74
Ca-rich	8	1.83	3.99
C-rich	18	11.05	2.99
Si-rich	7	1.11	2.88
Fe-rich	19	13.29	2.24
Al/S-rich	5	3.62	0.98
Al-rich	8	5.79	0.84
Cu-rich	1	0.72	0.76
Cu/S-rich	1	0.06	0.42
Zn-rich	4	2.89	0.40
Pb/Cl/Sn-rich	1	0.72	0.27
Na/S-rich	3	2.17	0.05
Zn/Sn-rich	1	0.72	0.02
Totals	230	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb-rich	6.9	0.0	20.9	52.1	16.0	10.1	0.9	0.0	0.0	0.0	0.0
Zn/S-rich	15.1	9.6	33.6	43.2	7.8	5.9	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	5.4	0.0	13.3	40.0	36.1	9.4	1.2	0.0	0.0	0.0	0.0
Pb/Cl-rich	1.2	0.0	0.0	0.0	72.7	21.8	5.5	0.0	0.0	0.0	0.0
Na/Cl-rich	3.1	0.0	23.1	0.0	56.4	20.4	0.0	0.0	0.0	0.0	0.0
Misc.	21.3	3.4	40.8	40.8	14.2	0.9	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	3.0	24.5	48.9	0.0	24.5	0.0	2.2	0.0	0.0	0.0	0.0
Ca-rich	1.8	0.0	0.0	39.5	43.0	17.5	0.0	0.0	0.0	0.0	0.0
C-rich	11.0	0.0	52.4	32.8	13.7	1.2	0.0	0.0	0.0	0.0	0.0
Si-rich	1.1	0.0	0.0	65.3	28.9	5.8	0.0	0.0	0.0	0.0	0.0
Fe-rich	13.3	12.4	65.3	16.3	5.4	0.5	0.0	0.0	0.0	0.0	0.0
Al/S-rich	3.6	0.0	20.0	60.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0
Al-rich	5.8	0.0	50.0	37.5	12.5	0.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.7	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	2.9	0.0	75.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.7	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/S-rich	2.2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.7	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	4.5	41.2	34.0	16.2	3.8	0.3	0.0	0.0	0.0	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name	NPN Environ
Client_Number	Inlet -01
Project_Number	ESH004050
Sample_Number	617099
Comment	Filter

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Pb-rich	22.9	0.0	0.3	7.8	11.8	42.0	38.1	0.0	0.0	0.0	0.0
Zn/S-rich	18.7	0.1	1.4	6.6	12.5	79.5	0.0	0.0	0.0	0.0	0.0
Si/Al-rich	12.4	0.0	0.1	3.6	24.3	41.0	31.1	0.0	0.0	0.0	0.0
Pb/Cl-rich	10.1	0.0	0.0	0.0	13.9	43.0	43.1	0.0	0.0	0.0	0.0
Na/Cl-rich	9.6	0.0	0.2	0.0	31.4	68.4	0.0	0.0	0.0	0.0	0.0
Misc.	5.7	0.1	3.8	19.5	55.2	21.3	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	4.7	0.2	1.7	0.0	11.1	0.0	87.1	0.0	0.0	0.0	0.0
Ca-rich	4.0	0.0	0.0	5.4	26.9	67.7	0.0	0.0	0.0	0.0	0.0
C-rich	3.0	0.0	6.8	23.6	28.2	41.4	0.0	0.0	0.0	0.0	0.0
Si-rich	2.9	0.0	0.0	11.8	32.8	55.3	0.0	0.0	0.0	0.0	0.0
Fe-rich	2.2	0.3	12.2	27.2	39.6	20.7	0.0	0.0	0.0	0.0	0.0
Al/S-rich	1.0	0.0	3.4	46.0	50.6	0.0	0.0	0.0	0.0	0.0	0.0
Al-rich	0.8	0.0	11.5	38.3	50.2	0.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.8	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu/S-rich	0.4	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	0.4	0.0	13.5	86.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.3	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/S-rich	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zn/Sn-rich	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	1.4	7.8	22.0	47.7	21.0	0.0	0.0	0.0	0.0

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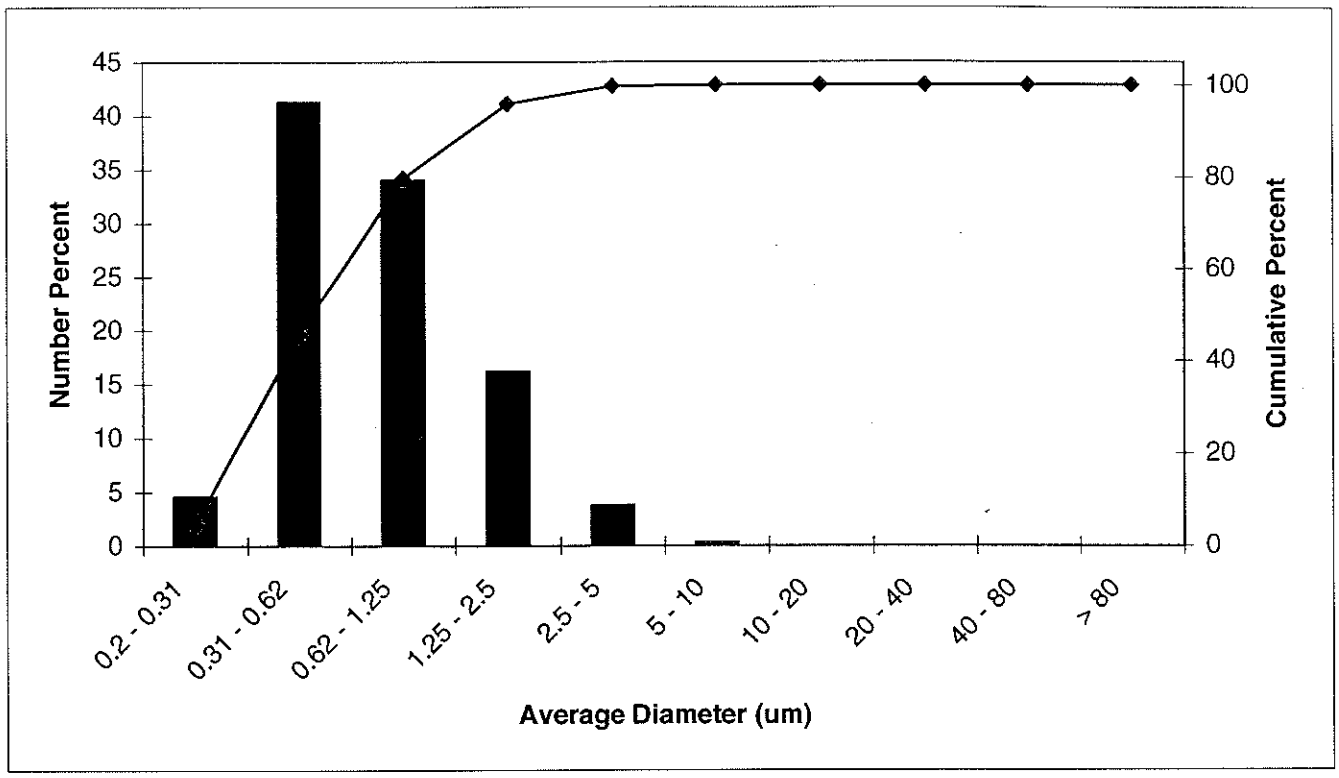
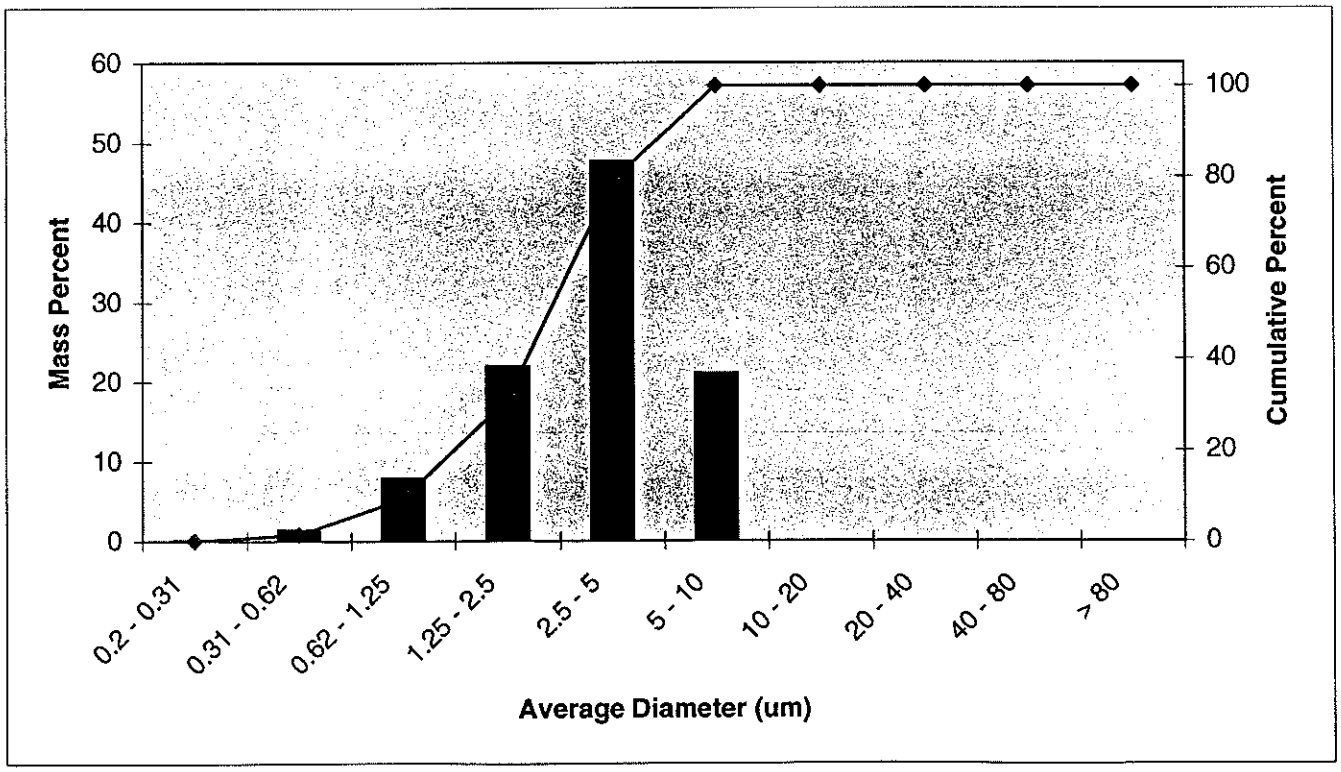
PH 724/325-1776 FAX 724/733-1799

Inlet -01, Filter (617099)





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Client_Name	NPN ENVIRO
Client_Number	INLET RUN 2-1
Project_Number	ESH004050
Sample_Number	617090
Comment	BEAKER

Table 1 - Abundance

Classes	#	Number %	Wt %
Na/S-rich	331	17.35	75.34
Pb-rich	71	7.33	7.24
Zn/S-rich	37	3.78	6.81
Fe-rich	13	1.50	1.99
Na-rich	127	15.62	1.70
Zn/Sn-rich	28	2.69	1.63
Zn-rich	116	15.08	1.44
Na/Cl-rich	2	0.07	0.64
Si-rich	3	0.11	0.55
Si/Al-rich	17	1.52	0.45
Cu-rich	4	0.40	0.40
C-rich	172	26.79	0.34
Pb/Cl-rich	5	0.57	0.28
Fe/Cr-rich	9	0.59	0.26
Al-rich	15	1.57	0.24
Misc.	18	1.68	0.21
Sn/Pb-rich	2	0.07	0.20
Ca-rich	10	1.00	0.18
Zn/Cl-rich	6	0.86	0.04
Al/S-rich	5	0.57	0.03
Pb/Cl/Sn-rich	1	0.04	0.01
Si/Mg-rich	1	0.16	0.01
Sn-rich	4	0.66	0.00
Totals	997	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Na/S-rich	17.4	0.0	5.7	14.2	25.6	28.0	18.6	7.3	0.6	0.0	0.0
Pb-rich	7.3	2.2	22.4	44.7	21.5	5.6	2.5	1.0	0.0	0.0	0.0
Zn/S-rich	3.8	8.7	52.0	21.7	2.9	5.9	6.9	2.0	0.0	0.0	0.0
Fe-rich	1.5	11.0	32.9	32.9	15.9	2.5	2.5	2.5	0.0	0.0	0.0
Na-rich	15.6	0.0	17.8	50.4	25.8	5.0	0.7	0.2	0.0	0.0	0.0
Zn/Sn-rich	2.7	0.0	18.3	42.7	28.0	6.9	2.8	1.4	0.0	0.0	0.0
Zn-rich	15.1	1.1	44.6	35.9	14.8	2.5	1.2	0.0	0.0	0.0	0.0
Na/Cl-rich	0.1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Si-rich	0.1	0.0	0.0	0.0	66.7	0.0	33.3	0.0	0.0	0.0	0.0
Si/Al-rich	1.5	0.0	21.6	32.4	31.4	9.8	4.9	0.0	0.0	0.0	0.0
Cu-rich	0.4	0.0	81.5	0.0	9.2	0.0	9.2	0.0	0.0	0.0	0.0
C-rich	26.8	9.2	49.5	34.9	5.4	1.0	0.0	0.0	0.0	0.0	0.0
Pb/Cl-rich	0.6	0.0	0.0	86.9	0.0	13.1	0.0	0.0	0.0	0.0	0.0
Fe/Cr-rich	0.6	0.0	0.0	55.8	12.6	31.6	0.0	0.0	0.0	0.0	0.0
Al-rich	1.6	0.0	10.4	52.2	23.2	14.2	0.0	0.0	0.0	0.0	0.0
Misc.	1.7	0.0	39.0	29.2	16.4	15.4	0.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Ca-rich	1.0	0.0	48.9	32.6	3.7	11.1	3.7	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.9	0.0	38.3	38.3	19.1	4.3	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.6	0.0	29.0	29.0	42.1	0.0	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.2	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.7	25.0	50.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	3.4	31.1	34.4	16.8	8.2	4.3	1.5	0.1	0.0	0.0

RJ LeeGroup, Inc.

350 Hochberg Road, Monroeville, PA 15146
724/325-1776 • 724/733-1799-FAX

Client_Name NPN ENVIRO
Client_Number INLET RUN 2-1
Project_Number ESH004050
Sample_Number 617090
Comment BEAKER

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Na/S-rich	75.3	0.0	0.0	0.0	0.5	4.5	23.9	49.5	21.5	0.0	0.0
Pb-rich	7.2	0.0	0.1	1.5	5.3	9.3	33.7	50.1	0.0	0.0	0.0
Zn/S-rich	6.8	0.0	0.0	0.1	0.3	1.8	25.1	72.7	0.0	0.0	0.0
Fe-rich	2.0	0.0	0.1	0.3	2.4	2.4	22.0	72.9	0.0	0.0	0.0
Na-rich	1.7	0.0	0.4	6.1	16.9	25.0	31.1	20.7	0.0	0.0	0.0
Zn/Sn-rich	1.6	0.0	0.0	1.8	6.6	8.8	21.3	61.5	0.0	0.0	0.0
Zn-rich	1.4	0.0	1.1	5.5	14.4	16.6	62.5	0.0	0.0	0.0	0.0
Na/Cl-rich	0.6	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Si-rich	0.6	0.0	0.0	0.0	1.8	0.0	98.2	0.0	0.0	0.0	0.0
Si/Al-rich	0.5	0.0	0.2	0.9	12.7	20.9	65.3	0.0	0.0	0.0	0.0
Cu-rich	0.4	0.0	0.1	0.0	4.1	0.0	95.7	0.0	0.0	0.0	0.0
C-rich	0.3	0.3	6.9	37.5	29.6	25.7	0.0	0.0	0.0	0.0	0.0
Pb/Cl-rich	0.3	0.0	0.0	3.7	0.0	96.3	0.0	0.0	0.0	0.0	0.0
Fe/Cr-rich	0.3	0.0	0.0	2.0	8.0	90.0	0.0	0.0	0.0	0.0	0.0
Al-rich	0.2	0.0	0.1	6.3	11.2	82.5	0.0	0.0	0.0	0.0	0.0
Misc.	0.2	0.0	0.6	1.5	16.9	81.0	0.0	0.0	0.0	0.0	0.0
Sn/Pb-rich	0.2	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Ca-rich	0.2	0.0	0.3	4.0	2.6	69.4	23.6	0.0	0.0	0.0	0.0
Zn/Cl-rich	0.0	0.0	1.8	24.1	17.2	57.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	0.0	0.0	0.4	12.1	87.5	0.0	0.0	0.0	0.0	0.0	0.0
Pb/Cl/Sn-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.0	5.5	26.0	68.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.1	0.5	1.8	6.5	26.3	48.7	16.2	0.0	0.0

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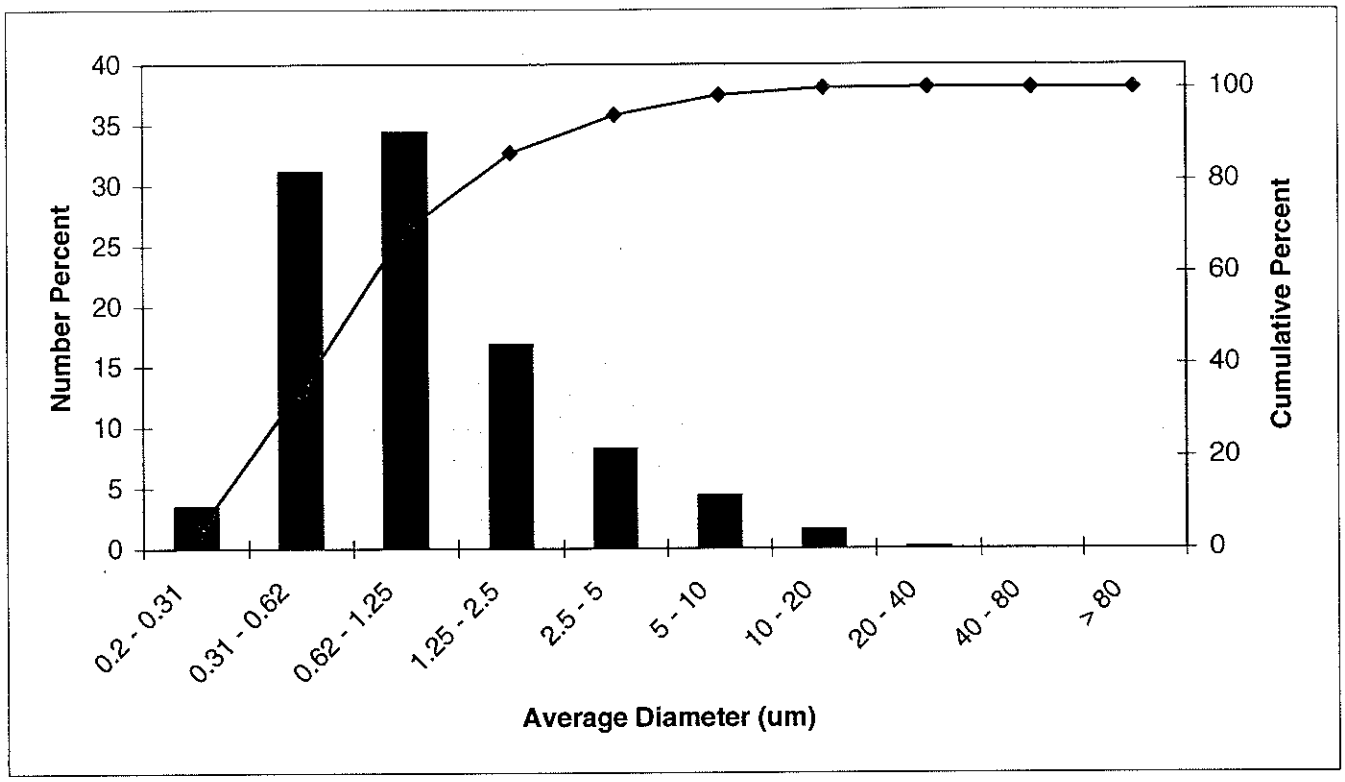
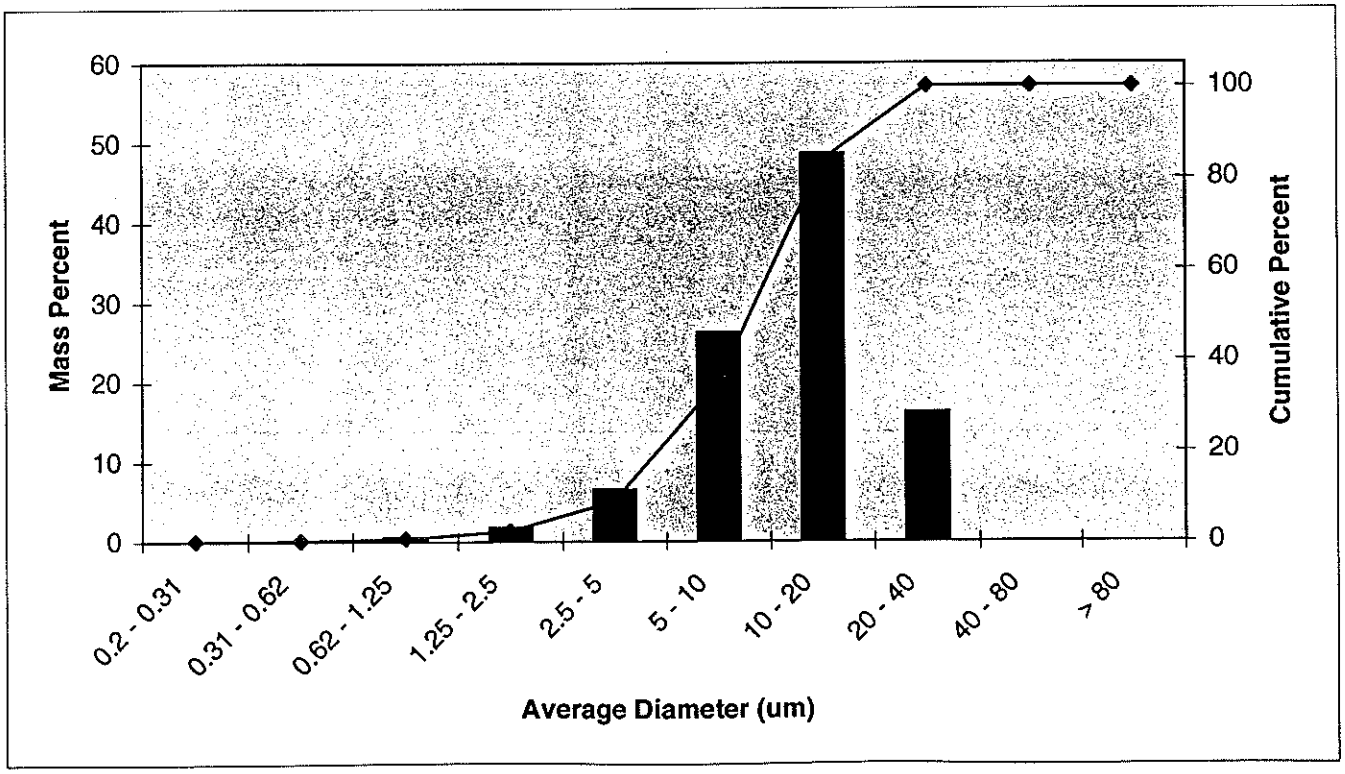
Inlet Run 2-1, Beaker (617090)





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Client_Name	NPN Environ
Client_Number	Inlet Run 2-2
Project_Number	ESH004050
Sample_Number	617091
Comment	Beaker

Table 1 - Abundance

Classes	#	Number %	Wt %
Al-rich	54	10.47	35.26
Pb-rich	70	16.71	18.45
Zn/Sn-rich	21	3.02	12.12
Zn-rich	18	2.32	8.34
Zn/Cl-rich	39	6.28	8.30
Sn/Pb-rich	3	0.08	7.63
Al/S-rich	68	17.60	2.20
Na/S-rich	3	0.08	2.18
Si-rich	12	1.24	1.72
Si/Al-rich	29	3.23	1.06
Fe-rich	42	11.42	0.78
Misc.	40	11.91	0.56
Ca-rich	14	2.84	0.41
C-rich	25	8.41	0.27
Fe/Cr-rich	10	2.12	0.26
Na/Cl-rich	4	0.41	0.17
Sn-rich	4	0.10	0.11
Pb/Cl-rich	2	0.36	0.06
Zn/S-rich	4	1.04	0.05
Si/Mg-rich	1	0.03	0.05
Cu-rich	1	0.34	0.01
Totals	464	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Al-rich	10.5	13.5	51.5	19.3	10.4	3.6	1.2	0.0	0.5	0.0	0.0
Pb-rich	16.7	0.0	40.3	52.4	4.5	2.3	0.2	0.5	0.0	0.0	0.0
Zn/Sn-rich	3.0	0.0	33.4	33.4	23.1	6.7	2.5	0.8	0.0	0.0	0.0
Zn-rich	2.3	0.0	29.0	43.4	15.6	6.6	4.4	0.0	1.1	0.0	0.0
Zn/Cl-rich	6.3	5.4	48.2	32.2	7.8	4.9	0.8	0.8	0.0	0.0	0.0
Sn/Pb-rich	0.1	0.0	0.0	0.0	66.7	0.0	0.0	33.3	0.0	0.0	0.0
Al/S-rich	17.6	3.8	65.0	26.8	3.1	0.9	0.4	0.0	0.0	0.0	0.0
Na/S-rich	0.1	0.0	0.0	0.0	0.0	33.3	33.3	33.3	0.0	0.0	0.0
Si-rich	1.2	0.0	0.0	54.4	29.2	6.2	10.3	0.0	0.0	0.0	0.0
Si/Al-rich	3.2	0.0	10.4	52.2	26.4	10.2	0.8	0.0	0.0	0.0	0.0
Fe-rich	11.4	6.6	61.9	29.5	0.7	1.3	0.0	0.0	0.0	0.0	0.0
Misc.	11.9	8.5	39.6	45.2	6.5	0.0	0.2	0.0	0.0	0.0	0.0
Ca-rich	2.8	11.8	23.7	59.2	2.7	2.7	0.0	0.0	0.0	0.0	0.0
C-rich	8.4	4.0	44.0	40.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe/Cr-rich	2.1	0.0	47.6	47.6	1.2	3.6	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.4	0.0	81.5	0.0	0.0	18.5	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.1	0.0	0.0	0.0	75.0	25.0	0.0	0.0	0.0	0.0	0.0
Pb/Cl-rich	0.4	0.0	0.0	93.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	1.0	0.0	0.0	97.5	0.0	2.5	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.3	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	4.9	46.1	38.4	7.3	2.5	0.7	0.2	0.1	0.0	0.0

RJ LeeGroup, Inc.

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Client_Name	NPN Environ
Client_Number	Inlet Run 2-2
Project_Number	ESH004050
Sample_Number	617091
Comment	Beaker

Table 3 - Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Al-rich	35.3	0.0	0.1	0.1	1.2	3.7	5.3	0.0	89.5	0.0	0.0
Pb-rich	18.5	0.0	0.4	2.5	1.3	6.0	3.2	86.6	0.0	0.0	0.0
Zn/Sn-rich	12.1	0.0	0.1	0.4	1.4	6.9	33.3	57.9	0.0	0.0	0.0
Zn-rich	8.3	0.0	0.1	0.2	0.7	4.7	17.1	0.0	77.1	0.0	0.0
Zn/Cl-rich	8.3	0.0	0.2	1.3	1.9	7.9	6.3	82.4	0.0	0.0	0.0
Sn/Pb-rich	7.6	0.0	0.0	0.0	0.5	0.0	0.0	99.5	0.0	0.0	0.0
Al/S-rich	2.2	0.0	3.0	6.1	10.7	17.6	62.6	0.0	0.0	0.0	0.0
Na/S-rich	2.2	0.0	0.0	0.0	0.0	1.1	8.0	90.9	0.0	0.0	0.0
Si-rich	1.7	0.0	0.0	1.2	4.2	4.0	90.6	0.0	0.0	0.0	0.0
Si/Al-rich	1.1	0.0	0.1	4.4	15.8	56.7	23.0	0.0	0.0	0.0	0.0
Fe-rich	0.8	0.1	4.0	15.9	5.8	74.3	0.0	0.0	0.0	0.0	0.0
Misc.	0.6	0.1	5.3	34.6	35.6	0.0	24.3	0.0	0.0	0.0	0.0
Ca-rich	0.4	0.1	1.2	16.5	10.7	71.5	0.0	0.0	0.0	0.0	0.0
C-rich	0.3	0.1	8.1	40.2	51.6	0.0	0.0	0.0	0.0	0.0	0.0
Fe/Cr-rich	0.3	0.0	4.2	20.1	6.8	68.9	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.2	0.0	0.5	0.0	0.0	99.5	0.0	0.0	0.0	0.0	0.0
Sn-rich	0.1	0.0	0.0	0.0	63.7	36.3	0.0	0.0	0.0	0.0	0.0
Pb/Cl-rich	0.1	0.0	0.0	39.2	60.8	0.0	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	0.1	0.0	0.0	48.4	0.0	51.6	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	0.0	0.3	1.5	2.1	6.7	11.9	39.4	38.0	0.0	0.0

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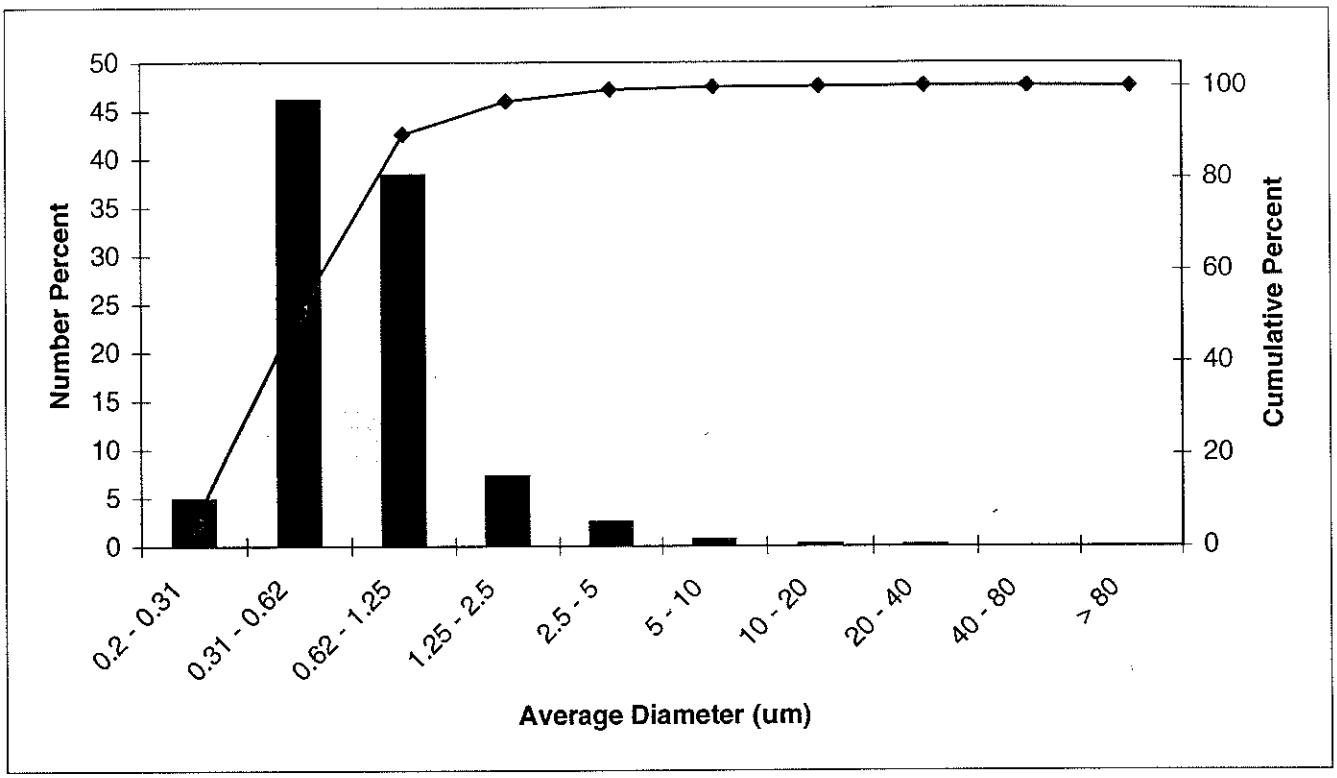
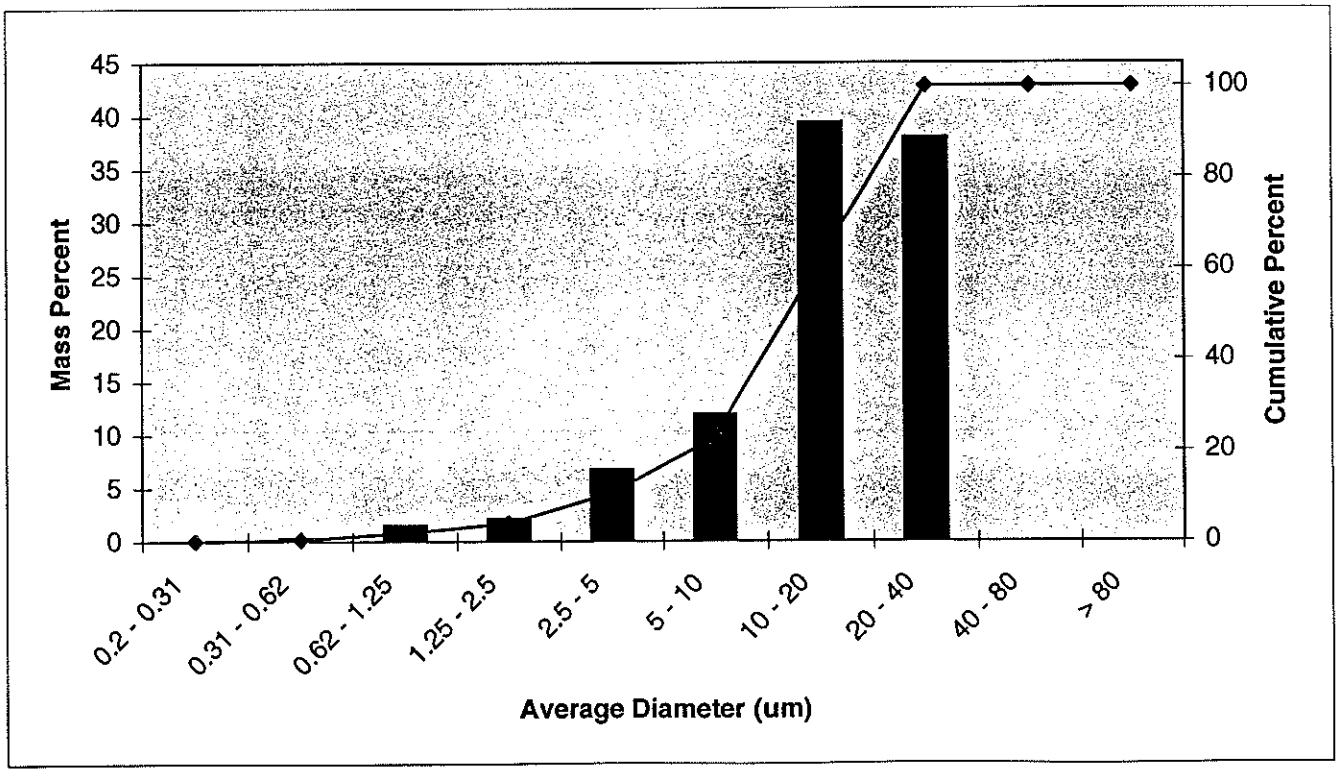
Inlet Run 2-2, Beaker (617091)





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Client_Name	NPN Environ
Client_Number	Inlet -02
Project_Number	ESH004050
Sample_Number	617100
Comment	Filter

Table 1 - Abundance

Classes	#	Number %	Wt %
Si/Al-rich	43	9.46	80.45
Na/S-rich	6	1.41	8.30
Si-rich	12	2.32	3.69
Ca-rich	24	8.19	2.82
Fe-rich	95	52.96	1.55
Misc.	15	6.07	1.00
Al-rich	6	1.92	0.60
C-rich	14	6.51	0.57
Zn/S-rich	6	2.93	0.51
Fe/Cr-rich	3	1.21	0.22
Pb/Cl-rich	1	0.07	0.12
Zn-rich	3	1.72	0.07
Al/S-rich	3	1.21	0.06
Zn/Cl-rich	2	1.15	0.02
Pb-rich	2	1.15	0.02
Si/Mg-rich	1	0.57	0.00
Cu-rich	1	0.57	0.00
Na/Cl-rich	1	0.57	0.00
Totals	238	100.00	100.00

Table 2 - Number % Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 0.3	0.3 - 0.6	0.6 - 1.3	1.3 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 20.0	20.0 - 40.0	40.0 - 80.0	>>>
Si/Al-rich	9.5	0.0	18.2	36.4	27.8	9.9	4.9	2.1	0.7	0.0	0.0
Na/S-rich	1.4	0.0	81.1	0.0	4.7	4.7	4.7	4.7	0.0	0.0	0.0
Si-rich	2.3	0.0	49.4	24.7	8.6	8.6	8.6	0.0	0.0	0.0	0.0
Ca-rich	8.2	0.0	28.0	35.0	28.8	7.3	0.8	0.0	0.0	0.0	0.0
Fe-rich	53.0	14.1	59.6	23.8	2.3	0.3	0.0	0.0	0.0	0.0	0.0
Misc.	6.1	9.4	66.1	9.4	10.6	3.3	1.1	0.0	0.0	0.0	0.0
Al-rich	1.9	0.0	89.6	0.0	3.5	7.0	0.0	0.0	0.0	0.0	0.0
C-rich	6.5	0.0	35.2	17.6	45.1	2.1	0.0	0.0	0.0	0.0	0.0
Zn/S-rich	2.9	19.5	78.2	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0
Fe/Cr-rich	1.2	0.0	0.0	94.5	0.0	5.5	0.0	0.0	0.0	0.0	0.0
Pb/Cl-rich	0.1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Zn-rich	1.7	33.3	0.0	66.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Al/S-rich	1.2	47.2	47.2	0.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0
Zn/Cl-rich	1.1	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pb-rich	1.1	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si/Mg-rich	0.6	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu-rich	0.6	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na/Cl-rich	0.6	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Totals	100.0	9.7	51.6	24.7	10.1	2.7	0.9	0.3	0.1	0.0	0.0

RJ Lee *Group*, Inc

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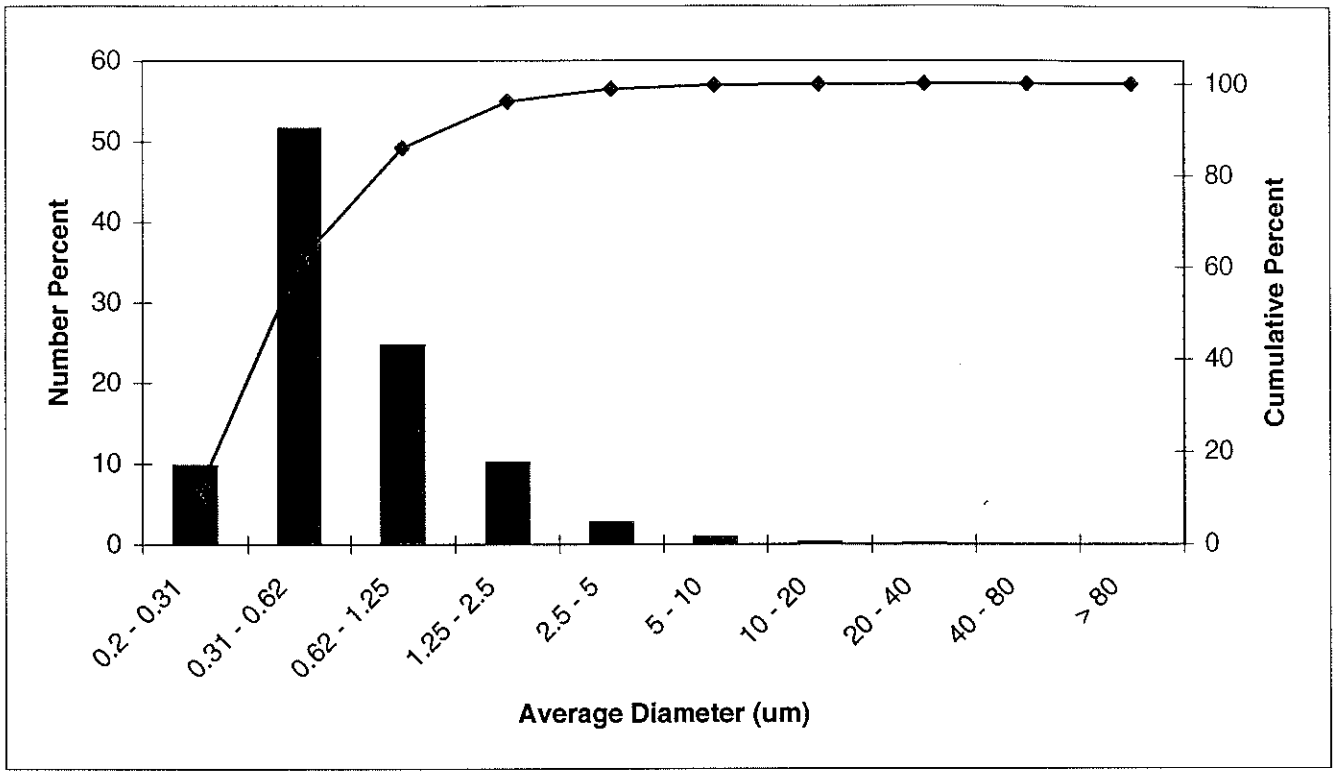
Inlet -02, Filter (617100)



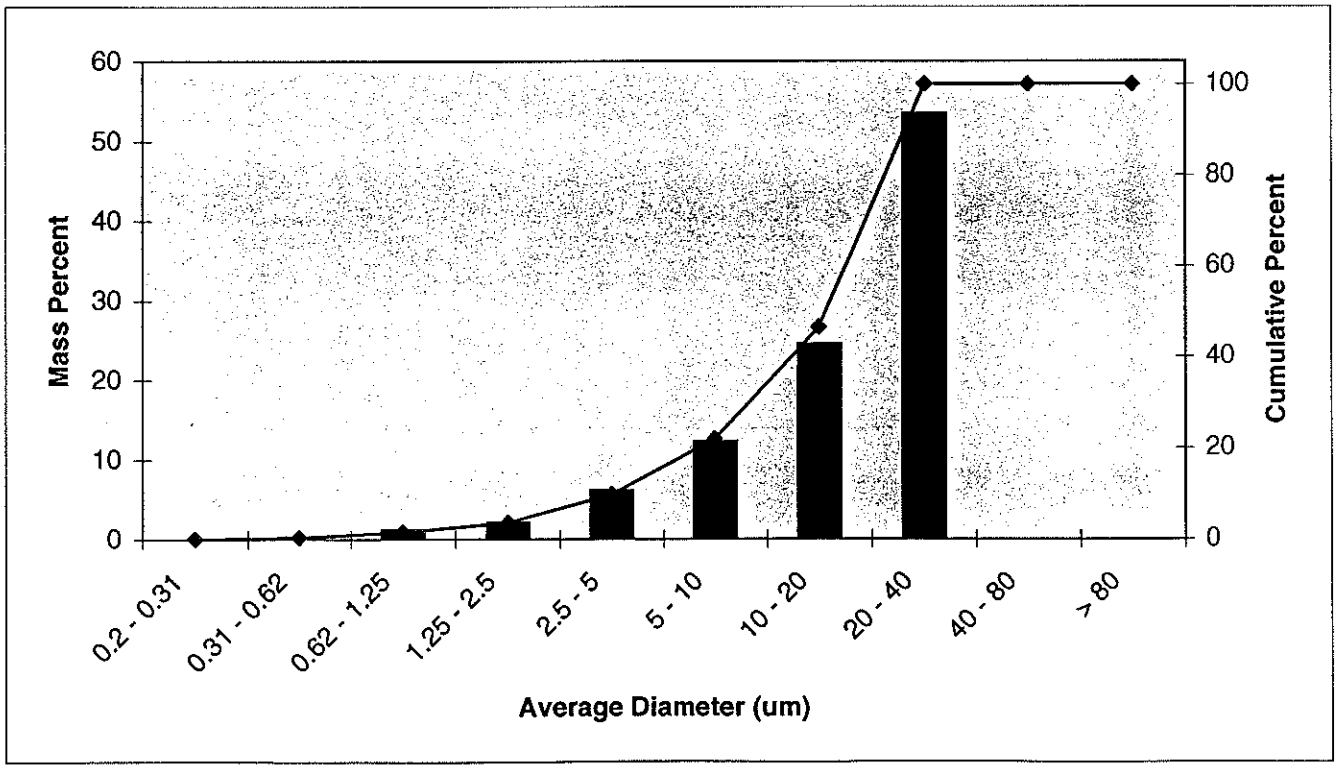


TABLE 1
Chemetco Gaseous Test Results
March 14-17, 2000

Source	Date	Run	Flowrate (dscfm)	NO_x (lb/hr)	SO_x (lb/hr)	HCl (lb/hr)	Cl_2 (lb/hr)
Stack 1	3/16/00	1	27,529	9.5	0	0.13	0.07
		2	23,117	4.1	0	0.10	0.09
		3	22,208	2.5	0	0.08	0.13
		Avg.	**24,284**	**5.4**	**0**	**0.10**	**0.10**
Stack 2	3/14/00	1	38,061	4.9	0	0.24	0.12
		2	46,771	2.2	0	0.18	0.07
		3	42,219	0	0	0.24	0.12
		Avg.	**42,350**	**2.4**	**0**	**0.22**	**0.10**
Stack 3	3/15/00	1	33,467	0	0	0.56	0.40
		2	33,697	0	0	0.32	0.24
		3	33,392	1.4	0	0.17	0
		Avg.	**33,519**	**0.46**	**0**	**0.35**	**0.21**
Stack 3 (Heat Cycle 4)	3/17/00	1	34,056	6.0	0	0.24	0.15
		2	33,370	2.2	0	0.25	0.22
		3	33,699	4.4	0	0.25	0.20
		Avg.	**33,708**	**4.2**	**0**	**0.25**	**0.19**
Overall Average			**33,465**	**3.1**	**0**	**0.23**	**0.15**

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/16/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 1
RUN NUMBER: 1

HYDROGEN CHLORIDE:	0.0023	grams collected - blank corrected
CHLORINE:	0.0012	grams collected
NOx:	74	ppmdv
SOx :	0	ppmdv
%O2:	20.5	%
%CO2:	0	%
WT. IMP:	57.7	g
WT. GEL:	9.8	g
VOL METER:	62.41	dscf
VOLUME FLOW (SCFM):	28942	scfm
VOLUME FLOW (DSCFM):	27529	dscfm
VOLUME FLOW (DSCFH):	1651747	dscfh
STACK TEMP. (F):	126	F

WT.wc:	2.72
WT.gel:	0.46
Bws:	0.048
% H2O:	4.8
DRY GAS FRACTION:	0.95

NOx EMISS:	9.51	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.13	(lb/hr)
CHLORINE EMISS:	0.07	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.14	14.80 psia
Pst (IN H2O):	0.1	
Ps (IN. Hg):	30.15	
Ts (F):	126	586 R
PITOT COEF.:	0.84	
%O2:	20.5	
%CO2:	0	
%N2+%CO:	79.5	
MW STACK GAS:	28.61	
DRY GAS FRACTION:	0.95	
dP^0.5	0.49	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.15	0.15	0.39	0.39
2	0.21	0.22	0.46	0.47
3	0.26	0.22	0.51	0.47
4	0.25	0.23	0.50	0.48
5	0.26	0.24	0.51	0.49
6	0.25	0.27	0.50	0.52
7	0.23	0.27	0.48	0.52
8	0.25	0.28	0.5	0.53
9	0.27	0.3	0.52	0.55
10	0.29	0.28	0.54	0.53
11	0.21	0.27	0.46	0.52
12	0.24	0.2	0.49	0.45
SUM	2.87	2.93	5.85	5.91
			dp SUM	11.76
			dp AVG	0.49

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	4503
EMISSION RATE (lb/hr):	0.005

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/16/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 1
RUN NUMBER: 2

HYDROGEN CHLORIDE:	0.002	grams collected - blank corrected
CHLORINE:	0.0018	grams collected
NOx:	38	ppmdv
SOx :	0	ppmdv
%O2:	18	%
%CO2:	2	%
WT. IMP:	84.8	g
WT. GEL:	10.5	g
VOL METER:	63.34	dscf
VOLUME FLOW (SCFM):	24765	scfm
VOLUME FLOW (DSCFM):	23117	dscfm
VOLUME FLOW (DSCFH):	1387034	dscfh
STACK TEMP. (F):	134	F

WT.wc:	3.99
WT.gel:	0.50
Bws:	0.066
% H2O:	6.6
DRY GAS FRACTION:	0.93

NOx EMISS:	4.10	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.10	(lb/hr)
CHLORINE EMISS:	0.09	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.14	14.80 psia
Pst (IN H2O):	0.1	
Ps (IN. Hg):	30.15	
Ts (F):	134	594 R
PITOT COEF.:	0.84	
%O2:	18	
%CO2:	2	
%N2+%CO:	80	
MW STACK GAS:	28.75	
DRY GAS FRACTION:	0.93	
dP^0.5	0.42	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.12	0.09	0.35	0.30
2	0.19	0.15	0.44	0.39
3	0.2	0.19	0.45	0.44
4	0.24	0.19	0.49	0.44
5	0.23	0.2	0.48	0.45
6	0.25	0.22	0.50	0.47
7	0.18	0.19	0.42	0.44
8	0.22	0.21	0.47	0.46
9	0.28	0.17	0.53	0.41
10	0.2	0.18	0.45	0.42
11	0.19	0.12	0.44	0.35
12	0.11	0.07	0.33	0.26
SUM	2.41	1.98	5.34	4.82
			dp SUM	10.15
			dp AVG	0.42

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	3853
EMISSION RATE (lb/hr):	0.004

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/16/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 1
RUN NUMBER: 3

HYDROGEN CHLORIDE:	0.0023	grams collected - blank corrected
CHLORINE:	0.0037	grams collected
NOx:	24	ppmdv
SOx :	0	ppmdv
%O2:	20.5	%
%CO2:	0	%
WT. IMP:	81.2	g
WT. GEL:	16.8	g
VOL METER:	84.78	dscf
VOLUME FLOW (SCFM):	23426	scfm
VOLUME FLOW (DSCFM):	22208	dscfm
VOLUME FLOW (DSCFH):	1332486	dscfh
STACK TEMP. (F):	131	F

WT.wc:	3.82
WT.gel:	0.79
Bws:	0.052
% H2O:	5.2
DRY GAS FRACTION:	0.95

NOx EMISS:	2.49	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.08	(lb/hr)
CHLORINE EMISS:	0.13	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.14	14.80 psia
Pst (IN H2O):	0.15	
Ps (IN. Hg):	30.15	
Ts (F):	131	591 R
PITOT COEF.:	0.84	
%O2:	20.5	
%CO2:	0	
%N2+%CO:	79.5	
MW STACK GAS:	28.60	
DRY GAS FRACTION:	0.95	
dP^0.5	0.40	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.1	0.1	0.32	0.32
2	0.15	0.13	0.39	0.36
3	0.14	0.18	0.37	0.42
4	0.17	0.19	0.41	0.44
5	0.17	0.19	0.41	0.44
6	0.15	0.14	0.39	0.37
7	0.2	0.15	0.45	0.39
8	0.18	0.15	0.42	0.39
9	0.2	0.17	0.45	0.41
10	0.21	0.19	0.46	0.44
11	0.21	0.17	0.46	0.41
12	0.11	0.1	0.33	0.32
SUM	1.99	1.86	4.86	4.70
			dp SUM	9.55
			dp AVG	0.40

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	3645
EMISSION RATE (lb/hr):	0.004

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/14/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 2
RUN NUMBER: 1

HYDROGEN CHLORIDE:	0.002	grams collected - blank corrected
CHLORINE:	0.001	grams collected
NOx:	28	ppmdv
SOx :	0	ppmdv
%O2:	13	%
%CO2:	1	%
WT. IMP:	27.6	g
WT. GEL:	8.2	g
VOL METER:	42.85	dscf
VOLUME FLOW (SCFM):	39574	scfm
VOLUME FLOW (DSCFM):	38061	dscfm
VOLUME FLOW (DSCFH):	2283641	dscfh
STACK TEMP. (F):	115	F

WT.wc:	1.30
WT.gel:	0.39
Bws:	0.038
% H2O:	3.8
DRY GAS FRACTION:	0.96

NOx EMISS:	4.98	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.24	(lb/hr)
CHLORINE EMISS:	0.12	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.25	14.86 psia
Pst (IN H2O):	0.08	
Ps (IN. Hg):	30.26	
Ts (F):	115	575 R
PITOT COEF.:	0.84	
%O2:	13	
%CO2:	1	
%N2+%CO:	86	
MW STACK GAS:	28.45	
DRY GAS FRACTION:	0.96	
dP^0.5	0.66	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.41	0.4	0.64	0.63
2	0.3	0.48	0.55	0.69
3	0.34	0.65	0.58	0.81
4	0.38	0.67	0.62	0.82
5	0.57	0.69	0.75	0.83
6	0.42	0.72	0.65	0.85
7	0.11	0.71	0.33	0.84
8	0.05	0.7	0.22	0.84
9	0.03	0.8	0.17	0.89
10	0.08	0.95	0.28	0.97
11	0.15	1.1	0.39	1.05
12	0.19	1	0.44	1.00
SUM	3.03	8.87	5.63	10.23
			dp SUM	15.85
			dp AVG	0.66

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	6158
EMISSION RATE (lb/hr):	0.006

CHEMETCO , GASEOUS TESTS – RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/14/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 2
RUN NUMBER: 2

HYDROGEN CHLORIDE:	0.0014	grams collected - blank corrected
CHLORINE:	0.0005	grams collected
NOx:	10	ppmdv
SOx :	0	ppmdv
%O2:	20.5	%
%CO2:	0	%
WT. IMP:	25.9	g
WT. GEL:	8.1	g
VOL METER:	47.48	dscf
VOLUME FLOW (SCFM):	48368	scfm
VOLUME FLOW (DSCFM):	46771	dscfm
VOLUME FLOW (DSCFH):	2806276	dscfh
STACK TEMP. (F):	111	F

WT.wc:	1.22
WT.gel:	0.38
Bws:	0.033
% H2O:	3.3
DRY GAS FRACTION:	0.97

NOx EMISS:	2.18	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.18	(lb/hr)
CHLORINE EMISS:	0.07	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.28	14.87 psia
Pst (IN H2O):	0.1	
Ps (IN. Hg):	30.29	
Ts (F):	111	571 R
PITOT COEF.:	0.84	
%O2:	20.5	
%CO2:	0	
%N2+%CO:	79.5	
MW STACK GAS:	28.68	
DRY GAS FRACTION:	0.97	
dP^0.5	0.81	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.69	0.55	0.83	0.74
2	0.87	0.69	0.93	0.83
3	0.89	0.7	0.94	0.84
4	0.95	0.75	0.97	0.87
5	0.95	0.63	0.97	0.79
6	0.68	0.55	0.82	0.74
7	0.33	0.62	0.57	0.79
8	0.3	0.65	0.55	0.81
9	0.3	0.8	0.55	0.89
10	0.45	1	0.67	1.00
11	0.3	1	0.55	1.00
12	0.5	1	0.71	1.00
SUM	7.21	8.94	9.08	10.30
			dp SUM	19.37
			dp AVG	0.81

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	7526
EMISSION RATE (lb/hr):	0.008

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/14/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 2
RUN NUMBER: 3

HYDROGEN CHLORIDE:	0.0027	grams collected - blank corrected
CHLORINE:	0.0013	grams collected
NOx:	0	ppmdv
SOx :	0	ppmdv
%O2:	20.5	%
%CO2:	0	%
WT. IMP:	39.7	g
WT. GEL:	11.8	g
VOL METER:	63.08	dscf
VOLUME FLOW (SCFM):	43860	scfm
VOLUME FLOW (DSCFM):	42219	dscfm
VOLUME FLOW (DSCFH):	2533152	dscfh
STACK TEMP. (F):	129	F

WT.wc:	1.87
WT.gel:	0.56
Bws:	0.037
% H2O:	3.7
DRY GAS FRACTION:	0.96

NOx EMISS:	0.00	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.24	(lb/hr)
CHLORINE EMISS:	0.12	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.25	14.86 psia
Pst (IN H2O):	0.1	
Ps (IN. Hg):	30.26	
Ts (F):	129	589 R
PITOT COEF.:	0.84	
%O2:	20.5	
%CO2:	0	
%N2+%CO:	79.5	
MW STACK GAS:	28.66	
DRY GAS FRACTION:	0.96	
dP^0.5	0.74	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.49	0.48	0.70	0.69
2	0.65	0.7	0.81	0.84
3	0.6	0.77	0.77	0.88
4	0.69	0.75	0.83	0.87
5	0.6	0.75	0.77	0.87
6	0.63	0.65	0.79	0.81
7	0.48	0.55	0.69	0.74
8	0.45	0.4	0.67	0.63
9	0.54	0.4	0.73	0.63
10	0.55	0.42	0.74	0.65
11	0.55	0.46	0.74	0.68
12	0.5	0.36	0.71	0.60
SUM	6.73	6.69	8.97	8.88
			dp SUM	17.85
			dp AVG	0.74

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	6824
EMISSION RATE (lb/hr):	0.007

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/15/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 3
RUN NUMBER: 1

HYDROGEN CHLORIDE:	0.0058	grams collected - blank corrected
CHLORINE:	0.0042	grams collected
NOx:	0	ppmdv
SOx:	0	ppmdv
%O2:	18	%
%CO2:	2	%
WT. IMP:	88.9	g
WT. GEL:	9.4	g
VOL METER:	45.96	dscf
VOLUME FLOW (SCFM):	36852	scfm
VOLUME FLOW (DSCFM):	33467	dscfm
VOLUME FLOW (DSCFH):	2008027	dscfh
STACK TEMP. (F):	152	F

WT.wc:	4.18
WT.gel:	0.44
Bws:	0.091
% H2O:	9.1
DRY GAS FRACTION:	0.91

NOx EMISS:	0.00	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.56	(lb/hr)
CHLORINE EMISS:	0.40	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.25	14.86 psia
Pst (IN H2O):	0.1	
Ps (IN. Hg):	30.26	
Ts (F):	152	612 R
PITOT COEF.:	0.84	
%O2:	18	
%CO2:	2	
%N2+%CO:	80	
MW STACK GAS:	28.64	
DRY GAS FRACTION:	0.91	
dP^0.5	0.64	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.03	0.41	0.17	0.64
2	0.21	0.46	0.46	0.68
3	0.2	0.45	0.45	0.67
4	0.26	0.41	0.51	0.64
5	0.32	0.43	0.57	0.66
6	0.62	0.5	0.79	0.71
7	0.58	0.48	0.76	0.69
8	0.63	0.49	0.79	0.70
9	0.63	0.48	0.79	0.69
10	0.55	0.48	0.74	0.69
11	0.55	0.48	0.74	0.69
12	0.18	0.38	0.42	0.62
SUM	4.76	5.45	7.20	8.08
			dp SUM	15.28
			dp AVG	0.64

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	5734
EMISSION RATE (lb/hr):	0.006

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/15/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 3
RUN NUMBER: 2

HYDROGEN CHLORIDE:	0.0034	grams collected - blank corrected
CHLORINE:	0.0025	grams collected
NOx:	0	ppmdv
SOx :	0	ppmdv
%O2:	20.5	%
%CO2:	0	%
WT. IMP:	73.9	g
WT. GEL:	11.3	g
VOL METER:	47.16	dscf
VOLUME FLOW (SCFM):	36578	scfm
VOLUME FLOW (DSCFM):	33697	dscfm
VOLUME FLOW (DSCFH):	2021823	dscfh
STACK TEMP. (F):	151	F

WT.wc:	3.48
WT.gel:	0.53
Bws:	0.078
% H2O:	7.8
DRY GAS FRACTION:	0.92

NOx EMISS:	0.00	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.32	(lb/hr)
CHLORINE EMISS:	0.24	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.14	14.80 psia
Pst (IN H2O):	0.1	
Ps (IN. Hg):	30.15	
Ts (F):	151	611 R
PITOT COEF.:	0.84	
%O2:	20.5	
%CO2:	0	
%N2+%CO:	79.5	
MW STACK GAS:	28.49	
DRY GAS FRACTION:	0.92	
dP^0.5	0.63	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.03	0.23	0.17	0.48
2	0.19	0.51	0.44	0.71
3	0.2	0.62	0.45	0.79
4	0.24	0.64	0.49	0.80
5	0.28	0.69	0.53	0.83
6	0.31	0.58	0.56	0.76
7	0.74	0.26	0.86	0.51
8	0.65	0.2	0.81	0.45
9	0.74	0.22	0.86	0.47
10	0.71	0.35	0.84	0.59
11	0.75	0.4	0.87	0.63
12	0.4	0.38	0.63	0.62
SUM	5.24	5.08	7.50	7.64
			dp SUM	15.14
			dp AVG	0.63

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	5691
EMISSION RATE (lb/hr):	0.006

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/15/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 3
RUN NUMBER: 3 (flow from run 2 due to early heat cycle completion)

HYDROGEN CHLORIDE:	0.0007	grams collected - blank corrected
CHLORINE:	0	grams collected
NOx:	9	ppmdv
SOx :	0	ppmdv
%O2:	20.5	%
%CO2:	0	%
WT. IMP:	31.5	g
WT. GEL:	4.5	g
VOL METER:	17.71	dscf
VOLUME FLOW (SCFM):	36602	scfm
VOLUME FLOW (DSCFM):	33392	dscfm
VOLUME FLOW (DSCFH):	2003521	dscfh
STACK TEMP. (F):	151	F

WT.wc:	1.48
WT.gel:	0.21
Bws:	0.087
% H2O:	8.7
DRY GAS FRACTION:	0.91

NOx EMISS:	1.40	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.17	(lb/hr)
CHLORINE EMISS:	0.00	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.14	14.80 psia
Pst (IN H2O):	0.1	
Ps (IN. Hg):	30.15	
Ts (F):	151	611 R
PITOT COEF.:	0.84	
%O2:	20.5	
%CO2:	0	
%N2+%CO:	79.5	
MW STACK GAS:	28.45	
DRY GAS FRACTION:	0.91	
dP^0.5	0.63	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.03	0.23	0.17	0.48
2	0.19	0.51	0.44	0.71
3	0.2	0.62	0.45	0.79
4	0.24	0.64	0.49	0.80
5	0.28	0.69	0.53	0.83
6	0.31	0.58	0.56	0.76
7	0.74	0.26	0.86	0.51
8	0.65	0.2	0.81	0.45
9	0.74	0.22	0.86	0.47
10	0.71	0.35	0.84	0.59
11	0.75	0.4	0.87	0.63
12	0.4	0.38	0.63	0.62
SUM	5.24	5.08	7.50	7.64
			dp SUM	15.14
			dp AVG	0.63

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	5695
EMISSION RATE (lb/hr):	0.006

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/17/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 3
RUN NUMBER: 1 heat cycle 4

HYDROGEN CHLORIDE:	0.0025	grams collected - blank corrected
CHLORINE:	0.0016	grams collected
NOx:	38	ppmdv
SOx :	0	ppmdv
%O2:	18	%
%CO2:	0	%
WT. IMP:	87.2	g
WT. GEL:	7.6	g
VOL METER:	47.77	dscf
VOLUME FLOW (SCFM):	37252	scfm
VOLUME FLOW (DSCFM):	34056	dscfm
VOLUME FLOW (DSCFH):	2043350	dscfh
STACK TEMP. (F):	143	F

WT.wc:	4.10
WT.gel:	0.36
Bws:	0.085
% H2O:	8.5
DRY GAS FRACTION:	0.91

NOx EMISS:	6.04	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.24	(lb/hr)
CHLORINE EMISS:	0.15	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.45	14.96 psia
Pst (IN H2O):	0.1	
Ps (IN. Hg):	30.46	
Ts (F):	143	603 R
PITOT COEF.:	0.84	
%O2:	18	
%CO2:	0	
%N2+%CO:	82	
MW STACK GAS:	28.30	
DRY GAS FRACTION:	0.91	
dP^0.5	0.63	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.04	0.23	0.20	0.48
2	0.2	0.48	0.45	0.69
3	0.24	0.65	0.49	0.81
4	0.3	0.7	0.55	0.84
5	0.29	0.62	0.54	0.79
6	0.38	0.68	0.62	0.82
7	0.55	0.32	0.74	0.57
8	0.6	0.25	0.77	0.50
9	0.58	0.25	0.76	0.50
10	0.65	0.31	0.81	0.56
11	0.6	0.35	0.77	0.59
12	0.6	0.33	0.77	0.57
SUM	5.03	5.17	7.47	7.72
			dp SUM	15.19
			dp AVG	0.63

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	5796
EMISSION RATE (lb/hr):	0.006

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/17/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 3
RUN NUMBER: 2 heat cycle 4

HYDROGEN CHLORIDE:	0.0027	grams collected - blank corrected
CHLORINE:	0.0024	grams collected
NOx:	14	ppmdv
SOx :	0	ppmdv
%O2:	20.5	%
%CO2:	0	%
WT. IMP:	76.6	g
WT. GEL:	8.2	g
VOL METER:	48.44	dscf
VOLUME FLOW (SCFM):	36135	scfm
VOLUME FLOW (DSCFM):	33370	dscfm
VOLUME FLOW (DSCFH):	2002209	dscfh
STACK TEMP. (F):	142	F

WT.wc:	3.61
WT.gel:	0.39
Bws:	0.076
% H2O:	7.6
DRY GAS FRACTION:	0.92

NOx EMISS:	2.18	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.25	(lb/hr)
CHLORINE EMISS:	0.22	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.5	14.98 psia
Pst (IN H2O):	0.1	
Ps (IN. Hg):	30.51	
Ts (F):	142	602 R
PITOT COEF.:	0.84	
%O2:	20.5	
%CO2:	0	
%N2+%CO:	79.5	
MW STACK GAS:	28.50	
DRY GAS FRACTION:	0.92	
dP^0.5	0.62	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.03	0.21	0.17	0.46
2	0.14	0.43	0.37	0.66
3	0.19	0.51	0.44	0.71
4	0.32	0.55	0.57	0.74
5	0.3	0.6	0.55	0.77
6	0.35	0.57	0.59	0.75
7	0.65	0.37	0.81	0.61
8	0.6	0.25	0.77	0.50
9	0.57	0.25	0.75	0.50
10	0.68	0.28	0.82	0.53
11	0.6	0.4	0.77	0.63
12	0.59	0.25	0.77	0.50
SUM	5.02	4.67	7.39	7.37
			dp SUM	14.76
			dp AVG	0.62

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	5622
EMISSION RATE (lb/hr):	0.006

CHEMETCO , GASEOUS TESTS -- RESULTS REPORT

PROJECT NAME: CHEMETCO
CONTRACT NO.: C-00005.B
DATE: 3/17/00
PERSONNEL: BLG, KAR, MWS, SSW
LOCATION: STACK # 3
RUN NUMBER: 3 heat cycle 4

HYDROGEN CHLORIDE:	0.0036	grams collected - blank corrected
CHLORINE:	0.0028	grams collected
NOx:	28	ppmdv
SOx :	0	ppmdv
%O2:	20.5	%
%CO2:	0	%
WT. IMP:	102.7	g
WT. GEL:	8.4	g
VOL METER:	63.47	dscf
VOLUME FLOW (SCFM):	36490	scfm
VOLUME FLOW (DSCFM):	33699	dscfm
VOLUME FLOW (DSCFH):	2021920	dscfh
STACK TEMP. (F):	145	F

WT.wc:	4.83
WT.gel:	0.40
Bws:	0.076
% H2O:	7.6
DRY GAS FRACTION:	0.92

NOx EMISS:	4.41	(lb/hr)
SOx:	0	ppmdv
SOx EMISS:	0.00	(lb/hr)
HCl EMISS:	0.25	(lb/hr)
CHLORINE EMISS:	0.20	(lb/hr)

STACK PARAMETERS

STACK DIMENSIONS:	58"	
STACK AREA (FT.):	18.35	
Pb (IN. Hg):	30.5	14.98 psia
Pst (IN H2O):	0.12	
Ps (IN. Hg):	30.51	
Ts (F):	145	605 R
PITOT COEF.:	0.84	
%O2:	20.5	
%CO2:	0	
%N2+%CO:	79.5	
MW STACK GAS:	28.50	
DRY GAS FRACTION:	0.92	
dP^0.5	0.62	

GAS VELOCITY & VOLUME CALCULATIONS SHEET

TRAVERSE POINT	VELOCITY HEAD (dp)	VELOCITY HEAD (dp)	(dp)^0.5	(dp)^0.5
1	0.01	0.26	0.10	0.51
2	0.18	0.49	0.42	0.70
3	0.22	0.7	0.47	0.84
4	0.23	0.7	0.48	0.84
5	0.27	0.65	0.52	0.81
6	0.39	0.66	0.62	0.81
7	0.48	0.33	0.69	0.57
8	0.6	0.22	0.77	0.47
9	0.5	0.26	0.71	0.51
10	0.61	0.33	0.78	0.57
11	0.6	0.4	0.77	0.63
12	0.55	0.35	0.74	0.59
SUM	4.64	5.35	7.09	7.85
			dp SUM	14.94
			dp AVG	0.62

CONSTITUENT PARAMETERS

CONCENTRATION (ppmvtot.):	1
MOLEC. WT. (lb/lb-mol):	1

EMISSION CALCULATIONS

MOLES AIR (lb-mol/hr):	5677
EMISSION RATE (lb/hr):	0.006

First Analytical Laboratories

ANALYSIS REPORT

Hydrochloric Acid and Chlorine
Method 26A

Project: Chemetco

Prepared for:

Blue 292
2525 Meridian Parkway; Suite 50
Durham, NC 27713

Reviewed and Approved by:

William H. Wadlin, Ph. D.
Laboratory Manager

March 29, 2000

First Analytical Laboratories

CASE NARRATIVE

Project #: 00314 Report Date: 29-Mar-00
Client: Blue 292
Client Project ID: Chemetco

Samples:

Thirteen pairs of Method 26A impinger solutions and a blank were submitted one of which was the blank pair. The acid impinger solutions required determination of chloride as HCl and the basic ones required determination of chloride as Cl_2. All were received in good condition, with no apparent leakage.

Preparation:

No sample preparation was required.

Analysis:

Chloride was determined by Ion Chromatography with conductivity detection (IC).

Results:

The Method 26 results are presented as total milligrams of HCl or Cl_2 trapped in the whole solution. The levels found were very low, ranging from about 2 mg to 4 mg of HCl, and from about 1 mg to 4 mg of chlorine.

Quality Control:

A trace of chloride was detected in the acid blank, so the HCl results should be blank corrected. The spike recoveries (99% and 110%) were within the normal range of 75% to 125%. All samples were analyzed in duplicate.

First Analytical Laboratories
1126 Burning Tree Dr. Chapel Hill, NC 27514
Tel. (919) 942-8607
FAX (919) 929-8688

ANALYSIS REPORT

Project #: 00314
Client: Blue 292
Client Project ID: Chemetco

Report Date: 29-Mar-00
Date Received: 28-Mar-00

Total Milligrams Sample

Sample	HCl mg	CL2 mg
Stack1 Run1	2.7	1.2
Stack1 Run2	2.4	1.8
Stack1 Run3	2.7	3.7
Stack2 Run1	2.4	1.0
Stack2 Run2	1.8	0.5
Stack2 Run3	3.1	1.3
Stack3 Run1	6.2	4.2
Stack3 Run2	3.8	2.5
Stack3 Run3	1.1	< 0.4
Stack3 C4 Run1	2.9	1.6
Stack3 C4 Run2	3.1	2.4
Stack3 C4 Run3	4.0	2.8
Blanks	0.4	< 0.2
Spikes, % Recovery	99%	110%

HYDROGEN CHLORIDE

IC ANALYSIS RUN SUMMARY AND CALCULATION WORKSHEET

Client: Blue 292
Proj. #: 00314
Date: 29-Mar-00

IDL = 0.1 mg/L
Spike concentr'n = 2.0 mg/L

Sample ID Client	FAL	Test Sol'n mg/L	Sample Volume ml	Peak Height	Dil'n Factor	Total mg as HCl
ACID IMPINGERS						
Stack1 Run1	00314.S1-1A	0.35	391	4.8	20	2.71
Stack1 Run2	00314.S1-2A	0.36	323	5.0	20	2.36
Stack1 Run3	00314.S1-3A	0.51	262	7.0	20	2.68
Stack2 Run1	00314.S2-1A	0.33	359	4.5	20	2.36
Stack2 Run2	00314.S2-2A	0.26	349	3.5	20	1.78
Stack2 Run3	00314.S2-3A	0.42	368	5.8	20	3.09
Stack3 Run1	00314.S3-1A	0.73	427	10.0	20	6.23
Stack3 Run2	00314.S3-2A	0.44	433	6.0	20	3.79
Stack3 Run3	00314.S3-3A	0.15	373	2.0	20	1.09
Stack3 C4 Run1	00314.S3S-1A	0.36	395	5.0	20	2.88
Stack3 C4 Run2	00314.S3S-2A	0.42	369	5.8	20	3.10
Stack3 C4 Run3	00314.S3S-3A	0.51	396	7.0	20	4.05
H2SO4 BLK	00314.BA	0.15	147	2.0	20	0.43
Spike	00314.S1-1AS	2.34	391	32.0	% Rec. =	99.4%

QUALITY CONTROL DATA

Calibration	Peak Ht.	True conc.	Regr
Blank	0	0.00	0.00
Standard 1	11.5	1.00	13.70
Standard 2	24.8	2.00	27.40
Standard 3	54.0	4.00	54.81
Standard 4	84.0	6.00	82.21

Regression Output:

Constant	0
Std Err of Y Est	1.98383
R Squared	0.99661
No. of Observations	5
Degrees of Freedom	4
X Coefficient(s)	13.70

CHLORINE

IC ANALYSIS RUN SUMMARY AND CALCULATION WORKSHEET

Client: Blue 292
Proj. #: 00314
Date: 29-Mar-00

IDL = 0.1 mg/L
Spike concentr'n = 3.00 mg/L

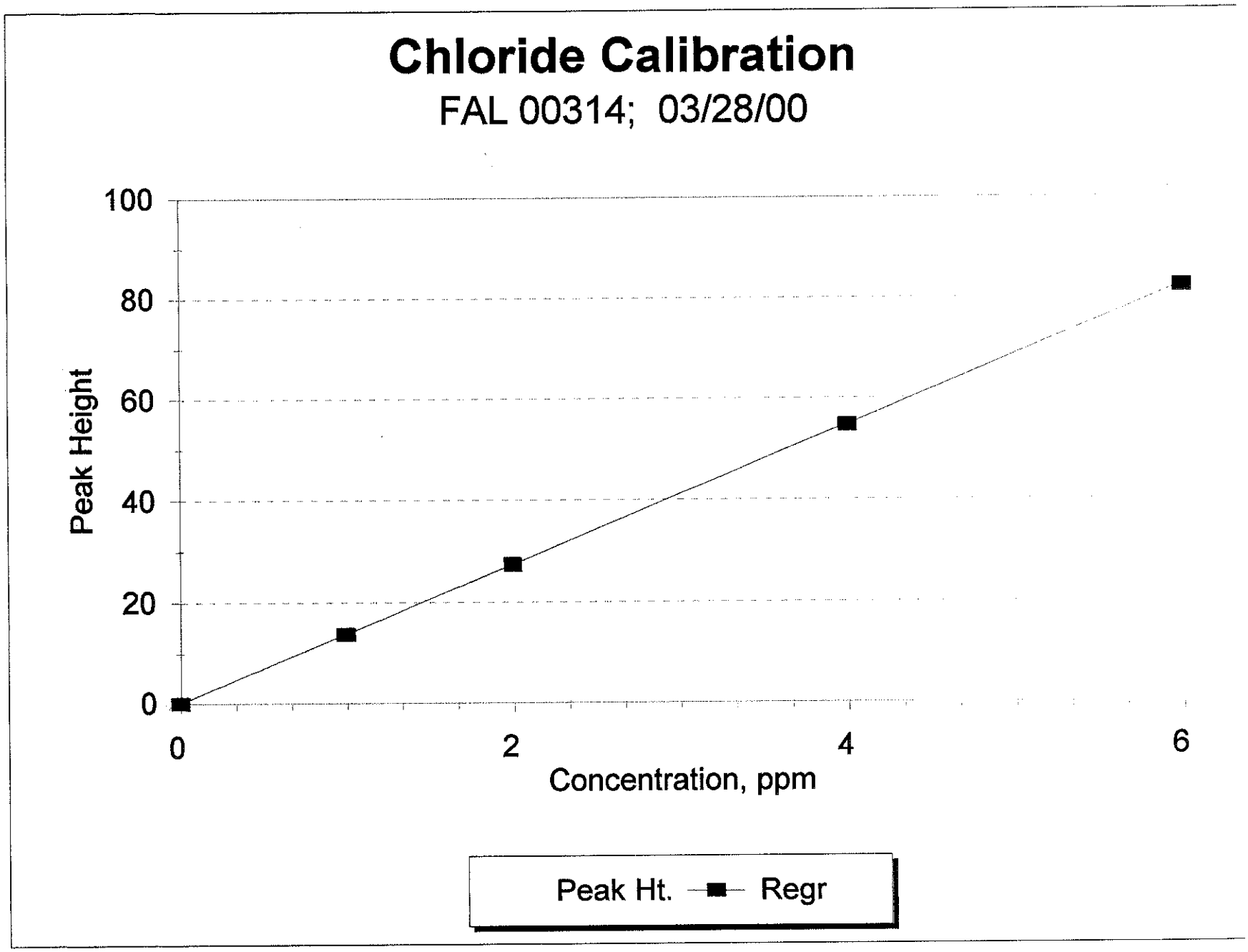
Sample ID Client	FAL	Test Sol'n mg/L	Sample Volume ml	Peak Height	Dil'n Factor		Total mg as Cl2
BASE IMPINGERS							
Stack1 Run1	00314.S1-1B	0.37	337	5.0	5		1.20
Stack1 Run2	00314.S1-2B	0.80	227	11.0	5		1.77
Stack1 Run3	00314.S1-3B	1.72	222	23.5	5		3.71
Stack2 Run1	00314.S2-1B	0.31	325	4.3	5		0.98
Stack2 Run2	00314.S2-2B	0.15	331	2.0	5		0.47
Stack2 Run3	00314.S2-3B	0.44	315	6.0	5		1.34
Stack3 Run1	00314.S3-1B	1.20	356	16.5	5		4.17
Stack3 Run2	00314.S3-2B	0.75	340	10.3	5		2.48
Stack3 Run3	00314.S3-3B	0.00	363	0.0	5	<	0.35
Stack3 C4 Run1	00314.S3S-1B	0.64	262	8.8	5		1.63
Stack3 C4 Run2	00314.S3S-2B	0.95	258	13.0	5		2.38
Stack3 C4 Run3	00314.S3S-3B	1.11	259	15.3	5		2.81
NaOH BLK	00314.BB	0.00	156	0.0	5	<	0.15
Spike	00314.S1-1BS	3.65	337	50.0	% Rec. =		109.5%

QUALITY CONTROL DATA

Calibration	Peak Ht.	True conc.	Regr
Blank	0	0.00	0.00
Standard 1	11.5	1.00	13.69
Standard 2	24.3	2.00	27.39
Standard 3	53.8	4.00	54.77
Standard 4	84.3	6.00	82.16

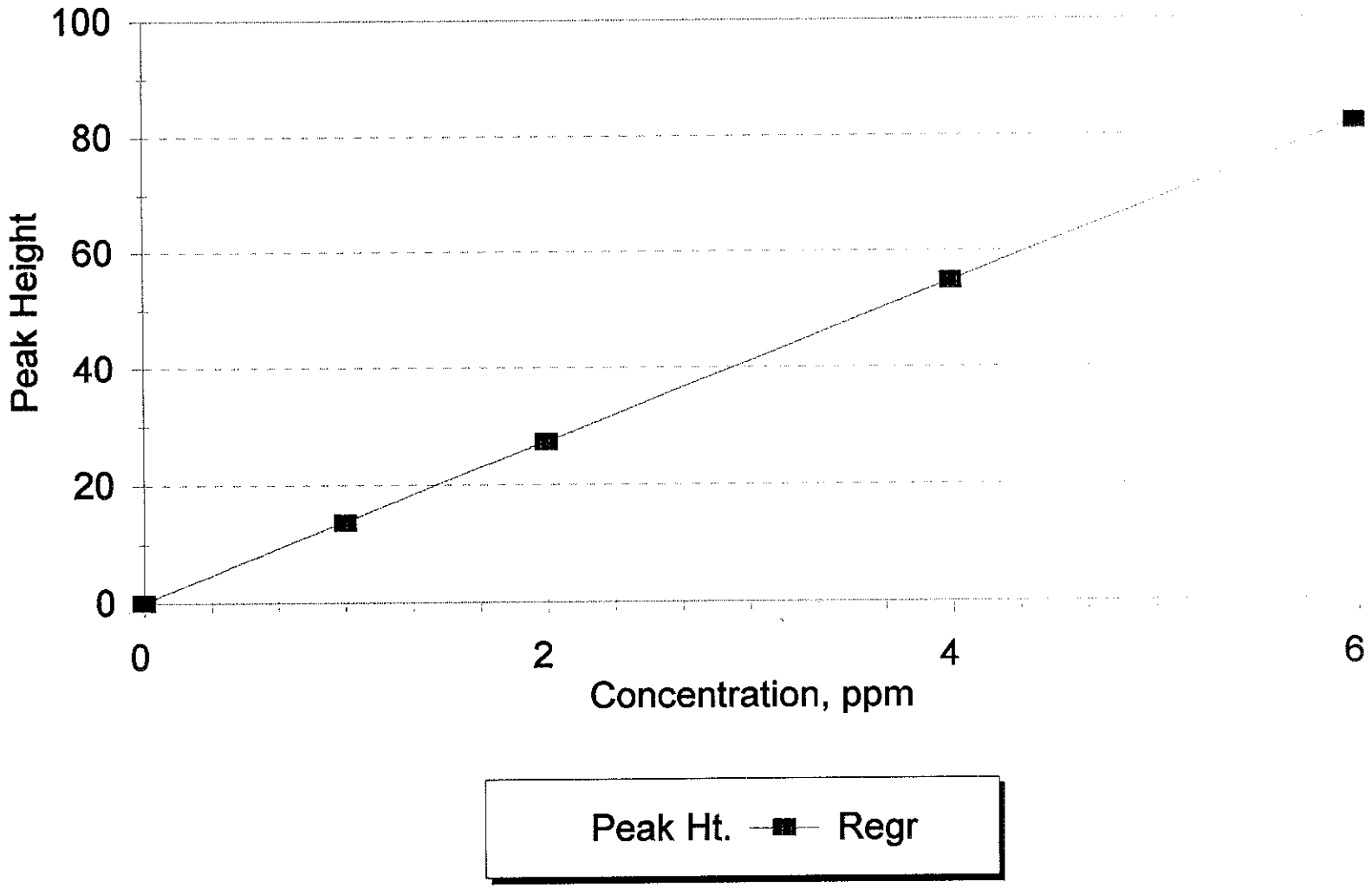
Regression Output:

Constant	0
Std Err of Y Est	2.23968
R Squared	0.9957
No. of Observations	5
Degrees of Freedom	4
X Coefficient(s)	13.69


Chloride Calibration
FAL 00314; 03/28/00
Peak Height
100
80
60
40
20
0
0
2
4
6
Concentration, ppm
Peak Ht.
Regr

Chloride Calibration

FAL 00314; 03/29/00



RTP Labs

Research Triangle Park Laboratories, Inc
8100 Brownleigh Drive, Suite 120 * Raleigh, NC 27612
Phone: 919-510-0228 Fax: 919-510-0141

Chain of Custody Record

Client: NPN Environmental	Project Manager: Brian Gregory	Phone Number: 6363431300	Fax Number: -8192
Date: 3/24/00			
Address: 927 Horan Drive		Page 2 of 2	
City: Fenton	State: MO	Zip Code: 63026	
Contract/Purchase Order No.: C00005.B	Project Name: Chemetco		

Sample ID No. and Description	Date	Time	Matrix Air, Liq, Solid	Preservatives	# of Containers	Analyses						Comments
H_2SO_4 Blank	3/17		Liq		1							Hcl via MZ6

Turn Around Time Required: ☐ 24Hrs ☐ 48 Hrs ☒ 1 week ☐ 2 weeks ☐ 3 Weeks ☐ Other

Special QC Requirements: None

Possible Hazards/ Known Concentrations: None

Relinquished By: [signature]	Date: 3/24	Time:	Received By: [signature]	Date: 3/28/00	Time: 9:30am
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

File: chain_RTP.doc/als

RTP Labs

0034

Research Triangle Park Laboratories, Inc
8100 Brownleigh Drive, Suite 120 * Raleigh, NC 27612
Phone: 919-510-0228 Fax: 919-510-0141

Chain of Custody Record

Client: NPN Environmental	Project Manager: Brian Gregory	Phone Number: 6363431300	Fax Number: -8192	Date: 3/24/00
Address: 927 Horan Drive				Page 1 of 2
City: Fenton	State: MO	Zip Code: 63026		
Contract/Purchase Order No.: C-00005.B	Project Name: Chemetco			

Sample ID No. and Description	Date	Time	Matrix Air, Liq, Solid	Preservatives	# of Containers	# of Containers						Comments
Stack3 cycle4 Run1	3/17		Liq.		2							NaOH bottles analyze for chlorine via Method 26. H_2SO_4 bottles analyze for Hydrogen Chloride per Method 26.
Stack3 cycle4 Run2	3/17		Liq.		3							
Stack3 cycle4 Run3	3/17		Liq.		4	4						
Stack3 run1	3/15		Liq.			2						
NaOH Blank	3/17		Liq.			1						
Stack3 Run2	3/15		Liq.			2						
Stack3 Run3	3/15		Liq.			2						
Stack 2 Run 1	3/14		Liq.			2						
Stack 2 Run 2	3/14		Liq.			2						
Stack 2 Run 3	3/14		Liq.			2						
Stack 1 Run 1	3/16		Liq.			2						
Stack 1 Run 2	3/16		Liq.			2						
Stack1 Run 3	3/16		Liq.			2						

Turn Around Time Required: ☐ 24Hrs ☐ 48 Hrs ☒ 1 week ☐ 2 weeks ☐ 3 Weeks ☐ Other

Special QC Requirements: None

Possible Hazards/ Known Concentrations: None

Relinquished By: [signature]	Date: 3/24	Time:	Received By: [signature]	Date: 3/28/00	Time: 9:30AM
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

File: chain_RTP.doc/als

APPENDIX B

CPMMS Evaluation Surveys

PARTICULATE CEM EVALUATION FORM

Manufacturer: Air Monitor Corp.
178 Mine Lake Court
Raleigh, NC 27615-6458

Phone: 919-844-3100
Fax: 919-844-3105
Web Address: www.airmonitor.com

Contact(s): Steve Pegg

Model: CAM- **(Flow only no mass PM units.)**

Units in operation (U.S.):

Closest sales/service representative:
Durken Equipment
2383 Chaffee
St. Louis, MO 63146

Phone: 432-2040
Fax:
Web Address:

Contact(s): Ron Tomasella

Description of theory of analysis. Pitot Tube

Description of operation, required routine maintenance, and installation requirements: Continuously measures flow rate from a single "average" sample point. Unit has an auto-purge system and a controller/logger.

Known Interferences: Wet dust. – Heavy PM loading.

Notable features, report format, storage format: Auto-purge works online. PLC compatible with hook-ups and connections. An additional way of cleaning is a port access at the back of the unit using a gun barrel type cleaning rod.

Manufacturer contact discussion: **No PM monitoring equipment**. This unit is compatible for use with PM monitors which do not have volumetric flow capability.

Owner/User contact discussion: Per Jay Turner 3/3/00- EPRI personnel are generally impressed with the tech support of the company.

Relative Cost: Low – approx. $6k per unit

PARTICULATE CEM EVALUATION FORM

Manufacturer: Altech Environment USA
2623 Kaneville Court
Geneva, IL 60154

Phone: 630-262-4400
Fax: 630-262-6220
Web Address: www.altechusa.com

Contact(s): Mr. Musa Zada

President

Model: Beta 5M

Units in operation (U.S.): 1- (50-100 Worldwide.)

Closest sales/service representative:
SAME

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Isokinetic extraction. Beta ray attenuation.

Description of operation, required routine maintenance, and installation requirements: Tape is used to sample analyze and record concentration on a rolling basis. TPM concentration is calculated based on gravimetric analysis and comparison of beta source results to clean filter analysis prior to sampling. Tape is changed monthly. Unit can be used for any PM makeup. Isokinetic extraction is based at single point pre-chosen. Quote review.
uses pitot for flow,lots of moving parts, tape change 8 times/yr, $220,000 plus installation, large assembly.

Known Interferences: None.

Notable features, report format, storage format: Has auto-cal system with PLC format 4-20 ma output and reports as needed. Light source has unlimited life, never needs replacement. PM makeup is not important. Unit is very rugged; same unit has been used at Dupont tests, Ely Lilly tests, a test in France, and the current ORNL tests.

Manufacturer contact discussion: During the Ely Lilly tests, the unit performed to 97% of Method 5 data results. A unit will be installed the week of 3/6/00 at the ORNL site for evaluation. An additional unit will be at the EPRI CEM's conference in San Antonio in May '00.

Owner/User contact discussion: ORNL- Jim Dunn 865-241-3737. 3/1/00 unit will be installed next week.
Initially had used unit which had prolems with condensation. Repair tech evetually had to come from France to repair. Unit was replaced and works fine now. (possible bad thermocouple for heated sample line.)
Does not take a continuous sample by definition. Cannot tell when unit is sampling or purging, must look at readings to decide. Can use dual head as with the Durag.
Uses a compressed gas to create a vacuum for sampling so there is no pumps. Has a flexi sample line for installation convenience. Cabinet is very large and has lots of moving parts. Collects sample pseudo-isokinetically at one point.
Owner has been happy with unit since the initial problems were solved.

Relative Cost: High – approx. $50k per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: BHA Group, Inc.
8800 East 63rd Street
Kansas City, MO 64133

Phone: 816-356-8400
Fax: 816-353-1873
Web Address: www.verewa@durag.com

Contact(s): Brian Vancrum
Stephanie Talley (rep for western IL.)

ext. 541

Model: CPM Series units,700,1000,2000,5000 **Units in operation (U.S.):** hundreds

Closest sales/service representative:
SAME

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Light Interruption.

Description of operation, required routine maintenance, and installation requirements: Continuously cleans lens so no build-up or calibration is needed. No moving parts. Annual inspection is recommended. Requires 5 stack diameters of straight flow for sample point.

Technology eliminated due to water interference.

Known Interferences: **Water Droplets.**

Notable features, report format, storage format: Auto-purge works online continuously so the lenses are always being cleaned and the light interruption does not decay. PLC compatible with pre-set alarm capability. No on-site calibration; on-site during installation of the unit.

Manufacturer contact discussion: Unit is different from other light based detection systems in that it measures the light interruption rather than the amount of particles moving by the source.

Owner/User contact discussion: None
PER JAY TURNER- 3/2/00- Ken Cushing (Southern Research Institute) Model CPM-5000; Unit used for utility application, owner is pleased with unit performance. Unit can be light-emitting diode or laser based light source. The optics purging system is sound. Ken says that his unit was calibrated in the field over a range of PM loadings. They use a Kurz instrument (hot-wire)for flow-rate data used in an array on the stack cross section and multiplexed through a single source.
BLG:(Past experience with the hot-wire type technology is that it works bet in low moisture environments and does not work well in saturated environments.)
PER JAY TURNER 3/3/00- EPRI conducted a comparative test on a baghouse source comparing the unit to Method 17. The initial test results were good but there was a severe shift in the calibration curve from the initial tests to tests conducted three months after startup so the overall performance was poor

Relative Cost: Med. – approx. $16k per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Durag Incorporated
1970 Christensen Ave.
West St. Paul, MN 55118

Phone: 651-451-1710
Fax: 651-457-7684
Web Address: www.durag.com

Contact(s): Mr. Carl Gohdes

Environmental/Emissions Products Manager

Model: F-904-K

Units in operation (U.S.):

Closest sales/service representative:
A.A. Hanson & Assoc.
30W260 Butterfield Rd. Suite 208
Warrenville, IL 60555

Phone:630-393-6600
Fax: 630-393-2766
Web Address:

Contact(s): Jeff Hanson

Description of theory of analysis. Dual Detector Charged Absorption.

Description of operation, required routine maintenance, and installation requirements: Tape is used to continuously analyze and record concentration on a rolling basis. TPM concentration is calculated based beta source results. Tape is changed monthly and sample pump unit is replaced annually. Unit can be used for any PM makeup.

Quote review.
$240,000 plus installation, no details of past use, no technical specs provided or requested.

Known Interferences: Changes in process system over time.

Notable features, report format, storage format: Has auto-cal system with PLC format and reports. TPM concentration is on dry-basis and corrected to 68 from stack temperature. PM makeup is not important.

Manufacturer contact discussion: Thinks this unit may work for this application.

Owner/User contact discussion: DOE – Oak Ridge Tosca incinerator- Jim Dunn- 865-241-3737- Unit had trouble with moisture content in stack for period of 7/99-1/00. Since much work on moistrue interference has been fixed unit works O.K..- 3/1/00.

Unit has a significant time delay which can be solved via dual sample heads (doubles everything). Cannot tell when unit is sampling or purging from control panel. Must guess by looking at readout. Unit initially had lots of moistrue condensation problems which has reduced it's valid availability . Since repairs made in March, unit has worked fine. Beta unit has lots of moving parts and can be hard to operate if your not familiar with it.

Unit has a very large cabinet, requires close proximity to sample point. Samples psuedo-isokinetically at one point which can be placed at centroid or other location. Sample pumps have gone out but no other operation problems. The moisture problem was evaluated to be a heater problem in the sample line.

Relative Cost: High – approx. $50k per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Durag Incorporated
1970 Christensen Ave.
West St. Paul, MN 55118

Phone: 651-451-1710
Fax: 651-457-7684
Web Address: www.durag.com

Contact(s): Mr. Carl Gohdes

Environmental/Emissions Products Manager

Model: D-RX-250

Units in operation (U.S.): "dozens"

Closest sales/service representative:
A.A. Hanson & Assoc.
30W260 Butterfield Rd. Suite 208
Warrenville, IL 60555

Phone:630-393-6600
Fax: 630-393-2766
Web Address:

Contact(s): Jeff Hanson

Description of theory of analysis. Triboelectric Probe

Description of operation, required routine maintenance, and installation requirements: A combined sensor probe to measure both dust concentration and gas flow rate. Dust concentration is determined by Triboelectric method, whereby the probe measures the electric charge on particles striking a rod inserted in the stack gas. Field calibration is necessary, and the signal response will be sensitive to changes in flue gas conditions (to the extent they influence particle charging properties) and changes in particulate matter composition. Gas flow rate is determined by a differential pressure measurement at two points on the probe in the direction of flow.

Technology eliminated via technology review.

Known Interferences: **Requires steady-state operation in regards to stack parameters.**

Notable features, report format, storage format: Does Not have an auto-cal system, must be calibrated manually. TPM concentration is on dry-basis and corrected to 68 from stack temperature.

Manufacturer contact discussion: **Tough to calibrate for plant personnel. Does not recommend this unit for our application.**

Owner/User contact discussion: None

Relative Cost: Low – approx. $5K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Durag Incorporated
1970 Christensen Ave.
West St. Paul, MN 55118

Phone: 651-451-1710
Fax: 651-457-7684
Web Address: www.durag.com

Contact(s): Mr. Carl Gohdes

Environmental/Emissions Products Manager

Model: DR-300

Units in operation (U.S.): 2 ("hundreds in Germany")

Closest sales/service representative:
A.A. Hanson & Assoc.
30W260 Butterfield Rd. Suite 208
Warrenville, IL 60555

Phone:630-393-6600
Fax: 630-393-2766
Web Address:

Contact(s): Jeff Hanson

Description of theory of analysis. Light Scattering

Description of operation, required routine maintenance, and installation requirements: Continuously runs optical scan which analyzes and records on a rolling basis. TPM concentration is calculated based on light absorption similar to an opacity monitor. Optics system must be changed every six months. Unit can be used for any PM makeup.

Unit eliminated via technology review.

Known Interferences: **Suspended water droplets.**

Notable features, report format, storage format: Has auto-cal system with PLC format and reports. TPM concentration is on dry-basis and corrected to 68 from stack temperature. System is very mobile; has virtually no moving parts. TPM makeup is not important. Thinks this unit may work for this application.

Manufacturer contact discussion: Thinks this unit may work for this application.

Owner/User contact discussion: None

Relative Cost: Med. – approx. $15K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Environmental Systems Corp.
200 Tech Center Drive
Knoxville, TN 37912

Phone: 423-688-7900
Fax: 423-687-8977
Web Address: www.envirosys.com

Contact(s): Tom Carlson - VP
Bob Nusplinger

Steve Drevik

Model: P-5B

Units in operation (U.S.): 1 – 2 dozen (dozens are in Korea)

Closest sales/service representative:
SAME AS ABOVE

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Light source backscatter.

Description of operation, required routine maintenance, and installation requirements: Similar operation to opacity monitor. Depending on PM loading, the filters and blowers need to be checked not more than quarterly. Unit needs only one port for installation.

Requested quote. Will not bid due to presence of water droplets.
RECOMMENDED THE SIGRIST UNIT.

Known Interferences: Water droplets. Gas stream characteristics need to be steady.

Notable features, report format, storage format: Auto cal. Report format can be in any form. Blower is only moving part.

Manufacturer contact discussion: Manufacturer has specific experience in dealing with IEPA reporting formats and requirements. Thinks unit can be used for this application if there are no water droplets at measuring point.

Owner/User contact discussion: None

Relative Cost: Med. – approx. $13K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Goyen Valve Corp.
25327 Avenue Stanford
Valencia, CA 91355

Phone: 661-257-0566
Fax: 661-257-8990
Web Address: www.goyenvalve.com

Contact(s): Odette Alsen
Harry Daggett- 2/11/00

odette_alsen@southcorp-usa.com
Product Manager

Model: BBD3,EMP3,EMS6,EMP5,EMS4 **Units in operation (U.S.):** thousands

Closest sales/service representative:
SAME AS ABOVE

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Triboelectric detectors (all)

Description of operation, required routine maintenance, and installation requirements: Triboelectric measurement technique. Field calibration is necessary, and the signal response is sensitive to changes in flue gas conditions (to the extent they influence particle charging properties) and changes in particulate matter composition. Probes can be multiplexed to a single processor.

Technology eliminated via review.

Known Interferences: **Water droplets.**

Notable features, report format, storage format: Solid state; no moving parts. Virtually any output can be used with PLC compatible data/communication system.

2/11/00- Mr. Daggett indictaed that the monitor can be added to obtain flowrates. Also that a two point zero-span curve can be programmed for M5 comparison. The unit cannot generate stand alone pm emissions.

Manufacturer contact discussion: **Units essentially only detect changes in PM loading. These units would probably not work for PM emission monitoring.**

Owner/User contact discussion: None

Relative Cost: Low – approx. $8K per unit. **OR LESS**

PARTICULATE CEM EVALUATION FORM

Manufacturer: Jonas Incorporated
113 Faun Rd.
Wilmington, DE 19803

Phone: 302-478-1375
Fax: 302-478-8173
Web Address:

Contact(s): Lee Machemer

E-mail – jonasinc@mindspring.com

Model: Particle Monitor

Units in operation (U.S.): 10

Closest sales/service representative:
SAME AS ABOVE

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Acoustic Shock

Description of operation, required routine maintenance, and installation requirements: Continuously monitors acoustic impact(s) on probe at an average velocity point. No moving parts. Unit is calibrated using a wave-guide curve according to impact intensity. Material for each probe is selected based on each installation's gas characteristics.

Quote review.
Will have engineer on-site first month of ops. Uses single point or traverse type flow monitor (Kurz type). Collects at super iso. $91,500.

Known Interferences: Water droplets.
Concerns regarding water droplet impaction potential as well as operations concerns from the DuPont study..

Notable features, report format, storage format: PLC compatible with pre-set alarm capability. No on-site calibration; on-site during installation of the unit. Four units can use central computer for data collections/storage/reporting.

Manufacturer contact discussion: Unit can be used at any temperature, any PM loading, with any variation in stack parameters. Manufacturer will conduct a 5-day feasibility study for $9,500 plus T&L or a non-limited study for $9,500 plus $2,800/week.

Owner/User contact discussion: None
PER JAY TURNER 3/3/00- During the DuPont study, Jonas provided no technical support and the unit apparently never actually collected any data.

Relative Cost: High – approx. $28K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: PCME Andersen
500 Technology Court
Smyrna, GA 30082

Phone: 800-241-6898
Fax: 770-319-0336
Web Address: www.pcmeinc.com

Contact(s): Bruce Kemp

Model: Stackflow 2000 (variation)

Units in operation (U.S.): 1 – (new application)

Closest sales/service representative:
SAME

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Electrodynamic "charged" Technology

Description of operation, required routine maintenance, and installation requirements: Interactions between charged particles and induction rod rejects DC current derived from collisions while measuring using AC current. The probes are coated with an appropriate material to reduce corrosion/buildup/condensation, etc. Maintenance consists of cleaning probes as needed with IPA and reinstalling. Unit is a dual probe device but can be installed in a large sample port.

Flow only instrument.

Known Interferences: **Particle buildup from "sticky" stack gas. Water droplets.**

Notable features, report format, storage format: Uses stand-alone logger with windows based software to store and report. Can be downloaded to PLC controls.

Manufacturer contact discussion: Better than triboelectric in most cases. Variations in PM loading do not effect as long as probe is kept clean.

Owner/User contact discussion: None

Relative Cost: Med. – approx. $15K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: PCME Andersen
500 Technology Court
Smyrna, GA 30082

Phone: 800-241-6898
Fax: 770-319-0336
Web Address: www.pcmeinc.com

Contact(s): Bruce Kemp

Model: SC-600

Units in operation (U.S.): 1 – (dozens in UK)

Closest sales/service representative:
SAME

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Optic intensity

Description of operation, required routine maintenance, and installation requirements: Opacity type single light source determines changes in intensity versus calibrated intensity. Has auto cal. Maintenance consists of cleaning lenses as needed.

Quote review.
$73,560.00, listed as dust monitor via opacity technology in quote. Only lists dry sources in references.

Known Interferences: **Water droplets.**

Unit eliminated due to potential water droplet interference as well as high PM loading points. Review of the quote indicates that the unit is essentially a dust detector/opacity monitor hybrid which can be used for CPMMS. (possibly).

Notable features, report format, storage format: Uses stand-alone logger with windows based software to store and report. Can be downloaded to PLC controls.

Manufacturer contact discussion: Operation, maintenance, and performance is similar to opacity monitor.

Owner/User contact discussion: None
PER JAY TURNER 3/3/00- The unit is certified in the UK in dry sources but did not pass a comparative test in the US.

Relative Cost: Low – approx. $10K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Sensible Technologies, Inc.
1656 Townhurst, Suite F
Houston, TX. 77043

Phone: 888-722-8287
Fax: 713-722-8577
Web Address: www.sensibletechnologies.com

Contact(s): Jim McCabe

President

Model: None

Units in operation (U.S.):

Closest sales/service representative:
Same

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Various; does not manufacture at component level.

Description of operation, required routine maintenance, and installation requirements: **Expertise is in area/fence line/ambient/ and meteorological monitoring. Does not list any source monitoring capability.**

Eliminated after review.

Known Interferences: **Temperature above 110 degrees F. Acids/bases/heavy PM, etc.**

Notable features, report format, storage format: Reporting is routinely done for regulatory compliance and is 100% automated.

Manufacturer contact discussion: **Has no in-situ stack monitoring experience for continuous operation.**

Owner/User contact discussion:

Relative Cost: Low less than $5K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: SICK Inc.
6900 West 110th Street
Bloomington, MN 55438

Phone: 612-941-6780
Fax: 612-941-9287
Web Address: www.sickoptic.com

Contact(s):

Model: RM-200

Units in operation (U.S.): Dozens

Closest sales/service representative:
MEMCO Sales & Service Corp.
7250 N. Cicero Ave Suite LL1
Lincolnwood, IL 60646-7627

Phone: 847-329-9393
Fax: 847-329-9397
Web Address:

Contact(s): George Folds
Don Jenkinson

Description of theory of analysis. Heated extraction with optic flowrate.

Description of operation, required routine maintenance, and installation requirements: Single port mounted instrument. Portion of gas stream is extracted (heated) and analyzed. An optic flow monitor is used in combination with the extractive system. The extracted portion of the sample is analyzed via scattered light method in a heated chamber. Unit uses single point extraction. Unit has several moving parts so general maintenance is conducted quarterly or semi-annually.

Quote review.
Calibrates with Method 17, spec for small to medium dust loads, 1 day for training, 1 day for installation, $242,332ttl.

Known Interferences: Aerosols. (Water droplets do not effect performance due to the extractive design.)

Notable features, report format, storage format: PLC compatible data storage and report capability. As a general rule; **the maximum stack temperature should be 230 degrees F.**

Manufacturer contact discussion: Extraction eliminates water droplet problem. Between the PM and the flow units there is more on-site panel/sample equipment than with other units.

Owner/User contact discussion: None

Relative Cost: Med. – approx. $20K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Sigrist-Photometer AG
Hofurlistrasse 1
CH-6373 Ennetburgen, Switzerland

Phone: 41 41 620 50 64
Fax: 41 41 620 41 80
Web Address: www.photometer.com

Contact(s):

Model: CTNR

Units in operation (U.S.): 2

Closest sales/service representative:
Peak Process Controls, Inc.
39 Brownsville Court
P.O. Box 26
Schomberg, Ontario Canada

Phone: 905-939-0555
Fax: 905-939-0550
Web Address:

Contact(s): T.J. Medland

Description of theory of analysis. Extractive Light Scatter

Description of operation, required routine maintenance, and installation requirements: A heated sample is extracted and analyzed via light scatter. The light source must be replaced bi-annually. Set-up requires typical stack diameter requirements.

Requested quote. ESC recommended this unit. (competitor which did not bid)
Quote review.
collects at super iso, unit can be remote (80Ft.) from sample point, light source lasts approx. one year, replacement is $40.00. Total cost $220,000 plus installation costs.

Known Interferences: None

Notable features, report format, storage format: Works best on wet stacks. PLC compatible outputs. Computer based report system.

Manufacturer contact discussion: 4 units can be used with one central computer for data acquisition and reporting. RS-422 or 4-20mA outputs available.

Owner/User contact discussion: Eli Lilly-Lafayette, IN
One unit is currently being evaluated at the TOSCA ORNL site test. Jim Dunn 865-241-3737- 3/1/00- Indicated that the unit has worked well for a period of 8 months. The light source was replaced once. "has chugged along good" other than that.

Has very few moving parts, can be placed up to 25 meters from sample point. Has multi ranges which can auto change or be locked in. The purge and failure alarm system works well. "Well engineered." Gives instant data which meets continuous criteria. Field data reflects good tracking of concentration. Collects sample psuedo-isokinetically at a single point.

Must conduct a manual calibration, may want to spec an auto-cal for our application..

Relative Cost: High – approx. $60K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Spectrum Systems, Inc.

Phone: 850-944-3392
Fax:
Web Address: www.specsys.com

Contact(s): H. Gordon Jones — President

Model: None **Units in operation (U.S.):**

Closest sales/service representative:
Same

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Various; does not manufacture at component level.

Description of operation, required routine maintenance, and installation requirements: Expertise is in Opacity,Sox,Nox,CO,CO2,O2, and THC CEM's systems. Also has volumetric flowmeters which are used for stack monitoring. **NO particulate CEM's currently.**

Known Interferences:

Notable features, report format, storage format: Reporting is routinely done for regulatory compliance and is 100% automated.
Company also provides CEM certification and RATA testing services.

Manufacturer contact discussion:

Owner/User contact discussion:

Relative Cost: Medium approx. $20K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: TSI Inc. (Dekati Brand)
500 Cardigan Road
P.O. Box 64394
St. Paul, MN 55164

Phone: 888-483-4712
Fax: 41 41 620 41 80

Web Address: www.dekati.fi/dekati/distributors.html

Contact(s): Roger Williams

Model: Dustrak RBD

Units in operation (U.S.): hundreds

Closest sales/service representative:
SAME

Phone:
Fax:
Web Address:

Contact(s):

Description of theory of analysis. Photometric HEPA filter

Description of operation, required routine maintenance, and installation requirements: **Mobile unit primarily used for area or ambient applications. Unit must be cleaned regularly during field use. The HEPA filter is analyzed via photometric scan and a PM concentration is calculated. An additional flow monitor would need to be added to determine mass emissions. Dekati Does Not supply this flow unit.**

Technology eliminated via review

Known Interferences: **CANNOT OPERATE IN TEMPERATURES ABOVE 140 F. Any oxides from combustion will effect performance.**

Notable features, report format, storage format: Has analog data storage and collection system. Records on-line continuously.

Manufacturer contact discussion: Does not recommend these units or this technology for stack applications of any kind.

Owner/User contact discussion: None

Relative Cost: Very Low –$3,300 per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: United Sciences-Monitor Labs Inc.
76 Inverness Drive East
Englewood, CO 80112

Phone: 800-422-1499
Fax: 303-792-7870
Web Address: www.monitorlabs.com

Contact(s): Gary Siver
Ernie Letterman

816-524-2600

Model: 300L

Units in operation (U.S.): approx. 2,000

Closest sales/service representative:
Inquest
Columbia, MO

Phone: 573-443-8052
Fax:
Web Address:

Contact(s): John Kunkel

Description of theory of analysis. Ruby Laser backscatter

Description of operation, required routine maintenance, and installation requirements: Laser uses one-way scan to determine PM concentrations. Unit calibration curve is determined via M5 or M17. There is no scheduled maintenance required (unit has no moving parts). This unit is used just for TPM.

Requested quote. Will not bid due to potential interference of water droplets.

Known Interferences: **Water droplets.**

Notable features, report format, storage format: Solid state light diode; no moving parts. No bounce-back signal is required. Zero drift is approximately 2% over time. On-site calibration is similar to opacity monitor cal. 4-20 Ma output with PLC compatible data/communication system.

Manufacturer contact discussion: Unit works best in atmosphere where PM concentrations change or are cyclic in nature.

Owner/User contact discussion: **2/22/00-** Conducted site visit of installed unit at a chemical manufacturing facility which uses the unit for process control via monitoring PM concentration continuously via hook-up to the plant PLC system.
The unit uses one port on the stack and is relatively small (12 in. X 8 in.) with the cover cabinet and blowback assembly being approx. 3 feet tall and 2 feet square. The sample length is 5 feet. The unit is easy to calibrate with a supplied cal prism. Calibration time takes less than 1 hour. The plant does not have a set calibration frequency and they do not feel they need one due to the consistent operation of the unit. The unit has been installed in an extremely acidic and harsh environment for two years without ANY maintenance requirements or down time due to parts failure.
Noted problems: "once in a while" due to process upsets; the sample tube blowback system cannot keep up with loading and the unit needs to be manually blown clean.
Owner Comments: Unit works great and requires little if any maintenance. No failures. Unit was installed in an existing 4 inch flange port. Uses PLC compatible 4-20 ma output.
NPN Comments: The unit is much smaller than the usual CEM monitor. The environment in which this unit operates is much harsher than the environment in the Chemetco stacks. This stack is a high moisture stack much like the Chemetco stacks.

Relative Cost: Med. – approx. $20K per unit.

PARTICULATE CEM EVALUATION FORM

Manufacturer: Verewa
Kollaustrasse 105
D-22453 Hamburg, Germany

Phone: 49 40/55 42 18-0
Fax: 49 40/58 41 54
Web Address: www.verewa@durag.de

Contact(s):

Model: F-701

Units in operation (U.S.): 0 (hundreds in Germany)

Closest sales/service representative:
A.A. Hanson & Assoc.
30W260 Butterfield Rd. Suite 208
Warrenville, IL 60555

Phone:630-393-6600
Fax:630-393-2766
Web Address:

Contact(s): Jeff Hanson

Description of theory of analysis. Beta absorption.

Description of operation, required routine maintenance, and installation requirements: Continuously extracts sample for tape absorption analysis. C-14 source is safe, stable, and can be operated without license. Moving parts require inspection and replacement depending on sample atmosphere.

Eliminated due to potential on-site requirements for operation and service. As well as heavy PM load.

Known Interferences: **Changes in process over time. Heavy PM loading.**

Notable features, report format, storage format: Auto-purge works online. PLC compatible with RS-232 output. No on-site calibration; calibration is done at factory based on expected stack gas and process parameters.

Manufacturer contact discussion: Unit is essentially a first generation model of the Durag F-904 and F-904-K units. Durag recommends the F-904-K over both of the other types for continuous monitoring.

Owner/User contact discussion: None

Relative Cost: High – approx. $30K per unit.

APPENDIX C

Request for Quotations

April 11, 2000

«Title» «FirstName» «LastName»
«Company»
«Address1»
«City», «State» «PostalCode»

RE: Request for Quotation

«Title» «LastName»:

NPN Environmental Engineers, Inc. (NPN Environmental) has entered into a service agreement with the Electric Power Research Institute (EPRI) to provide professional environmental engineering and testing services at a secondary smelting facility in the St. Louis area. This service agreement with EPRI is funded jointly by EPRI and the facility. The scope of work developed and currently being implemented specifically addresses:

1. Issues regarding EPRI and the facility's request to research the applicability and practicality of installing and successfully operating a Continuous Particulate Monitoring System (CPMMS) on the four exhaust stacks.

2. Conduct baseline source testing to verify operation of the CPMMS system, validate an established calibration curve of the CPMMS once installed, and establish baseline operating ranges for the pollution control devices.

As a result of our investigations into an appropriate CPMMS for the facility, your «Model» has been selected as one of the systems which will potentially provide accurate continuous emission data for this application. Please provide a per unit cost estimate and written justification for use of your system based on the information provided no later than April 20, 2000. Your cost estimate should include time frame estimates for installation, site installation requirements, and site operation requirements. If you require additional information or a site visit, please contact me as soon as possible.

The minimum performance requirements of the CPMMS are as follows:

1. Analyze and record total particulate concentration and mass emission rate for each stack on a continuous basis.

2. Interface continuously with the facility process control system to integrate process operations with the emission monitoring system.

3. Demonstrate consistent, accurate data with as little facility maintenance as possible.

4. Generate agency acceptable data for use in determining compliance status.

I have attached a process flow diagram, stack diagram, and the most recent stack test results for your review. Please note the variability of the stack gas parameters during normal operations. Particle size distribution analysis results will be forwarded upon receipt in the coming days.

The «Model» performance will be verified using EPA Test Method 5 and the procedures listed in EPA Draft Performance Specification 11.

If you have any additional questions, please call me at 636-343-1300. NPN Environmental appreciates your timely response to this request.

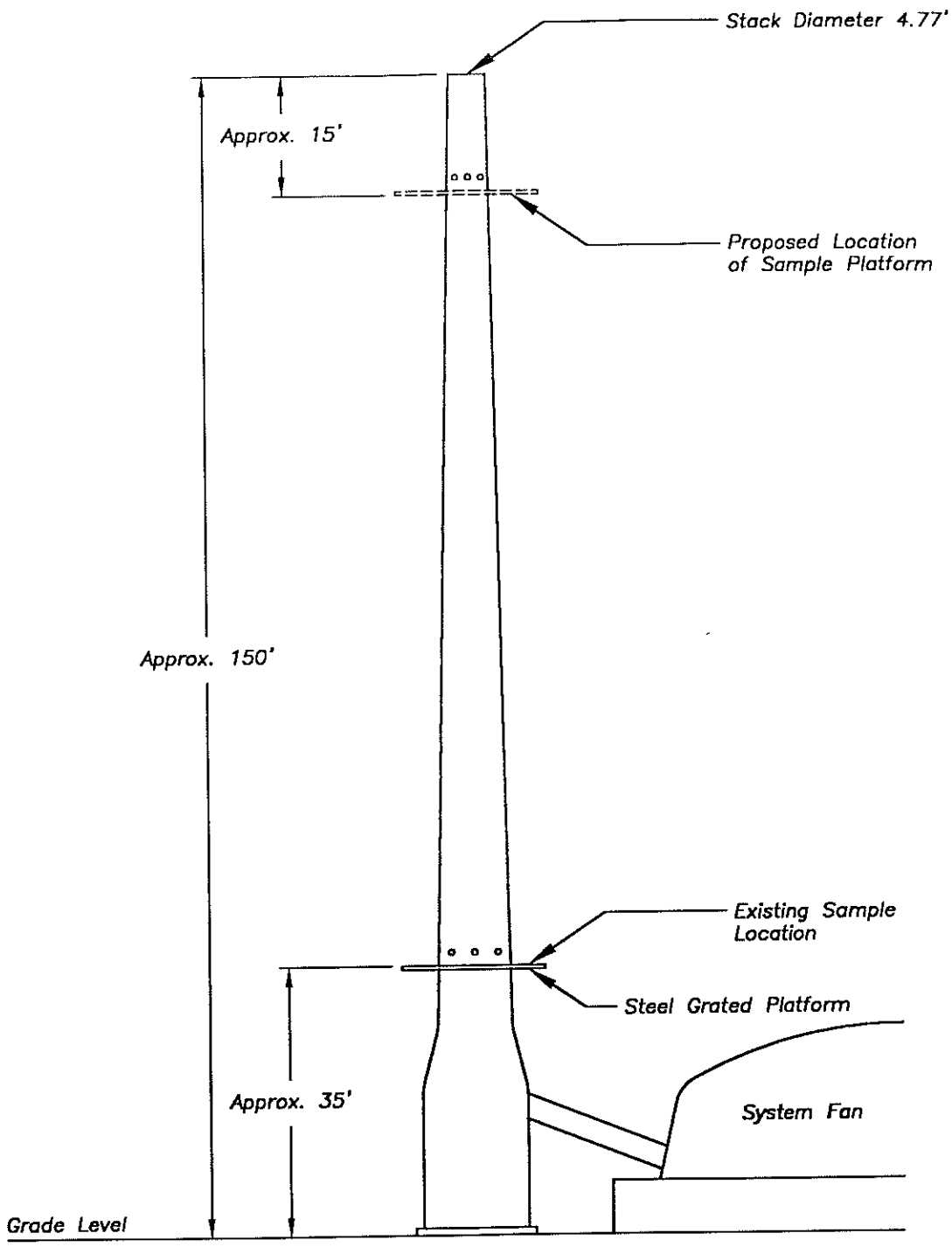
Sincerely,

Brian L. Gregory
Project Manager

Stack Exhaust Parameter Summary
C-00005.C

Stack Location	Temperature °F	Dew Point °F	Moisture %	Volumetric Flow dscfm	Velocity ft/min	Total Particulate Concentration gr/dscf	NO_x (lb/hr)	HCl (lb/hr)	Cl_2 (lb/hr)
Stack 1	**174**	131	12.5	22,700	1,670	0.07	**9.5**	0.13	0.07
	158	105	5.5	25,400	1,690	0.01	2.5	0.08	0.13
Stack 2	125	125	6.7	35,200	2,230	**0.53**	4.9	0.24	0.12
	141	109	6.0	29,500	1,910	0.02	0	0.18	0.07
Stack 3	144	**144**	**18.1**	30,900	2,320	0.05	0	**0.56**	**0.40**
	149	122	8.8	35,400	2,400	0.08	1.4	0.17	0
Stack 4	137	85	4.5	**45,900**	**2,900**	0.03	6.0	0.24	0.15
	144	90	4.1	44,600	2,840	0.01	2.2	0.25	0.22

Letters in bold print indicate maximum values for each parameter.
Testing indicated no appreciable emission of SO_x.

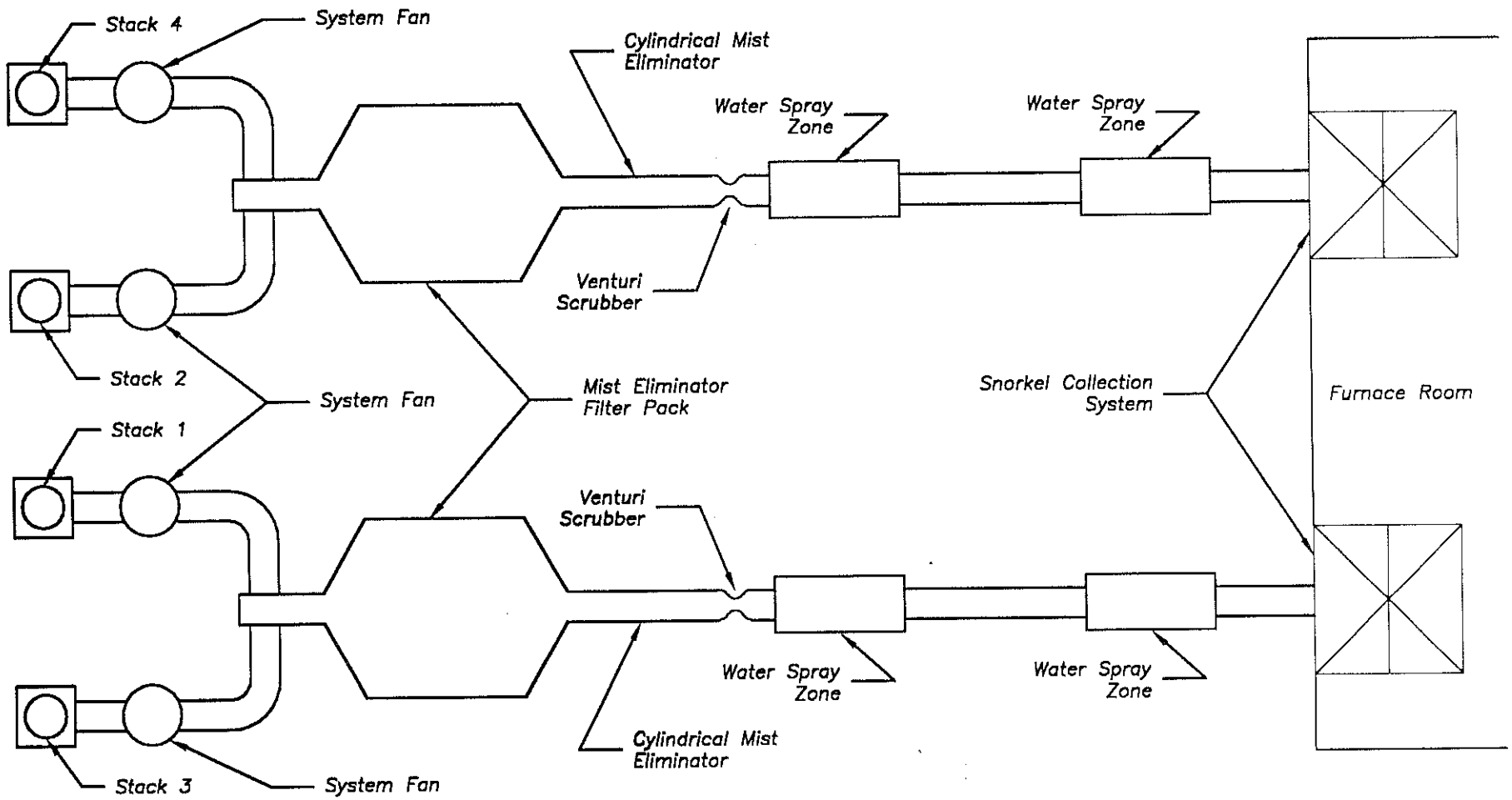


NPN ENVIRONMENTAL

FIGURE 1
Stack Specification Diagram
(All Stacks)

927 Horan Dr. - Fenton, MO 63026

Project No.	Date	Scale	Drawn By:	Checked By:
C-00005.C	4/00	AS SHOWN	SRR	



NPN ENVIRONMENTAL

FIGURE 2

Process Flow Diagram

527 Horan Dr. - Fenton, MO 63026

Project No.	Date	Scale	Drawn By:	Checked By:
C-00005.C	4/00	NONE	SRR	

APPENDIX D

Vendor Quotations

- Peak Process Controls Inc.
- Jonas, Inc.
- Altech Environment USA Corp.
- SICK
- Andersen Instruments Incorporated
- Durag, Inc.

Peak Process Controls Inc.

PEAK PROCESS CONTROLS INC.

..... process control solutions for discerning customers .....

P.O. Box 26, Schomberg, ON, Canada, L0G 1T0 ph. 905-939-0555, fax 905-939-0550

April 19, 2000

Mr. Brian Gregory
NPN Environmental
927 Horan Drive
St. Louis, MO 63026

Ref: your request for quotation
dated April 11, 2000

Dear Mr. Gregory,

Thank-you for the opportunity to offer a cost estimate for the Sigrist Model CTNR Continuous Particulate Monitoring System (CPMMS) for the four exhaust stacks at the St. Louis smelting facility. As you know, Peak Process Controls Inc. is the exclusive representative to Sigrist-Photometer AG of Switzerland. Sigrist is an ISO 9001 certified company who have experience with over 350 installations of the CTNR and its' predecessor, the KTNR in service throughout the world.

The enclosed data sheet describes the measuring principle, design and operating data of the model CTNR. I have also enclosed a questionnaire which we will require being completed prior to offering a firm quotation. Of course many of the questions have already been answered by the information which you have sent to me. Once the questionnaire is completed, Sigrist will prepare a detailed drawing of the quoted equipment as it would be installed on the four stacks. A small sample drawing is enclosed which demonstrates how the CTNR is installed on a stack of similar proportions to that of the St. Louis smelting facility.

Stack Exhaust Parameter Study

I have reviewed the stack exhaust parameter study that you have sent and have also consulted with Sigrist and we agree that this is a good application for the CTNR. Since the moisture content can be quite high, an extractive type system such as the CTNR is recommended so that the sample gas can be heated above the dew point to eliminate measurement errors caused by water particles. The extraction sample rate is super-isokinetic at normal gas flow rate. Super-isokinetic sampling significantly reduces the error caused by velocity changes and is an alternative to continuous monitoring of the stack gas velocity and adjustment of the sampling rate. The variability of the stack gas parameters shown are well within the limits of the CTNR.

Stack Requirements for Installing the Sigrist CTNR

The CTNR has a sample and return probe. The sample probe is installed through a

standard ANSI flange and extends to the center of the stack. If flanges for M5 testing are at the same elevation, the sample probe can be shortened to eliminate interference with the sample trains. The return probe is installed upstream of the sample probe and extends 500 mm (20") into the stack. Drawings of typical probes are enclosed for your reference. The probes are constructed of Hastelloy or PVDF. Valves are installed on the sampling and return lines to protect the system in the event of a system malfunction. The valves are battery backed which will enable them to close in case of a power failure. All components upstream of the sample valve are constructed of Hastelloy including the first heater. This is to prevent corrosion caused by acid droplets condensing in the pipes.

The monitor, controller, blower and ring pipe are installed on a platform large enough to provide maintenance and access to the instrument. The platform railing should be about 6 feet from the stack wall. This would mean that for your stack diameter of 4.77 feet the platform diameter should be about 17 feet. The overall height of the instrument is about 8 ½ feet. The weight of the complete system is approximately 800 pounds. Please refer to the enclosed drawing which shows the CTNR mounted on a stack which has a diameter of 1365mm (4 ½') and a platform diameter of 4384mm (14.4').

The monitor may be installed remote from the sample and return points but the total sampling loop shall not exceed 25m (80'). The instrument enclosures are NEMA 4 although they should be protected from rain, snow etc. with a suitable shelter.

Estimated Installation Time per System
Experience has shown that it takes two men, two days to install, wire, start-up, test and calibrate the equipment. This time includes unpacking and identifying all of the components. This assumes that stack flanges are in place and a crane is available for lifting the components to the platform. Many of the components can be pre-assembled at ground level and completed on the platform.

Performance
The Sigrist CTNR monitors total particulate on a continuous bases and sends an isolated 4-20mA output to the facility process control system. Relays in the controller signal range status, service or run mode and system malfunction. System malfunctions are easily identified by error messages which will appear on the alpha-numeric display.

At recent demonstration tests in the USA, the Sigrist CTNR met the EPA Draft Performance Specification 11 (PS11) and had a data availability of 98%. (100% data availability is not possible since data collecting is disrupted when instrument is in the service or calibration mode). The use of particulate monitors is fairly new to North America however many years of testing by TUV Rheinland, Germany (considered as experts in calibration and operation of PM CEMS) have concluded that the Sigrist CTNR meets their criteria and have certified it for all source categories.

Maintenance
The Sigrist CTNR is a light scatter type instrument and therefore has very few moving parts and requires little maintenance. Filtered purge air surrounds the measured sample and

protects the flow cell optics from contamination. This, and the compensation measuring method (refer to data sheet) give the instrument long term stability and long service life. A maintenance schedule is enclosed for your review. Please note that the light source and filter wadding are the only parts that require routine replacement. The light source will typically last one-year of full time operation. The cost of the light source is about $40.00. The filter wadding for the purge air blower is standard cotton wadding available locally.

I trust this information will be helpful in your assessment of Continuous Particulate Monitoring Systems and hopefully answers most of your questions related to the Sigrist Model CTNR. If you have any additional questions or concerns please call. I am also available to meet with you in St. Louis at your convenience.

Sincerely,

TJ Medland
Peak Process Controls Inc.

PEAK PROCESS CONTROLS INC.

Quotation # 4035

..... process control solutions for discerning customers .....

P.O. Box 26, Schomberg, ON Canada, L0G 1T0 ph. 905-939-0555, fax 905-939-0550

Representing: SIGRIST PROCESS-PHOTOMETER

To: **Mr. Brian Gregory**
NPN Environmental
927 Horan Drive
St. Louis, MO 63026

Reference: **Sigrist PM CEMS**

Date: **April 19, 2000**

The following quotation is based on information supplied by NPN Environmental on April 11, 2000. This quote is to be used as a per unit cost estimate and may be modified following completion of the Sigrist CTNR questionnaire which asks site specific questions related to the operation, conditions, structure and other details of the incinerator. A detailed drawing and complete bill of materials will be supplied at that time.

Item	Description	Qty.		
1	**Sigrist Photometer Model CTNR B22-F3** • s.s. inlet and outlet adapters • purge air heater • heat insulated flow cell • dual-beam optics • checking rod for range 0-1.0 range • TUV certification • ranges 0-.05 / 0.2 / 1.0 / 5.0 PLA 0-1.0 / 3.0 / 10.0 / 30.0 PLA	1		
2	**Complete ring pipe system including:** • sample inlet probe (Hastelloy or PVDF) • sample heaters (1 Hastelloy / 1 stainless steel) • stainless steel sample valve with battery back up • sample return probe (Hastelloy or PVDF) • stainless steel return line valve with battery back-up • galvanized steel instrument stand • all piping with insulation (stainless steel) • 400 volt suction fan • purge air blower with air filters • temperature controller • differential pressure controller	1		

Item	Description	Qty.		
3	**Control Box Model SIGAR4000** • alpha-numeric digital display • system diagnostics • system malfuction codes • inputs for temperature and pressure controllers • 5 control / alarm relays • 4-20mA islolated output	1		
4	**8 kVa transformer** 480 V / 60 Hz. primary to 400Y / 230 secondary *this assumes that 3 phase 480 Volt power is available on site*	1		
5	**Calibration Checking Accessories including:;** • calibration checking filter • zero point calibration filter • differential pressure gauge • flow meter • all required tubing and fittings • foam fitted carrying case	1		
	Lot Cost per stack	1	55,000.00	$55,000.00
	Optional installation supervision, start-up and training (expenses including airfare, hotel and meals are billed at cost)		$750/day	

Validity: 60 days **Terms: Net 30 days** **Shipment F.O.B: Zurich Airport**

Delivery 10-12 weeks **Prices in US funds** **Issued by: TJ Meland**

PEAK PROCESS CONTROLS INC.

..... process control solutions for discerning customers .....

P.O. Box 26, Schomberg, ON, Canada, L0G 1T0 ph. 905-939-0555, fax 905-939-0550

April 25, 2000

Mr. Brian Gregory
NPN Environmental
927 Horan Drive
St. Louis, MO 63026

Ref: your request for quotation
dated April 11, 2000

Dear Mr. Gregory,

Enclosed, please find two drawings which I left out of the package I sent to you last week. Please add these drawings to the package.

regards,

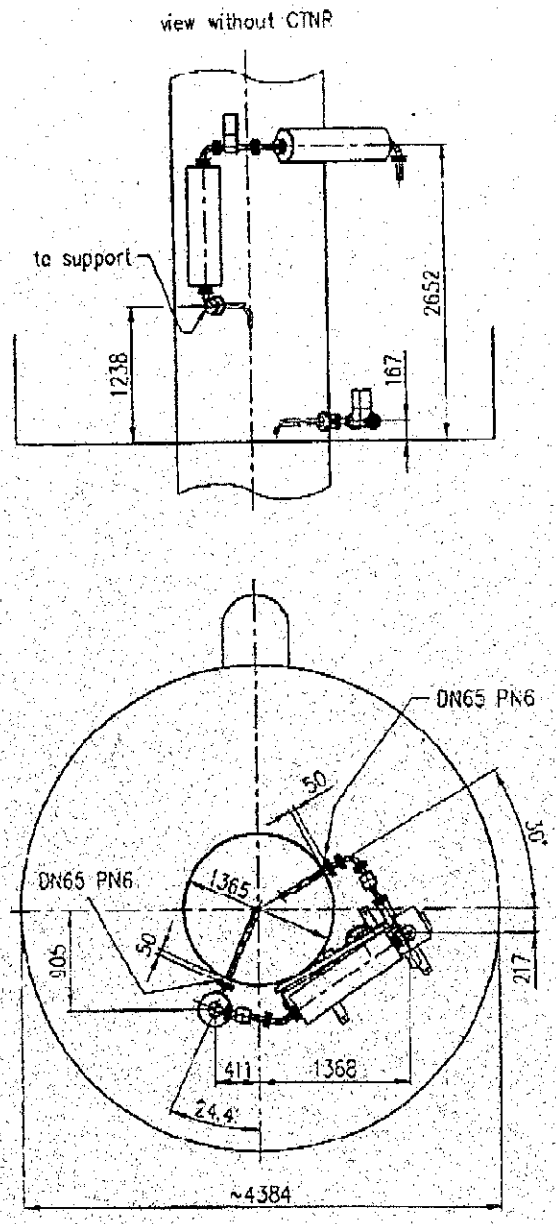
TJ Medland

Representing ..... SIGRIST PROCESS-PHOTOMETER

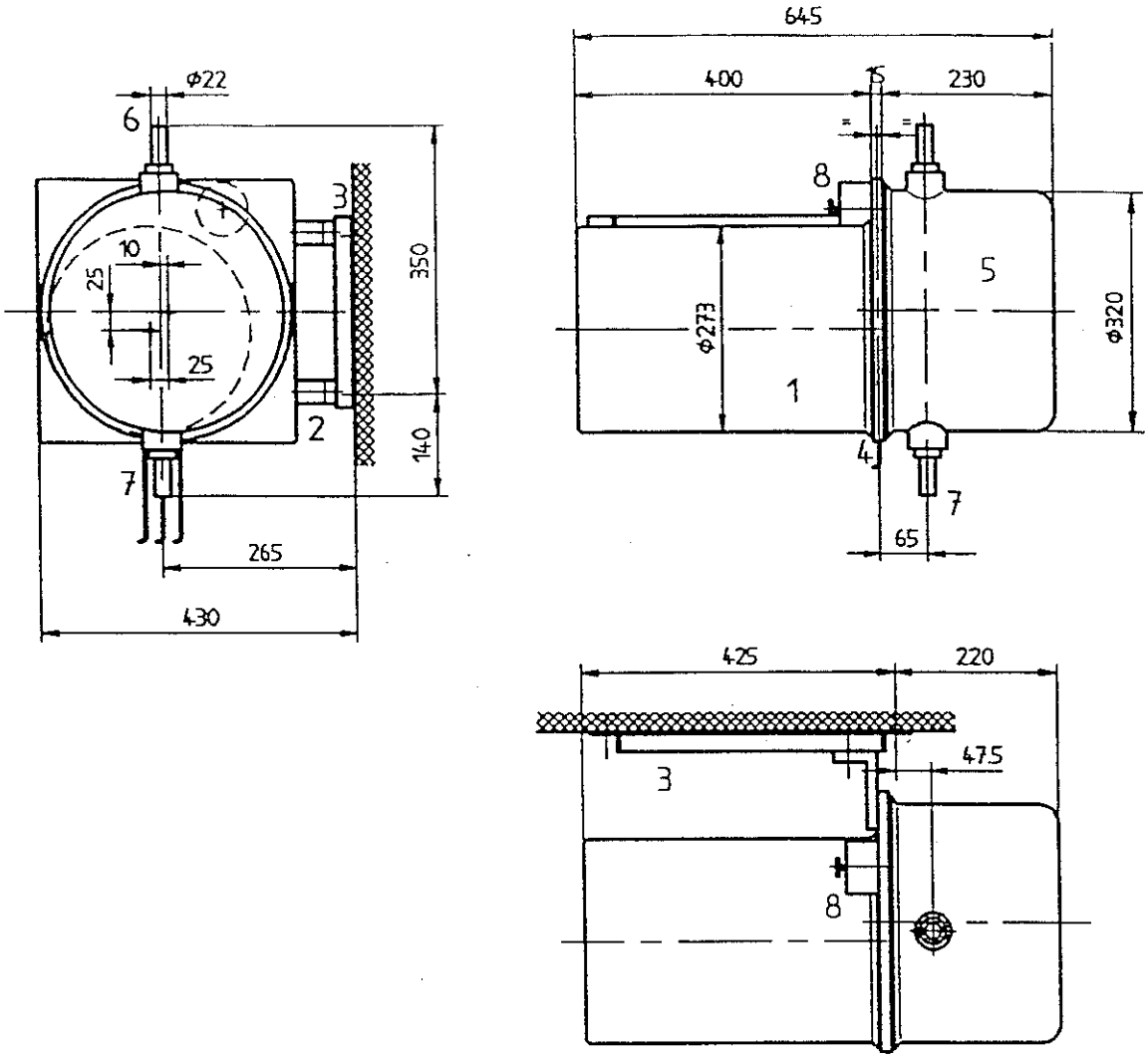
PEAK PROCESS CONTROLS INC.

..... process control solutions for discerning customers .....

P.O. Box 26, Schomberg, ON, Canada, L0G 1T0 ph. 905-939-0555, fax 905-939-0550



Mounting (proposal) CTNR Project: [redacted]	Massstab	Datum	24.06.98
		Gezeichnet	
		Verteiler	
		Gerechnet	P3
SIGRIST PROCESS-PHOTOMETER	SIGRIST PHOTOMETER AG Hofurlistrasse 1 CH-6373 Ennetbürgen	Zeichnung-No.	$CTNR/LOCKHEED-001
		Index	5



1 Gehäuse	-housing
2 Montagefüsse	-mounting brackets
3 Montagerahmen siehe	-mounting frame acc. to KZM1-MB
4 Elektr.Anschluss	-electr. connection
5 Probenachse	-axis of gas flow
6 Einlauf	-sample inlet
7 Auslauf	-sample outlet
8 Vorfilter	-roughing filter

Massblatt Type: KTN Plan	Massstab	18.07.90	
		Nachtrag	26.05.93 PS
		Gesehen	
		Gezeichnet	hy
SIGRIST PROCESS-PHOTOMETER	SIGRIST PHOTOMETER AG Hofurlistrasse 1 CH-6373 Ennetbürgen	Zeichnung No. KTN-MB	
		Index 7	

Jonas, Inc.

JONAS, Inc.
CONSULTANTS

Corrosion, Water and Steam Chemistry, Failure Analysis,
Boilers, Turbines, Life Extension, Instrumentation

Otakar Jonas, P.E., Ph.D.
1113 Faun Road
Wilmington, DE 19803, U.S.A.
Tel: (302) 478-1375
Fax: (302) 478-8173
E-mail: jonasinc@mindspring.com
www.mindspring.com/~jonasinc

April 19, 2000

Brian L. Gregory
Project Manager
NPN Environmental
927 Horan Drive
St. Louis, MO 63026
Fax (636) 343-8192

Re: Cost Estimate and Justification for Continuous Particulate Monitoring System

Mr. Gregory,

This is our Cost Estimate and Justification for the purchase, installation and testing of a Jonas, Inc. Particle Monitor for use in four stacks at a secondary smelting facility. It is based on your April 11, 2000 Request for Quotation, the additional information on particle size distributions which was received on April 18, 2000, and our phone conversations. The Particle Monitor will provide continuous particle flow, mass flow and particle size data to be used to establish baseline operating ranges for the pollution control devices.

Test Conditions

Four stacks at a copper smelting facility will be simultaneously monitored as a part of a joint EPRI project. NPN Environmental is in charge of selecting a particle monitoring system and performing tests to verify the operation of the equipment along with establishing baseline operating ranges for the pollution control devices. The test site consists of four 150 ft. high, 4.77 ft. internal diameter stacks. The gas flow in the stack contains NO_x, HCl and Cl along with particles of various compositions. The stacks are run on 8 hour cycles where 30% of the time the gas is wet, 30% of the time it is at or near the dew point (corrosive and sticky) and the rest of the time it is dry. The particles range in size from sub-micron to 50 μm, and the particles above 2.5 μm make up approximately 75% of the particle mass.

Description of the Jonas, Inc System for NPN Environmental

The proposed particle monitoring system consists of one monitor, and four fixed Particle Probes with integral Kurz velocity probes and air blow cleaning of the probe tip. A typical block diagram of the Particle Monitoring System is shown in the attached Figure 1. The probe material will be Hastalloy C22 to assure corrosion resistance under all service conditions. According to the information provided by NPN Environmental, the copper smelter flue gas properties are very challenging, being periodically both corrosive and wet and sticky.

The proposed system consists of the following:

1. One Particle Monitor with connections for four Particle Probes and 4 - 20 mA isolated current outputs of the particle and mass flow in each stack. The rackmount instrument would be installed in a building close to one of the stacks.

2. Four Particle Probes with integral velocity probes, transducer and preamplifier, and necessary connections to the stack. The Probes will be built to be rugged to avoid corrosion and build-up of muddy deposits on the Particle Probe detecting tip. A part of the design will include constructing exposed parts of Hastalloy C22 and providing an air blast system to keep the detecting tip clean of the sticky particles. A water blast can be retrofitted if the air blast is not sufficient. As an option, one or all of the Probes can be made to traverse the stack diameter to determine the particle flow profile.

   Our recommended installation location for the Particle Probe detecting tip in the stack is at the point of average flow velocity (typically 11.5 % of the pipe ID). This does not meet the requirements stated in Paragraph 3.1.3 of the EPA Draft Performance Specification 11 which specifies that the measurement point should be at the center of the stack. Based on the flow profile across the stack, a measuring point at the location of average velocity would give the best representation of the average particle and mass flow rate.

3. Four sets of three coaxial cables connecting each of the Particle Probes to the Monitor.

Cost Estimate

The following are the costs of our proposed monitoring system.

Item	Qty.	Unit Cost ($)	Total Cost ($)
1. Jonas, Inc Particle Monitor with four (4) 4 - 20 mA Mass and Particle Flow Outputs	1	18,500	18,500
2. Fixed Particle Probe with Integral Velocity Measuring Probes and probe tip cleaning	4	10,400	41,600
3. One Jonas, Inc. Engineer on-site for 30 days for Installation and Testing ($60/hr)	1	14,400	14,400
4. Estimated Travel Expenses for Jonas, Inc Engineer (includes flight, hotel, rental car and meals for 30 days, approx. $140/day)	1	5,000	5,000
5. One Jonas, Inc. engineer on-site for 10 days to assist in Installation and Calibration ($60/hr)	1	4,800	4,800
6. Estimated Travel Expenses for second Jonas, Inc. Engineer (includes flight, hotel, and meals for 10 days, approx. $120/day)	1	2,000	2,000
7. Report on Installation, Calibration and Testing	1	5,200	5,200
		Total Cost	**$91,500**
8. Optional Traversing Capability for one Particle Probe (in addition to the probe cost)	1	3,000	3,000

The cost for installation and testing in one stack would be $56,700, since one Monitor and one Probe would be required. In the case of delays due to plant outages, etc., the daily rate including time, hotel, rental car and meals for the Jonas, Inc. Engineer ($620/day) would apply. If the outage is for an extended period of time

(greater than 6 days), the cost of travel back to Jonas, Inc during the delay would also apply.

Estimated delivery for the Monitor and four Particle Probes is 6 to 8 weeks.

Justification for the Use of Jonas, Inc. Particle Monitoring System

The Jonas, Inc. Particle Monitor has been successfully used in many particle monitoring applications, including an EPA evaluation of Continuous Emissions Monitoring Systems (CEMS) at the DuPont Experimental Station in Wilmington, DE, and EPA and Department of Energy tests in a coal gasification application with Southern Research Institute in Wilsonsville, AL. The Particle Monitor uses acoustic emissions technology which allows in-line, on-line monitoring in a wide range of environments and temperature conditions. Attached is a leaflet describing the instrument along with several examples of Particle Probes used in similar applications. Its main advantages include:

- in-line monitoring (does not require sampling)
- high sensitivity
- possibility of traversing of the flow area
- easy calibration
- rugged design (low maintenance)
- self-cleaning option for Particle Probes
- one monitor can handle multiple monitoring points

Time Frame for Installation

The estimated time for installing and calibrating the Jonas, Inc Particle Monitoring System is ten (10) days. This includes two days per probe location (stack) for installation and calibration and two additional days for setup of the Monitor with output to the facility's process control computer.

Site Installation Requirements

The flanged connections to each stack and the required coaxial cables for each probe should be installed before the Jonas, Inc. engineer arrives on site. The cables should be installed in conduits from the sampling platform to the building where the Monitor will be installed. Connections to shop air and a 110V power source must be available on the sample platform on each stack. The location where the Monitor will

be installed must have a well grounded 110 volt power supply, and estimates of any electrical interference around the stacks should be supplied to Jonas, Inc. with the purchase order. Appropriate steps should be taken to prevent lightning damage to the equipment installed on the stacks (i.e. lightning rods, etc.)

The installation will require a person familiar with the facilities process control computer to assist in the connection to the Monitor, one person to assist in installing the Particle Probes, and two technicians to assist during traversing tests (if required).

Site Operating Requirements

Once the monitoring system is installed, the only maintenance requirement is to periodically remove the Particle Probes and inspect them for corrosion or deposit build-up on the detecting surface.

If you have any questions or require any additional information, please let me know.

Thank you for considering us for this job,

Sincerely,

Otakar Jonas
President

Attachments

npn.wpd/6

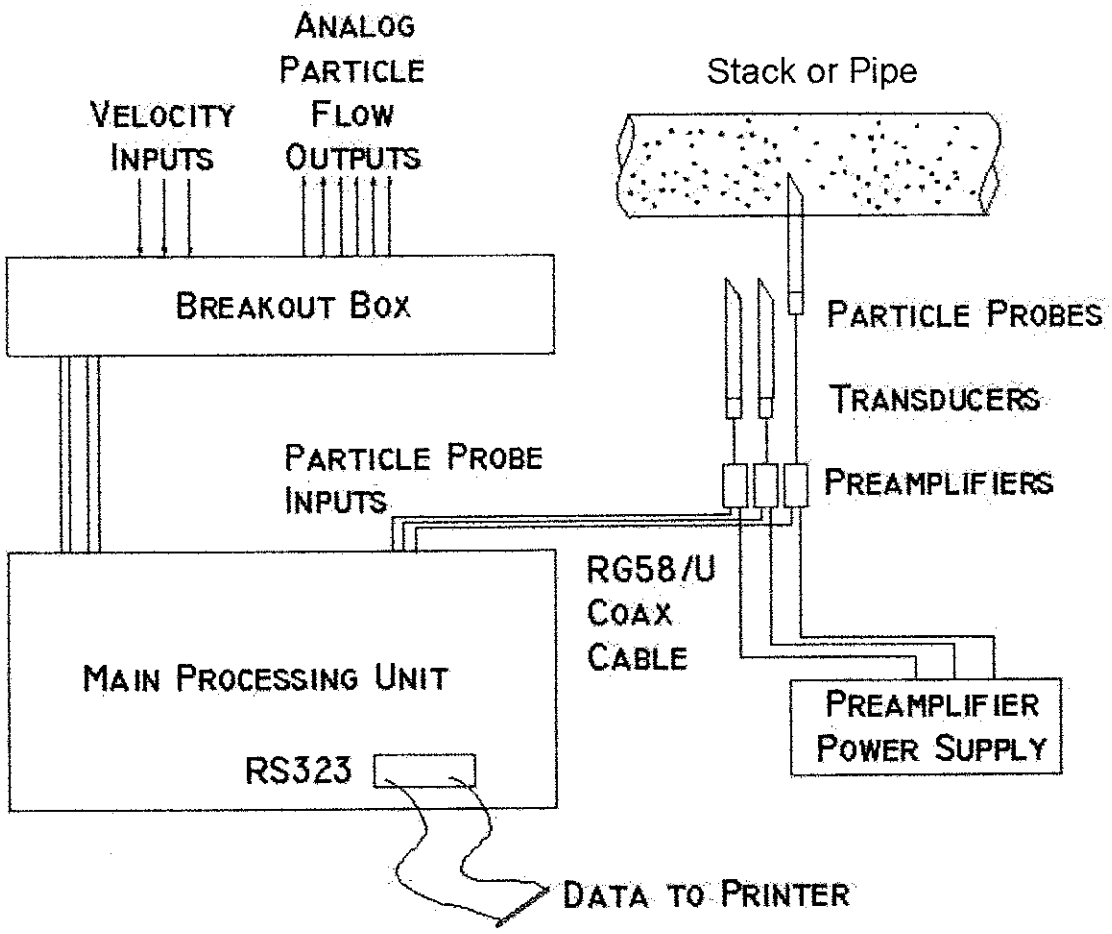


Figure 1. Block Diagram of Jonas, Inc Particle Monitor

JONAS, Inc.
CONSULTANTS

Corrosion, Water and Steam Chemistry, Failure Analysis,
Boilers, Turbines, Life Extension, Instrumentation

Otakar Jonas, P.E., Ph.D.
1113 Faun Road
Wilmington, DE 19803, U.S.A.
Tel: (302) 478-1375
Fax: (302) 478-8173
E-mail: jonasinc@mindspring.com
www.mindspring.com/~jonasinc

PARTICLE MONITOR AND ALARM

A new instrument for the continuous in-line on-line monitoring of particle flow and concentration; solid particles in gases and liquids, and liquid droplets in gases. The monitor can measure the number of particles, the average mass of particles, and the mass of each individual particle and calculate particle size. Up to eight probers per monitor.

Characteristics

Particle size:	sub-micron (~10 nm) and larger
Particle weight:	10^{-17} grams and higher
Environment:	any gas or liquid including air, steam, reactive gases, water, oil, and acids
Temperature:	up to 1400°C/2500°F (higher possible)
Pressure:	up to 70 MPa/10,000 psi (higher possible)
Detecting Probes:	Up to 8 per monitor, stationary or traversing

Applications

Steam generation: Exfoliated oxides in steam lines; flue gas particulates; control of combustion, precipitators, bag filters, and emissions; coal pulverization; coal movement through hoppers; presence of water droplets in steam (water induction and carry-over); geothermal steam; demisters.

Environmental monitoring: Industrial emissions; dust and powders in the workplace, fugitive dust, aerosols.

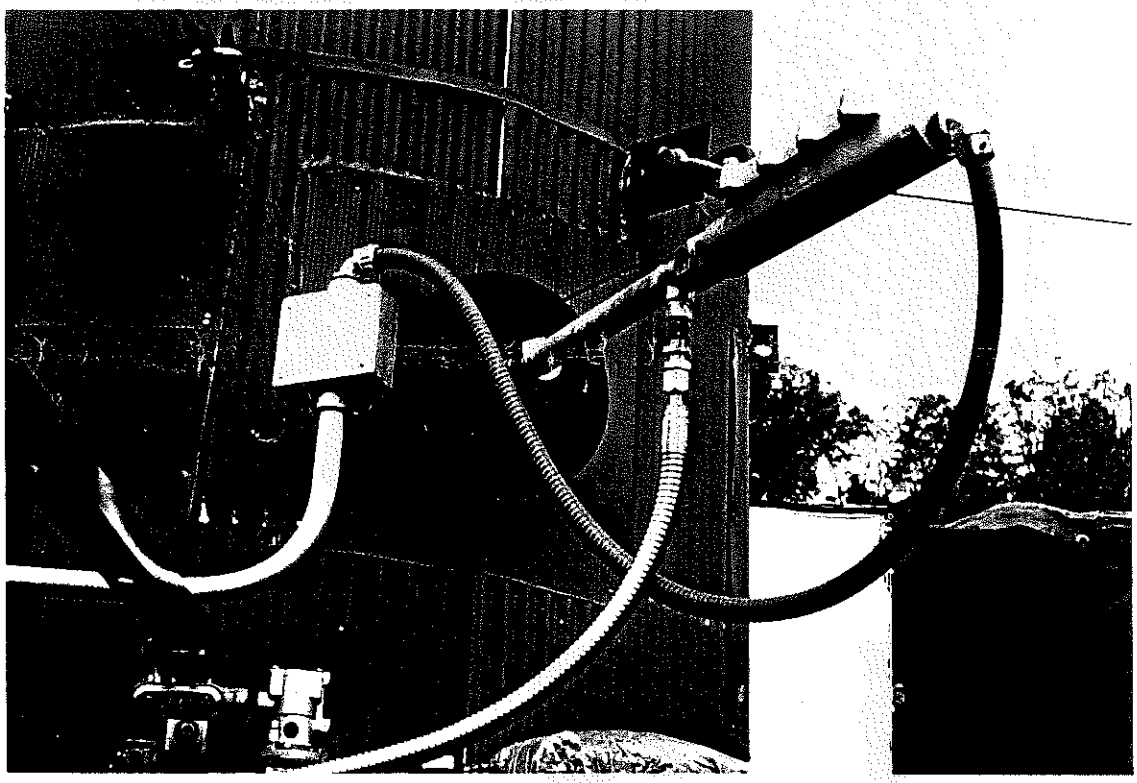
Industrial processes: Any process in which the presence or flow of powders or particles (fine or coarse) needs to be monitored such as in mixing, pigment and paint production, milling, or precipitation. Also useful for detecting malfunctions of particle removal equipment such as filters and electrostatic precipitators and monitoring of clean rooms.

Material flow and transport: Coal and ore mining and handling, agriculture, and manufacturing.

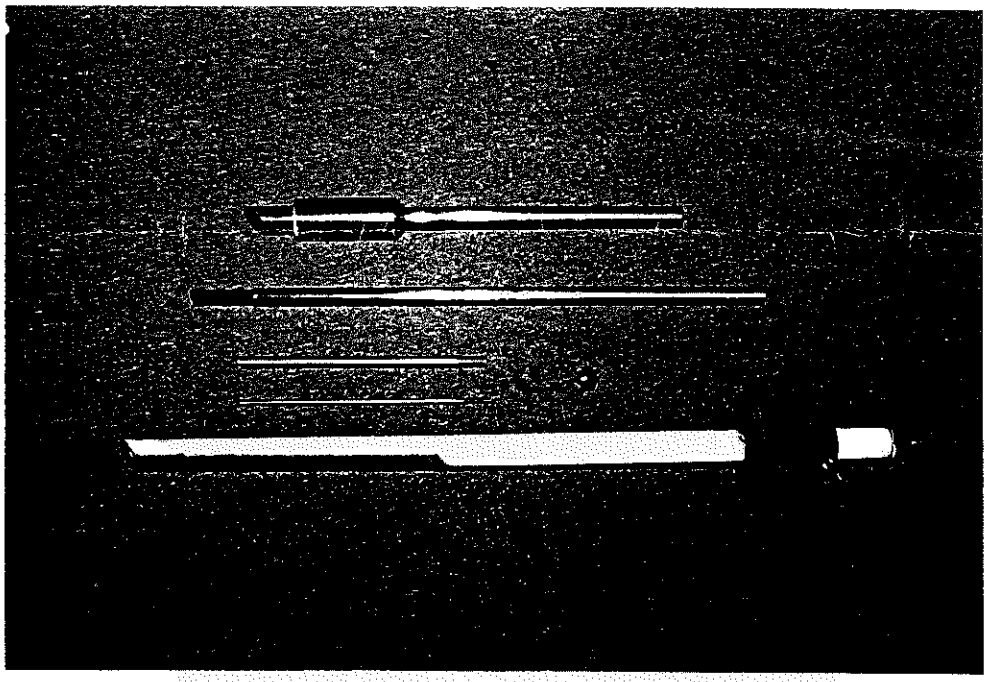
Oil and gas: Monitoring of sand in oil, solid and liquid particulates in gas, catalysts.

Atmospheric processes: Special surveys of solid and liquid (aerosols and droplets) particulates (such as in weather and acid rain research); detection of rain, sleet, and hail.

JONAS, INC. PARTICLE FLOW MONITOR



Stack Particle Emission Monitoring Probe in a Solid Waste Incinerator



Two Particle Flow Probes for Monitoring Exfoliated Oxides in High Temperature Steam Pipes, (top), Three Duct Monitoring Probes (middle), and Traversing Probe for Monitoring Electrostatic Precipitators (bottom) in a Power Generating Station

Altech Environment USA Corp.

Technical Proposal
Prepared for

NPN ENVIRONMENTAL

BETA GAUGE
Stack Dust Monitor

ALTECH ENVIRONMENT USA Corp.
2623 Kaneville Court
GENEVA, ILLINOIS, 60134

Tel : 630-262-4400 Fax : 630-262-6220

Email : sales@altechusa.com

STACK DUST MONITOR
BETA 5M

I. DESCRIPTION OF BETA 5M :

. Isokinetic sampling of gases in duct or stack
. Collection of dust on filter tape automatic sequential feed device
. Measurement of dust mass by absorption of beta radiation
. Automatic calculation of dust concentration expressed in milligrams per normal cubic meter (mg/Nm^3)
. Microprocessor controlled instrument
. Supply : Power : 230 V/50 Hz or 110 V/60 Hz on request
. flow : 9 Nm^3/h at normal flow
. Air quality :dew point ≤ - 20°C,
. dust content < 5 mg/Nm^3 and ∅ < 5 µm,
. oil content < 1 mg/m^3

COMPOSITION OF THE EQUIPMENT
It is composed of 3 main assemblies :
. 1 sampling probe
. 1 measurement unit
. 1 measurement unit support

I.1 Sampling probe

Entirely equipped, made of 316L stainless steel, heated and equipped with a pneumatically controlled nozzle shutter valve. The Pitot tube (316L stainless steel) is mechanically attached to the probe

overall length 1,5 m **Réf. CA-B5-15**

(Options) : Other possible lengths :
overall length 2,25 m *Réf. CA-B5-22*
overall length 3 m *Réf. CA-B5-30*
overall length 4 m *Réf. CA-B5-40*

I.2 Measurement unit BETA 5 M

Réf. B5-C

. Containing the following main sub-assemblies :
. Mobile nozzle
. Filter tape feed device
. Beta gauge measurement device (radioactive source + detector)
. Suction device by pneumatic ejector
. Microprocessor based measurement and control electronics
. Operator's console equipped with a 28-key keyboard and a 48 character alphanumeric display

DAC 4 board, 4 analog outputs : 0-1 V, 0-10 V, 0-20 mA, 4-20 mA on 500 ohms max. load uninsulated

1.3 Measurement unit support

Réf. B5-SUP-S

For the installation and mounting of the BETA 5M measurement unit suspended for probe of 3 meters or less.

The Beta 5 M is equipped with the following components:

- Return stirrup and sampling tube handling carriage for IPN 100 ①.
- Elevating platform ② (not included with proposal)·
- Pitot tube reverse blowing .
- Stack temperature probe (PT 100 Ω) .
- Geiger sensor temperature control system (Vortex-effect system).
- Galvanic insulation box for analogue outputs .
- RS-232 - 422 serial link board .

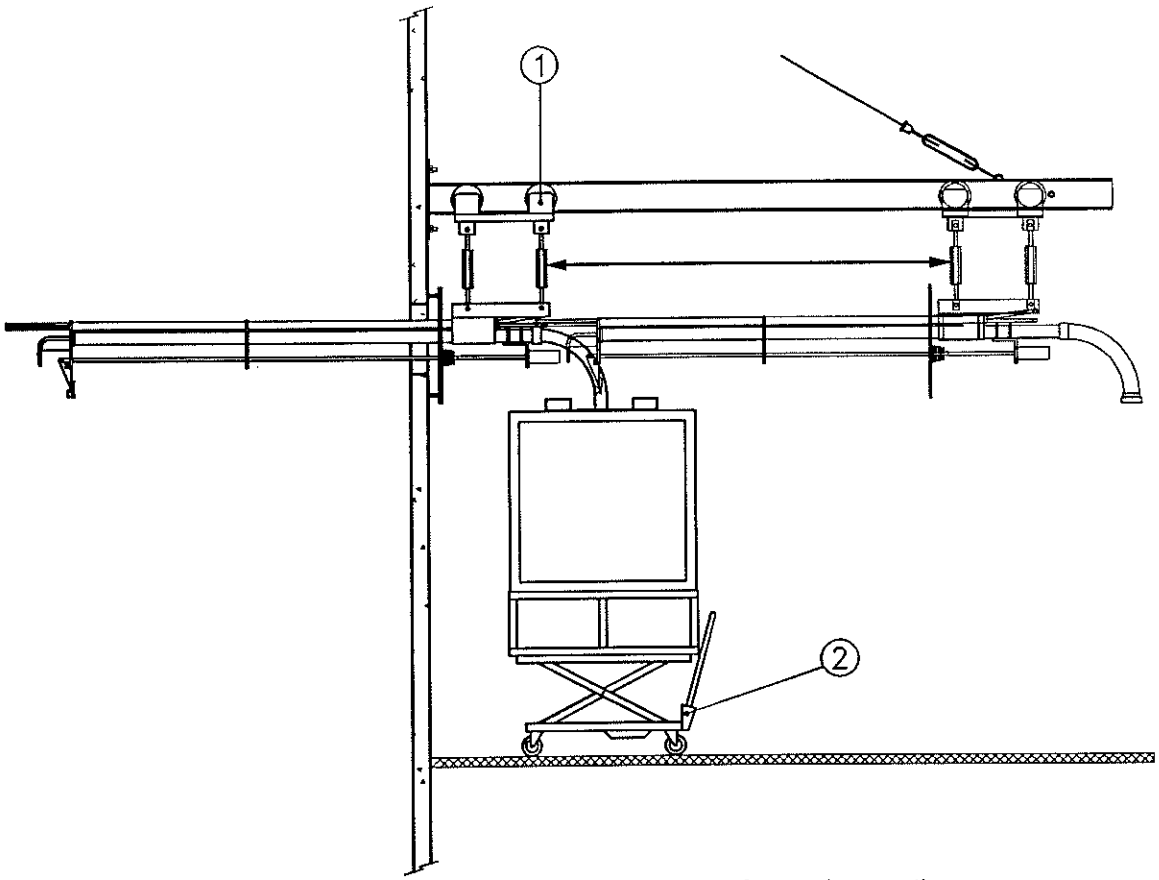


Figure 1.1 - Elevating platform and sampling tube carriage options

II. OPTIONS for BETA 5M (not included in this proposal):

II.1 Measurement unit base — Ref. B5-SS

II.2 Interfaces — Ref. RS

2 RS 232 serial output board –
For connection with compatible computer or printer (1 channel RS 232) including standard software and/or with SAM 32 E (1 channel RS 232 or RS 422) which requires a micro-computer and the SCANEM software.

II.3 MAINTENANCE MATERIAL — Ref. B5-E

For adjusting flow-rate :
- rotameter : 0-50 l/mn,
- stainless steel tube (int. diam. 8 mm) with welded connector for adaptation on measurement unit inlet.

For cleaning the sampling probe :
- 8 mm diam. nylon brush mounted on 5 mm diam. flexible tube, 4 m long
- Staubli blower delivered with tip, two fixation rings and 2 m of plastic tubing (int. diam. 6 mm).

II.4 MAINTENANCE KIT — Ref. BE-K

Maintenance kit for one year operation :
- 8 rolls of filter tape RF 5 M (5000 measurements per roll)
- 1 set of fuses
- 1 eccentric ring with Viton gasket for connection between sampling probe and measurement unit
- 6 Viton gaskets

II.5 SPARE PARTS (Up to 3 analysers) — Ref. BE-P

Nozzle plug made of Viton	Ref. P06-0263
12 V spool feed motoreducer	Ref.SAV-K-000008
1 Nipple mobile nozzle	Ref. P06-0256
1 Temperature probe	Ref. D01-0264
1 Notched belt	Ref. G05-BM-6T5
1 Carriage presser motoreducer	Ref.SAV-K-000009
1 GEIGER (MULLER) tube (LND)	Ref. M02-72412-LND
1 O ring, diam. 23.52 cord 1.78	Ref. G06-023.5-1.7-V
1 Grid (grate screen) unit, stand and ring	Ref. P01-0329
1 Plug cap	Ref. P02-0641
1 Differential captor, VENTURI 0-250	Ref. F02-0006
1 Draining valve with cable	Ref D01-0244
1 Cooling valve with cable	Ref D01-0243
1 Brass 20/25/55 ejector	Ref. F09-20-25-55
1 6 V motorized valve motoreducer	Ref.SAV-K-000010
1 Bellow CPC	Ref. P06-0143
1 Temperature probe PT100 SA 1000 with cable	Ref. D01-0254
1 Static relay 240 D4	Ref. E11-RS-0001
1 Static relay 240 D25	Ref. E11-RS-0004
1 multiplexor (DG 506 ACJ)	Ref. E00-00506
1 Converter V/F (AD 652 AQ)	Ref. E04-0652
1 CTC Z 80	Ref. E06-CTC80
1 CI RAM 128x8	Ref. E06-RA1000
1 CPU Z 180 A	Ref. E06-CPU180
1 IC PIO Z 84 A	Ref. E06-PIO84
1 IC convertor AD 7541	Ref. E04-7541

Pricing:

The Beta 5 analyzer with its probe and support equipment is offered for the lump sum price of $55,000. This price does not include any field installation support, which is offered at $780 per day plus travel and living expenses at cost plus 10%

1.1 Payment Terms

- 30 % upon placement of purchase order.
- 70% upon shipment of equipment from the factory.

1.2 Shipment of Equipment

The equipment will arrive, FOB Geneva, IL. 3 months after receipt of a formal Purchase Order (excluding August Holidays)

1.3 Price Validity

The pricing is valid for 90 days.

1.4 Documentation : The documentation will be dispatched, free of charge, in 2 sets : manuals and plant test certificates for each monitor in English.

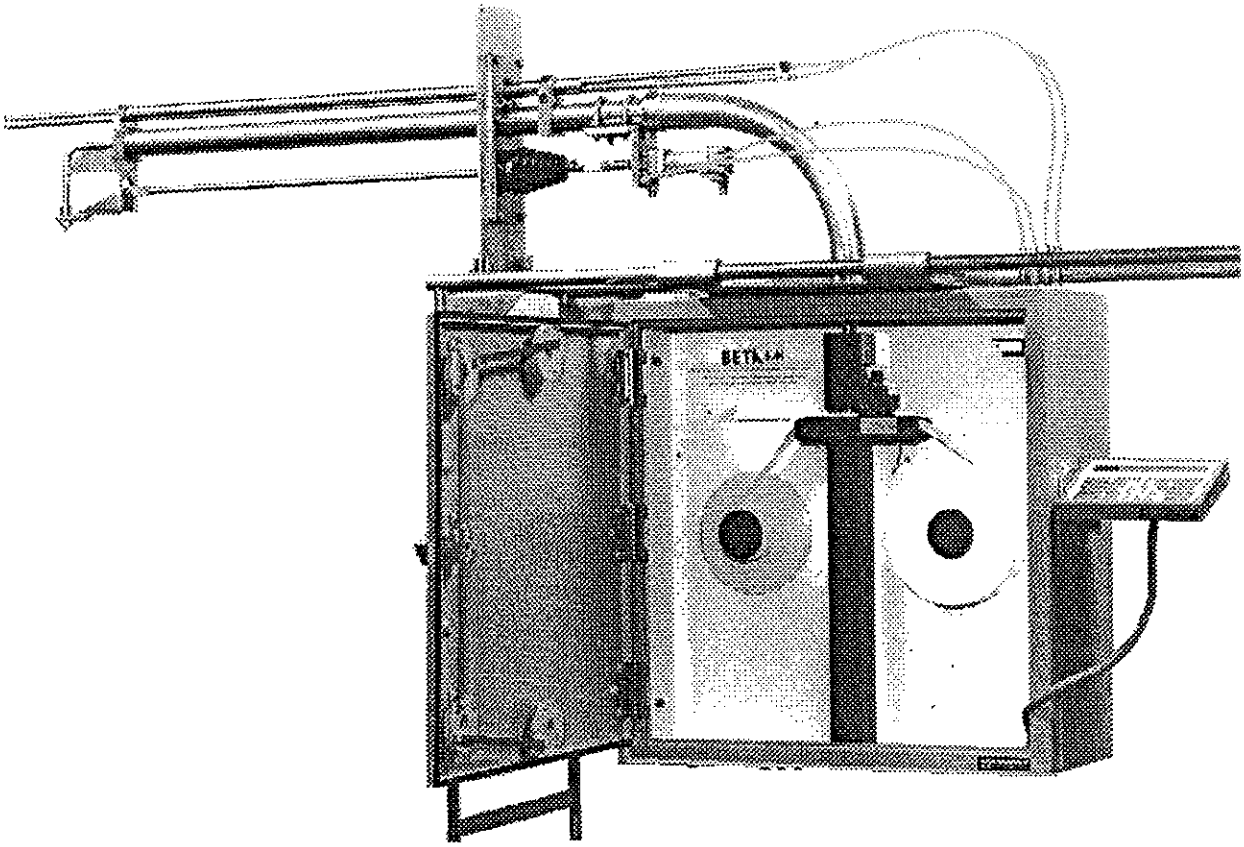
1.5 Warranty :

Period of warranty of 12 months from the date of commissioning but limited to a maximum of 15 months from the date of shipment of the analyzer.

Environnement SA warrants its equipment to be free from defects in material and workmanship when used under normal operating conditions. Environnement SA will repair the instrument or replace any defective components.

Environnement SA labor will be free of charge for all repairs in its factory. All overseas visits will be charged on an elapsed time, fares and expenses basis.

Our responsibility is towards the supply of repaired or replaced parts free of charge but doesn't include payment of any other duties, etc. which may become liveable in the country of import.



SICK

SOURCE FOR SENSORS **SICK**

SICK, Inc.• 6900 West 110th Street • Bloomington, MN 55438 • Tel: 952-941-6780 • Fax: 952-941-9287 • www.sickoptic.com

FAX TRANSMITTAL

Date: 4/19/00 **Total Pages (incl. coversheet):** 11

Company: NPN Environmental
Attn: Brian L. Gregory

Fax No: 636-343-8192

From: Dave Thomas

Subject: **Quotation Attached**

Here is our Quotation 200094 for our 'FWE 200 Dust Concentration Device. Also please find attached literature on the 'FEW 200,Terms & Conditions, Rate Sheet and Technical Questionnaire.

Please note that Start-Up includes one day of a gravimetric comparison calibration using a SICK-Optic Model: Gravimat 502 Method 17 tester. This calibration is used as the baseline curve to be loaded into the 'FEW 200 representing the plant operating conditions.

The above pricing for services start-up, installation supervision and trqining is assuming a single mobilization for one system. Of course, if more than one system is purchased or selected, expenses can be combined and could reduce the overall cost.

Several of these systems for PS 11 have already been installed:

Example: 2 systems are running at Holnam Cement in Texas. Both systems are after a wet srubber FGB.

Example: Another system is currently being installed for International Paper and the USEPA Enforcement Group for evaluation on a wet stack to measure particulate Concentrtion in a paper mill.

If I can be of further service or if you have any questions regarding the attached, please don't hesitate to call me at 612/829-4814.

Best regards,

Dave Thomas
Attachment

SICK, Inc.
6900 West 110th Street
Bloomington MN 55438 USA
Telephone: 612-941-6780
1-800-325-7425 Fax: 612-941-9287

SALES Quotation

Number:	Date:	Page 1
200094	04-19-00	
Customer Number:		Exp Date:
		05-19-00

Quoted To:

NPN ENVIRONMENTAL
927 HORAN DRIVE
FENTON, MO 63026
Phone: 636-343-1300
Fax: 636-343-8192

Delivery Terms:	Payment Terms:	Freight Terms:
FOB Bloomington	Net 30 After Shipment	Pre-Pay & Add

Contact:	Sales Rep:	Customer PO Number:	Approx Delivery:	Sales Manager:
BRIAN L. GREGORY	MEMECO		10-12 WKS AR	DAVE THOMAS

Item:	Qty:	Part No.:	Product / Description:	Unit Price:	Extended Price:
1	1		FWE 200 DUST CONCENTRATION DEVICE Device based on scattering light measurement principle to detect smallest to medium dust concentrations	52518.00	52518.00
		7047001	Gas extraction and return of gas in one probe, length 1200mm, PVDF		
		7047605	Measuring and control unit consists of thermocyclone, scattered light cell, transmitter/receiver unit FWSE 200, ejector and control cabinet; 115V		
		1014070	Purge air unit Separate blower unit 2BH13:1PH with 5m air hose DN-=10mm; with filter and underpressure switch		
		7047616	Flange with tube; DA=139, 7mm; length=200mm; ST 37		
2			FOR OUTDOOR INSTALLATION THE FOLLOWING IS REQUIRED:		
	1	2702407	WSH 03-01 WEATHER HOOD for sender/receiver unit FWSE 101/102	329.00	
	1	5306100	WEATHER HOOD, AIR PURGE unit 2 BH 13	357.00	
3			OPTIONS:		
	1	7040012	CABLE, RS232 INTERFACE	47.00	
	1	7047542	Memory for values and events	1800.00	
	1	7047544	Bag filter software FW 102	820.00	
	1	7040546	Calculation of regression curve	250.00	
	1	7047536	Purge air hose, 10m	420.00	
	1	7047531	Signal cable with plug, 10m	210.00	
4			WEAR AND TEAR PARTS FOR TWO YEARS OF OPERATION:		
	4	5306091	FILTER INSERT, MICRO-TOP for purge air unit 2BH13	97.00	
	4	7047560	Filter insert for AKS	54.00	
	2	4003353	OPTICAL CLOTH	19.00	
5	3	7024584	START-UP SERVICES	1040.00	3120.00

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE AFTER QUOTATION EXPIRATION DATE.
THIS QUOTATION IS SUBJECT TO THE TERMS AND CONDITIONS OF SALE ON THE BACK OF THIS FORM.
FINAL PRICING DEPENDENT ON SIGNED AND COMPLETED TECHNICAL QUESTIONAIRE.

Authorized Signature:	Quotation Total:	Currency Type:
	<See Last Page>	<See Last Page>

SICK ..., Inc.
6900 West 110th Street
Bloomington MN 55438 USA
Telephone: 612-941-6780
1-800-325-7425 Fax: 612-941-9287

SALES Quotation

Number:	Date:	Page 2
200094	04-19-00	
Customer Number:		Exp Date:
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NPN ENVIRONMENTAL
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Phone: 636-343-1300
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Delivery Terms:	Payment Terms:	Freight Terms:
FOB Bloomington	Net 30 After Shipment	Pre-Pay & Add

Contact:	Sales Rep:	Customer PO Number:	Approx Delivery:	Sales Manager:
BRIAN L. GREGORY	MEMECO		10-12 WKS AR	DAVE THOMAS

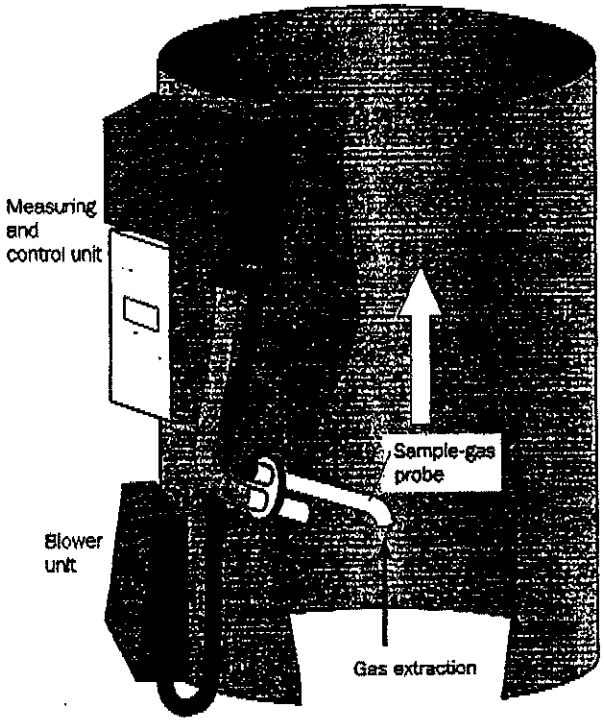
Item:	Qty:	Part No.:	Product / Description:	Unit Price:	Extended Price
			Estimated 3 days of start-up on the above mentioned analyzers. Additional days required will be charged at the daily rates. Expenses will be charged according to the attached Rate Sheet. Customer is responsible for all wiring, conduit, mounting and piping.		
6	1	7024585	INSTALLATION SUPERVISION Estimated 1 day of installation supervision by SICK Inc. Application Engineer to assist customer with installation.	1040.00	1040.0
7	1	7024589	TRAINING A SICK Inc. Application Engineer will perform 1 day of onsite training for the above mentioned analyzers. Additional time will be charged according to the unit price.	1040.00	1040.0
8	1		ESTIMATED EXPENSES for installation supervision, start-up services and training if done during single trip - airfaire = $1000.00 - travel time = $680.00 - per diem = $620.00 - rental car = $340.00 Cost is estimated. Actual charges according to the attached rate sheet.	2640.00	2640.0
9	1	7024596	DOCUMENTATION 1 SET OF EQUIPMENT MANUALS. ADDITIONAL COPIES AVAILABLE ON REQUEST AT ADDITIONAL COST.	225.00	225.0
10			NOTE: SICK Inc. must receive a signed and completed technical questionnaire before final pricing may be provided and acceptance of customer PO. All Analyzer performance is based upon this technical questionnaire.		

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE AFTER QUOTATION EXPIRATION DATE.
THIS QUOTATION IS SUBJECT TO THE TERMS AND CONDITIONS OF SALE ON THE BACK OF THIS FORM.
FINAL PRICING DEPENDENT ON SIGNED AND COMPLETED TECHNICAL QUESTIONAIRE.

Authorized Signature:	Quotation Total:	Currency Type:
	60583.00	UNITED STATES DOLLAR

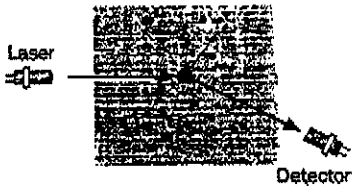
FWE 200 Measurement of Dust Concentrations

NEW



Compact, robust, low maintenance: Dust measurement in wet gases

Scattered light enables even minimal dust concentrations to be measured.



The FWE 200 is designed to measure dust concentrations in saturated flue gas using the scattered light measuring principle.

The gas is withdrawn via an extraction probe. Any droplets are vaporized and, therefore, cannot falsify the result of the measurement.

Applications

Measuring dust concentrations, e.g.

- in saturated gas downstream of desulfurization plants
- downstream of wet scrubbing plants, e.g. in waste incinerators
- in wet exhaust gas from industrial processes.

Key Features

- Compact design
- Easy to install
- Only one probe for gas extraction and return
- Easy to operate

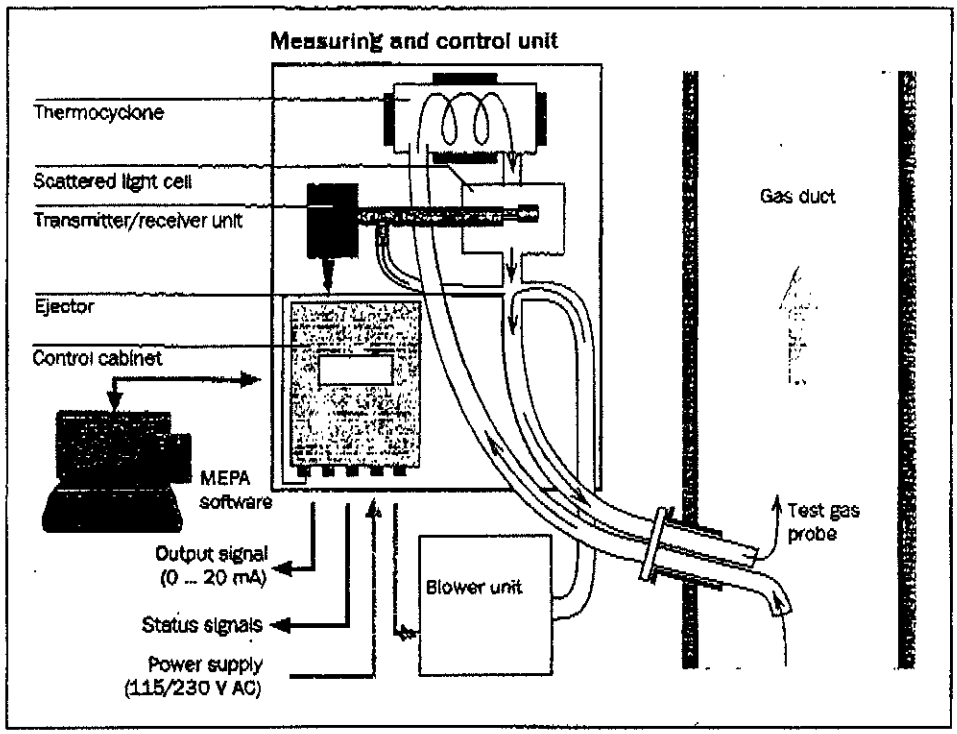
SICK

Operating Principle

A partial flow of gas is extracted from the flue gas duct via a probe and superheated in a thermocyclone before it is supplied to a scattered-light cell. The FWE 200 then uses the transmitter/receiver unit to measure the scattered light intensity in the test cell as a measure of the dust concentration. Following this, the test gas is fed to the sample-gas probe via an ejector and returned to the duct.

The sample gas is forwarded via the ejector by means of a blower unit that also supplies the transmitter/receiver unit with purge air for keeping the optical boundary surfaces clean.

Overview of FWE 200 Components



Technical Data	
General data	
Measured variable	Scattered light intensity, proportional to the dust concentration
Measurement range	0 ... 5 mg/m³ to 0 ... 200 mg/m³
Accuracy	< 2 % of full scale
Flue gas duct	
Gas temperature	max. 120 °C for PVFD probes; optional 200 °C for hasteloy probes
Gas wetness	max. 10 g water per m³ (content by mass 1 %) (no water vapor content)
Internal duct pressure	± 20 mbar
Gas velocity	4 to 20 m/s
Terminals	
Analog output	0/2/4 ... 20 mA
Relay outputs	one for malfunction, warning, maintenance, limit value; load 48 V DC, 0.5 A
Binary input	for maintenance switch
Interfaces	RS 232 for parameterization and service
Power supply	115/230 V AC, 50/60 Hz; power consumption 2.5 kW
Ambient conditions	
Ambient temperature	–20 ... +50 °C
Protection class	IP 54 electronic housing IP 65
For outdoor installation	weatherproof cover required for blower unit
Dimensions, weight	
Meas. and control cell	H x W x D: 830 x 730 x 400 mm; approx. 65 kg
Sample-gas probe	nominal length 600 mm, optional 1200 mm; max. 15 kg
Blower unit	H x W x D: 550 x 550 x 270 mm; 14 kg

SICK

SICK AG
Environmental Monitoring
Nimburger Str. 11
D-79276 Reute, Germany
Phone (+49) 76 41/4 69 0
Fax (+49) 76 41/4 69 11 49
http://www.sick.de

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SICK

SICK, Inc.
6900 West 110th Street
Bloomington, MN 55438 USA
Telephone 612.941.6780
Facsimile 612.941.9287
www.sickoptic.com

Source For Sensors

2000 SERVICE AND SUPPORT RATES

Standard Labor (8:00 am to 5:00 pm, Monday - Friday)	$130.00/hour
Overtime (prior to 8:00 am and after 5:00 pm Monday - Friday)	$170.00/hour
Weekend/Holiday/Emergency Unscheduled	$230.00/hour
Travel Time	$ 85.00/hour
Daily Expenses per Person (Hotels/Meals)	$155.00/day
Air Transportation	actual + 10%
Ground Transportation (Car and Gas) (remote destinations may have additional charges)	$ 85.00/day
Scheduled Service Visits (1 month advance)	$800.00/day
Preventative Maintenance Contract (also receives 10% discount on spares used)	$700.00/day

**NOTE: 15% penalty for cancellation less than 30 days in advance, plus actual incurred expenses.

TERMS AND CONDITIONS OF SALE

1. Price: All prices are subject to change by SICK, Inc. without notice. Orders which are agreed to by both SICK, Inc. and the Purchaser and which call for delivery in the future are intended by the parties to be binding upon each of them and will be invoiced at SICK, Inc.'s standard price prevailing at the time of shipment.

2. Payment Terms: Unless otherwise stated in the Quotation or the Order Confirmation, the Purchaser will pay to SICK, Inc. the total amount stated on the invoice within thirty (30) days after the date of the invoice.

3. Taxes: The Purchaser shall pay all sales, excise, use, value-added and other taxes levied by any jurisdiction, domestic or foreign, on the products sold pursuant to this agreement.

4. Quotations: SICK, Inc. may terminate any quotation at any time. A quotation which is not terminated by SICK, Inc. expires thirty (30) days after it is issued, unless otherwise agreed to in writing.

5. Minimum Order: Orders for products totaling less than $150.00 will include a service charge of $20.00 per order.

6. No Returns: No products purchased pursuant to this agreement may be returned to SICK, Inc. without its written consent. SICK, Inc. may in its sole discretion impose any terms or conditions on returns to which it consents.

7. Time and Method of Shipment: SICK, Inc. shall in its sole discretion determine when the products sold pursuant to this agreement shall be shipped. All deliveries of products sold pursuant to this agreement are F.O.B. SICK, Inc.'s facility in Bloomington, Minnesota, U.S.A. SICK, Inc. will ship the purchased products to the Purchaser and, at the written request of the Purchaser, will insure the shipment for the amount of the purchase price, both at the Purchaser's expense. SICK, Inc. shall select the method and route of shipment unless a specified method or route is designated in writing by the Purchaser.

8. Limited Warranty: SICK, Inc. warrants for a period of twelve (12) months from the date of shipment by SICK, Inc. that, except for lamps, fuses, relays and other expendable components, the products sold pursuant to this agreement shall be free from defects in material and workmanship, subject to the following limitations: (1) SICK, Inc. shall have no liability with respect to defects caused by the fault or negligence of the Purchaser or any third party, improper use of the purchased product, catastrophic or normal wear and tear; (2) all claims under this limited warranty must be made in writing at SICK, Inc.'s facility in Bloomington, Minnesota, U.S.A. within thirty (30) days after the defect is discovered and (3) the sole and exclusive remedy under this limited warranty in law or in equity shall be limited to, at SICK, Inc.'s option, either the repair or replacement of the defective product at no charge to the Purchaser who at its own expense shall remove the defective product or component, transport it to SICK, Inc.'s facility in Bloomington, Minnesota U.S.A. and install the replaced or repaired product or component. SICK will return ship, at no expense, repaired or replacement products covered by warranty.

9. Disclaimer of Warranties: Except for the limited warranty expressed in paragraph 8 above, SICK, Inc. disclaims all warranties, whether expressed or implied, including, without limitation, any warranties of merchantability and fitness for a particular purpose.

10. Limitation on Remedies: The sole and exclusive remedy in law or in equity for a breach of any warranty by SICK, Inc. and for SICK, Inc.'s liability of any kind (including liability for negligence), shall be limited to the repair or replacement of the defective product as set forth in paragraph 8 above. In no event shall SICK, Inc. be liable for any special, consequential or incidental loss or damage.

11. Resale by the Purchaser: If any product purchased pursuant to this agreement is resold by the Purchaser, either standing alone or as a component in another product, the Purchaser shall include in a written agreement with the person to whom the Purchaser is reselling, a disclaimer of warranties by SICK, Inc. under this agreement and limitation on remedies available against SICK, Inc. under this agreement having the same effect as those set forth in paragraphs 9 and 10 above.

12. Patents: SICK, Inc. will defend the Purchaser and pay any damages and costs awarded against the Purchaser in any suit or proceeding based on a claim by a third party that the products sold pursuant to this agreement infringe any valid patent of the United States, provided that SICK, Inc. is notified promptly in writing of any claim of infringement and given authority, information and, at SICK, Inc.'s expense, assistance to defend the claim. If in any such suit any of the products purchased pursuant to this agreement are held to constitute an infringement and the use of such product is enjoined, SICK, Inc. will at its option and expense: (1) procure for the Purchaser the right to continue using the product, (2) replace the purchased product with a product which is not infringing, (3) modify the purchased product so that it no longer infringes the patents upon which the finding of infringement is based or (4) allow the Purchaser to return the product for a credit toward the purchase of other products offered for sale by SICK, Inc., such credit to equal the depreciated value of the product at the time of its return as determined by SICK, Inc. SICK, Inc. shall not be liable under this paragraph in the following circumstances: (1) if the claim of infringement is based on the use of the purchased product with other products not delivered by SICK, Inc. or in a manner which SICK, Inc. did not intend at the time of sale, (2) where the purchased product has been modified in a manner which caused the infringement, or (3) where the purchased product was produced by SICK, Inc. to designs or specifications supplied by the Purchaser. The Purchaser shall defend and indemnify SICK, Inc. against all loss, damages, costs and expenses (including, without limitation, attorneys' fees and settlement payments) caused by any claim of patent infringement based on a product produced by SICK, Inc. to designs or specifications supplied by the Purchaser.

13. Applicable Law: This agreement is governed and interpreted under the laws of the State of Minnesota.

Technical Questionnaire

The details of the Technical Questionnaire serve for determination of the SICK measuring devices and analyzers and the adaptation to the measuring task. Please fill in the questionnaire completely in order to prevent further questions.

Customer

Company: _____

_____
Name, address

Contact: _____ phone: _____
Name, dept. Fax: _____
Email: _____

Project: _____ Plant type: _____

Mount. location: _____
Country, area, altitude

Measurement details

☐ Furnace, fuel: _____

☐ Process, method: _____

For internal notice

Emission monitoring:

☐ TA-Luft (Clean Air Act) ☐ 13. BImSchV ☐ 17. BImSchV

☐ EPA Part: _____ , country: _____ ☐ GOST

☐ _____ ☐ no specific compliance

Plant Overview

Fill in measuring points and plant designation;
If necessary complete draft.

The technical correct execution of the order in due time can only be ensured if the questionnaire is duality filled in and signed. SICK reserves the right to charge for subsequent changes.

[redacted]

Technical Questionnaire

This page is to be filled in separately for every measuring point!

Measuring point no.: _____

Measuring task

Measuring component(s)	Measuring range(s)	Unit*
Dust content		
Gas velocity		
Humidity		
Temperature		
Gas analysis		

*mg/m³ in standardized condition, mg/m³ in operation, ppm, vol%, m/s, hPa, °C etc.

Measuring gas details

Measuring gas	min.	normal	max.	Unit*
Water dew point				%
Acid dew point				°C
Pressure				hPa
Temperature				°C
Dust content				mg/m³
Velocity				m/s
Gas composition CO_2				
NO				
SO_2				
O_2				
CO_2				
H_2O				

Measuring gas composition: 100 vol%

*mg/m³ in standardized condition, mg/m³ in operation, ppm, vol%, m/s, hPa, °C etc

Contamination due to aerosols? ☐ no ☐ yes, which: _____

Does the meas. gas represent an explosion hazard when combined with air? ☐ no ☐ yes, zone: _____

Technical Questionnaire

This page is to be filled in separately for every measuring point!

Measuring point no.: _____

Details of measuring point/extraction point

Mounting location: ☐ under cover ☐ in the open

Weather proof cover required? ☐ no ☐ yes

Ambient temperature: min.: _____ °C max.: _____ °C normal: _____ °C

Atmosphere: explosive ☐ no ☐ yes, zone: _____
aggressive ☐ no ☐ yes, component: _____

Compressed air available? ☐ no ☐ yes, _____ hPa
☐ others: _____

Temperature measurement available? ☐ no ☐ yes, from _____ °C to _____ °C

Power supply (in situ):

☐ 230 V/50 Hz/1 phase
☐ 3 x 230 V/50 Hz/1 phase
☐ 3 x 400 V/50 Hz/1 phase
Measuring device

☐ 230 V/50 Hz/1 phase
☐ 3 x 230 V/50 Hz/1 phase
☐ _____ V/_____ Hz/_____ phase
Purge air unit

Channel/duct

- cross-section: ☐ circular ☐ rectangle, W: _____, H: _____ ☐ square
- Material: ☐ stainless steel ☐ bricks ☐ others: _____
- Outer Ø (without insulation): _____ mm
- Wall thickness: _____ mm
- Insulation thickness: _____ mm
- Double walled duct: ☐ yes ☐ no
- Inner lining: ☐ yes ☐ no
- Mounting position: ☐ ☐ ☐ ☐
  (probe/device view)
  ☐ or see draft
- Measuring axis (in situ): ☐ diagonal ☐ horizontal ☐ vertical
- Flange material: ☐ Carbon steel ☐ Stainless steel: _____ or
  ☐ _____

For internal notice:
distance flange – flange: _____ m
active measuring distance: _____ m

Technical Questionnaire

This page is to be filled in separately for every measuring point!

Measuring point no.: _____

Details for the analyzer location (for extractive measurement only)

Power supply:
- ☐ 230 V/50 Hz, 1 phase
- ☐ 115 V/60 Hz, 1 phase
- ☐ 115 V/50 Hz, 1 phase
- ☐ 400 V/50 Hz, 3 phase
- ☐ ____ V/ ____ Hz, ____ phase

Mounting location: ☐ under cover ☐ in the open (diagram/draft if necessary)

Ambient temperature: min.: _____ °C max.: _____ °C normal: _____ °C

Explosion protection necessary? ☐ no ☐ yes, zone: ____

Measuring container required? ☐ no ☐ yes
(for the analyzer cabinets)

Condensation drainage available? ☐ no ☐ yes

Meas. gas extraction line: length: _____ m ☐ heated ☐ not heated

Return path measuring gas: ☐ no ☐ yes, length : _____ m
- ☐ heated
- ☐ not heated

Remarks, draft of the analyzer location

For internal notice

SICK AG • Environmental Monitoring • Nimburger Str. 11 • 96276 Reute • Germany
Tel. (++49) 7641-469-0 • Fax (++49) 7641-460-1149

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Andersen Instruments Incorporated

ANDERSEN
INSTRUMENTS INCORPORATED

Fax

Date: Tuesday, April 18, 2000

To: NPN Environmental
Brian Gregory *www.npnenv.com*
Phone: 314-343-1300
Fax: 314-343-8192

From: ANDERSEN INSTRUMENTS INC.
Bruce Kempe *bkempe@AndersenInstruments.com*
Phone: 770-319-9999
Fax: 770-319-0336

Pages:

Subject: CPMMS

Brian;
I e-mailed you the attached quote earlier today and wanted to take a second to explain the quote itself. The first quote is for four separate monitors. It isn't the approach that I'd recommend since we can multiplex four sensors into one common controller to save you some money, but you did specify breaking out pricing on a per unit basis and this is what would be required to conform to separate unit pricing. Certainly if 2-3 channels are decided upon we can requote for that type system with the cost falling between ¼ of the four channel and the $9,990 for a single channel.

I quoted 60 days from receipt of order to delivery. We had been quoting 4 weeks, but recent history shows us running a bit longer than that. It likely won't be the full 60 days, and obviously is a function of what else is in the shop and the need to expidite according to your needs. Let us know what your timetable is and I'm sure we can accommodate you.

ANDERSEN INSTRUMENTS INCORPORATED
A Subsidiary of Thermo Instruments Systems, Inc.
500 Technology Court, Smyrna, GA, 30082 USA
TEL: (770) 319 9999 Fax (770) 319 0336

ANDERSEN
INSTRUMENTS INCORPORATED

To: Brian Gregory
NPN Environmental
927 Horan Dr
St. Louis, MO 63026
Phone: 314-343-1300
Fax: 314-343-8192

Date: 4/18/00
Quotation No: 11889
Terms: Net 30 Days ARO
F.O.B. Point: Smyrna, GA USA
Delivery Date: 60 Days ARO
Contact: Bruce Kempe

QUOTATION

Part #	Description	Qty	Price	Extend
SC-600/1	PCME SC-600 Scintilla Dust Emissions Monitoring System Advanced Dynamic Opacity Technology part number SC-600/1 Features: Combined Monitor, control unit, and recording system EPA monitoring and process control applications Full report and analysis facility by linking to any PC and printer/recorder* Up to 4 channels of monitoring via expansion module Innovative microprocessor based operation employing dynamic opacity technology * Via EPA Reporter PC Software- Add $ 500.00	4	$9,990.00	$39,960.00
SC600/4	PCME SC-600 Scintilla Dust Emissions Monitoring System Advanced Dynamic Opacity Technology part number SC-600/4/1 Features: 4 Dynamic Opacity sensor units feeding one common control unit via an expansion unit, and recording system Full report and analysis facility by linking to any PC and printer/recorder* Innovative microprocessor based operation	1	$31,800.00	$31,800.00

Note: Quotation is valid for products shipped and invoiced in the United States.

Quotation Valid To: 6/2/00
Federal I.D. No. 95-3792692
D-U-N-S No. 08-936-1042

ANDERSEN INSTRUMENTS INCORPORATED
A Subsidiary of Thermo Instruments Systems Inc.
500 TECHNOLOGY COURT, SMYRNA, GA, 30082-5211, USA
TEL: 800 241 6898 or 770 319 9999 FAX 770 319 0336
E-Mail: Andersen@AndersenInstruments.com
Web Site: www.AndersenInstruments.com

ANDERSEN
INSTRUMENTS INCORPORATED

To: Brian Gregory
NPN Environmental
Project:

Date: 4/18/00
Quotation No: 11889
Contact: Bruce Kempe

QUOTATION

Part #	Description	Qty	Price	Extend
	employing dynamic opacity technology *Includes 200 foot of cable for each sensor supplied as 800 foot roll to be cut as required on site			

By: Bruce Kempe

Quotation Valid To: 6/2/00
Federal I.D. No. 95-3792692
D-U-N-S No. 08-936-1042

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Web Site: www.AndersenInstruments.com

ANDERSEN
INSTRUMENTS INCORPORATED

To: Brian Gregory
NPN Environmental
927 Horan Dr
St. Louis, MO 63026
Phone: 314-343-1300
Fax: 314-343-8192

Date: 4/18/00
Quotation No: 11889
Terms: Net 30 Days ARO
F.O.B. Point: Smyrna, GA USA
Delivery Date: 60 Days ARO
Contact: Bruce Kempe

QUOTATION

Part #	Description	Qty	Price	Extend
SC600/4	PCME SC-600 Scintilla Dust Emissions Monitoring System Advanced Dynamic Opacity Technology part number SC-600/4/1 Features: 4 Dynamic Opacity sensor units feeding one common control unit via an expansion unit, and recording system Full report and analysis facility by linking to any PC and printer/recorder* Innovative microprocessor based operation employing dynamic opacity technology *Includes 200 foot of cable for each sensor supplied as 800 foot roll to be cut as required on site	1	$31,800.00	$31,800.00
SF2000	Stack Flow 2000 Electrodynamic Stack Particlate Velocity Monitor Features: Direct measurement of particle / stack velocity, unaffected by gas density or temperature Rugged measurement technique without pitots or moving parts Insulated sensor permits operation in humid stacks and corrosive or aggressive gas streams Requires only single mounting point on stack Virtually contamination free in particle laden applications Suitable for monitoring on both inlets and outlets to cyclones, ESPs and Baghouses	4	$8,400.00	$33,600.00

Note: Quotation is valid for products shipped and invoiced in the United States.

Bruce Kempe

Quotation Valid To: 6/2/00
Federal I.D. No. 95-3792692
D-U-N-S No. 08-936-1042

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E-Mail: Andersen@Andersaninstruments.com
Web Site: www.Andersaninstruments.com

PARTICULATE MONITORING SYSTEMS

PCME

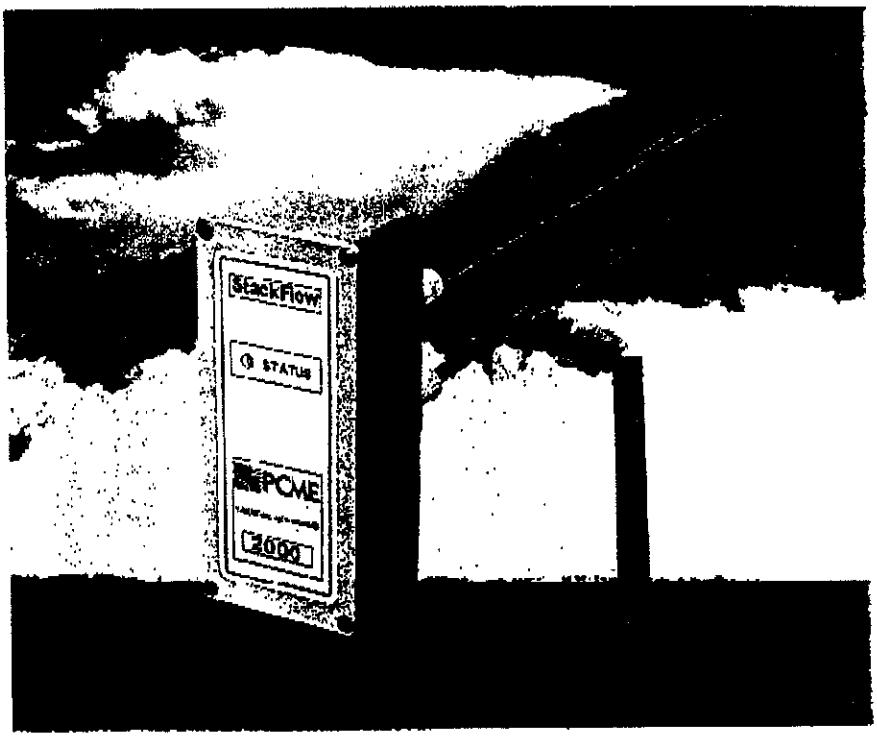
STACK PARTICULATE VELOCITY MONITOR

ELECTRODYNAMIC

STACK

PARTICULATE

VELOCITY MONITOR



ISO 9002
Certificate No: 9389

MILLENNIUM 2000 COMPLIANT

CE

- Rugged measurement of stack velocity in particle laden applications
- Unique electrodynamic time of flight correlation system
- Reliability in high dust and humid applications
- Virtually unaffected by sensor contamination or blockage
- Permits measurement of Mass emissions (kg/year) when used in conjunction with PCME's particle concentration monitors

Principles of Operation

The StackFlow 2000 utilises advanced electrodynamic technology to accurately determine particle and hence stack velocity. The instrument accurately measures the electrical signature induced by particles passing a sensor rod. This signal is cross-correlated with the signal derived from a second rod downstream of the first rod to determine the transit time of the particles. The velocity is simultaneously calculated since the geometric separation of the sensor rods is known. The high-speed correlator provides sufficient dynamic range and bandwidth for practical stack measurement.

Unlike most other velocity techniques the response of the instrument is not impaired by the presence of particles. This means in highly aggressive applications the StackFlow 2000 can provide robust operation combined with a reliable measurement of particle and stack flow velocities.

Features

- Direct measurement of particle / stack velocity, unaffected by gas density or temperature
- Rugged measurement technique without pitots or moving parts
- Insulated sensor permits operation in humid stacks and corrosive or aggresive gas streams
- Requires only single mounting point on stack
- Virtually contamination free in particle laden applications
- Suitable for monitoring on both inlets and outlets to cyclones, ESPs and Baghouses

Specification

Process Limits	
Temperature	0-250°C (consult PCME for higher temperatures)
Duct Size	150mm to 3m
Velocity Range	0-50m/s
Response Time	0-5 secs
Minimum Dust Concentration	5mg/m³
Cross Correlation Accuracy	>99.5%
System Accuracy	Application Specific
Sensor	
Enclosure Rating	IP65
Material	316 stainless steel, PTFE insulator
Connection	4" BSP 100mm flange
Lengths	100mm, 250mm, 500mm, 750mm, 1000mm
Control Box	
Rating	IP65
Power	115-230Vac 50/60Hz
Output	4-20mA (isolated) scaled m/sec

About PCME

PCME is a world leader in particulate measurement. The company produces equipment for both emissions monitoring, process control and solids flow monitoring. A dedicated team of qualified application and sales engineers is always on hand and should be consulted in the selection and usage of the most suitable equipment for any particulate application.

PCME Ltd
Clearview Building, Edison Road
St. Ives, Cambs PE17 4GH
Tel: Int +44 (0)1480 468200
Fax: Int + 44 (0)1480 463400
E-mail: sales@pcme.co.uk
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www.pcmeinc.com

Contact your national or area sales and service office

PCME products are the subject of worldwide patents. Due to the continuing product development programme, PCME reserves the right to change

Durag, Inc.

DURAG

Fax Cover Sheet

Date:	4/14/00	**Time:**	4:41 PM
To:	Brian Gregory NPN Environmental 927 Horan Drive St. Louis, MO 63026	**Fax:** **Phone:**	636-343-8192 888-343-1300
From:	Carl Gohdes	**Number of pages including cover sheet:**	**2**
Subject:	Your RFQ date April 11, 2000		

Dear Mr. Gregory,

Attached is the quotation for the D-R 300. This would be the lowest price option provided the stack gas stayed above the dew point. My records show that I sent you information on the D-R 300 as well as the F 904K beta gauge in February. The price for the F-904K will be $60,000 and this will handle wet stacks with condensing moisture. Both systems are complete and the plant/EPRI will need to supply the platform,

DURAG

Fax Cover Sheet

Date: 4/14/00

Time: 4:41 PM

To: Brian Gregory
NPN Environmental
927 Horan Drive
St. Louis, MO 63026

Fax: 636-343-8192
Phone: 888-343-1300

From: Carl Gohdes

Number of pages including cover sheet: 2

Subject: Your RFQ date April 11, 2000

Dear Mr. Gregory,

Attached is the quotation for the D-R 300. This would be the lowest price option provided the stack gas stayed above the dew point. My records show that I sent you information on the D-R 300 as well as the F-904K beta gauge in February. The price for the F-904K will be $60,000 and this will handle wet stacks with condensing moisture. Both systems are complete and the plant/EPRI will need to supply the platform, installation of the provided flanges, and the electrical and signal wiring. I will be out of the office the first part of next week so I wanted to get this abbreviated information out to you right away. Please give me a call if you have any questions or if you need further information.

Sincerely,

Carl Gohdes
Environmental Products Manager

DURAG, Inc.
Emissions Monitoring Equipment • Boiler Instrumentation • Pilot Burners
1970 Christensen Avenue • West St. Paul, MN 55118 • (651) 451-1710 • Fax (651) 457-7684
e-mail: durag@durag.com • http://www.durag.com/

DURAG

D-R 300-40
Low-Concentration Particulate Monitor
page 1 of 1

EQUIPMENT	PART NUMBER	UNITS EACH	US LIST PRICE $
Total System D-R 300 – 40	**D-R 300-40 SYS**	**1**	**$ 13,530.00**
For measuring dust concentration in the range of 0 to 900 mg/m³ (according to selected range) Monitor to include two relay outputs for limit thresholds and two 4 to 20 mA current outputs			
Consisting of: Sender/receiver system D-R 300-40, 115 V/60 Hz Control display and terminal box Installation flange (carbon steel) Purge air blower assembly Fail-safe shutter assembly, complete Weather hood for D-R 300 S/E Weather hood for D-R 300 G-MP Light trap 26" (carbon steel) Automatic measuring range selection	D-R 300-40 S/E D-R 300 B D-R 300 A SK D-R 300 G-MP D-SK 310 Complete D-WSH 300 HM D-WSH 300 G D-R 300-40 L D-R 300 MP-17		

OPTIONAL EQUIPMENT	PART NUMBER	UNITS EACH	US LIST PRICE $
Weather hood for sender/receiver unit (vertical)	D-WSH 300 VM		$ 543.00
Fail-safe shutter attachment for high-temperature applications	D-SK 300 ZUTE		$ 1,778.00
D-R 300 flange for fail-safe shutter, stainless steel - V4A/1.4571	D-R 300 A V4A SK		$ 368.00
1 light trap for D-R 300, length 660mm (stainless steel V4A/1.4571) including light trap inserts	D-R 300-40 L V4A		$ 1,110.00
Test filter box for testing the linearity of the D-R 300-40	D-R 300-80		$ 7,341.00
Optical aid for welding in the light traps	D-R 300-70		$ 1,105.00

DURAG, Inc.
Emissions Monitoring Equipment • Boiler Instrumentation • Pilot Burners
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e-mail: durag@durag.com • http://www.durag.com/

APPENDIX E

Installation and Certification Protocol

INSTALLATION AND CERTIFICATION PROTOCOL

Introduction

EPA has developed CEMS performance specifications for all stack emissions that will be regulated regardless of whether or not a demonstrated CEMS currently exists. The decision to require particulate matter and total mercury CEMS is based on the availability of instruments and EPA's assessment that monitoring using these instruments is feasible pending the outcome of demonstration tests.

In general, the performance specifications that have been developed have (for the purposes of consistency) followed the general form and requirements of 40 CFR part 60, Appendix B, Performance Specification 2 for SO_2 and NO_x CEMS (PS 2). In fact, PS 2 has been used as a standard for what is in general the minimum performance acceptable by a CEMS for compliance purposes. These performance specifications contain specifications and test procedures for calibration and zero drift, calibration error (where applicable), interference tests (where applicable), relative accuracy, and response time. Recommendations for location are also included.

All the performance specifications contain a requirement that the CEMS sample continuously and have a response time less than or equal to two minutes. This is the current requirement under the BIF rule, and it was also adopted in the new rule and performance specifications because hazardous waste burning facilities are characterized by transient changes in their emissions due to the variability of the feed. The objective of this requirement is to ensure the CEMS can track these emission transients. In the case of batch CEMS, this requirement is waived and the following requirements apply. Sampling time must be no longer than one-third of the averaging time. This allows three or more measurements per sampling period, thus providing some warning of an impending violation and allowing time for corrective action to be taken. A maximum delay of one hour for analysis of the sample is allowed, and the pause in sampling between exchange of sampling media must be less than five percent of the averaging period or five minutes, whichever is smaller.

A calibration of the particulate CEMS against manual gravimetric measurements is required, the statistical treatment of the calibration data is specified, and minimum requirements on the quality of the calibration relation are set. These requirements are roughly equivalent to a relative accuracy of 20%. Calibration and zero drift are specified as less than 2% of the emissions limit, and span is required to be at least three times the emissions limit. Because the particulate matter properties that define the CEMS response may change as operating and load conditions change, the range of validity of the calibration is limited to the particulate matter load range over which the calibration was carried out. Further, recalibration is required if facility operation or hardware is changed.

Installation

Per the Consent Decree, Chemetco is required to install mass monitors pursuant to installation requirements found in Section 5 of ISO 10155:1995(E) (with the exception that the particulate matter reference measurement method to be used should be Reference Method 5, Appendix A, 40 CFR Part 60 instead of ISO 9096) and will install the flow monitors pursuant to installation requirements found in Section 1.2.1 of Appendix A, 40 CFR Part 75 within 60 days of plan approval. If CPMMS requiring heated bypass duct systems for proper sampling and processing of wet, aerosol-laden exhaust gases are used, the installation and certification schedule shall be extended an additional 60 days to provide for design and engineering of those bypass systems.

Thirty days after Chemetco installs and begins operation of its CPMMS, Chemetco will conduct and complete tests to demonstrate that the Mass Monitor conforms to the performance characteristics and test specifications found in the international standard for the automated monitoring of the mass concentration of particulate matter in stationary source gas streams, ISO 10155:1995 (E). Chemetco will conduct and complete tests to demonstrate that the installed Flow Monitor conforms to performance characteristics and test specifications found in the 40 CFR Part 75 Appendix A, Sections 2.1.4, 2.2.2, 6.3.2, 6.5.2, 6.5.8, 6.5.10, 7.2.2, and 7.3.

NPN Environmental will test each CPMMS to demonstrate conformance with certification requirements.

Each CPMMS will be tested to demonstrate conformance with the response time, zero drift, span, span drift, and calibration specifications found in Section 6 of ISO 10155:1995(E) using the test procedures in Section 7.

During the mass monitor calibration test, at least nine sets of particulate concentration measurements for each CPMMS (each set a minimum of one-hour duration) will be collected. At least three sets of such data will reflect a combination of furnace modes within a process emission unit associated with low emission rates, at least three sets of data will reflect a combination of furnace modes within a process emission unit associated with intermediate emission rates, and at least three sets of data will reflect a combination of furnace modes within a process emission unit associated with high emission rates.

The flow monitor in each CPMMS will be tested to demonstrate conformance with the calibration error specification (less than or equal to 3.0 percent of span) using the test procedures in Sections 6.3.2 and 7.2.2. of 40 CFR Part 75 Appendix A. The span of the flow monitor shall be 125 percent of either the maximum potential velocity or maximum potential flow (scfh –wet basis) in the monitored stack. The flow monitor in each CPMMS will be tested to demonstrate conformance with the relative accuracy specification (15 percent) using the test procedures in Sections 6.5.2, 6.5.4, 6.5.8I, 6.5.9, and 6.5.10.

Chemetco will perform a daily calibration error test and interference check on the flow monitor (40 CFR Part 75, Appendix A, Sections 2.2.2.1 and 2.2.2.2, respectively). Chemetco will also perform a daily zero and span drift check on the mass monitor (ISO 10155:1995 (E) Section 7.3.3). Corrective actions or adjustments are required on the monitors if calibration error, drift values, or accumulated automatic adjustments exceed six percent of the span or interference is detected.

Certification testing will be carried out to assess whether or not performance specifications for reproducibility, drift, and accuracy are met under actual field conditions and to assess the long-term endurance and maintenance requirements of the CEMS. Some of the performance specifications are:

1) Zero point drift of <2% over the maintenance interval.

2) Sensitivity drift (as determined by an internal calibration) of <2% over the maintenance interval.

3) Automatic corrections to the reference point to account for the build-up of dirt on the optics are limited to 6%. At that point, an alarm must be given and the instrument serviced. The time it takes to reach this situation determines the maintenance interval and is a function of the effectiveness of the purge system.

4) Data availability must be greater than 90%.

Items 1 and 2 are analogous to the zero and calibration drift requirements required by the EPA in the performance specifications set forth in 40 CFR part 60, Appendix B. Items 3 and 4 are analogous to the data quality assurance requirements for zero and calibration drift and data availability set forth in 40 CFR part 60, Appendix F.

In general, satisfactory performance must be demonstrated at each CPMMS. A statistical correlation between the CPMMS measurement and particulate matter loading must be demonstrated. The CEM's regulations also require that scale and zero checks be performed at least once per maintenance interval, although they may be performed more frequently. The maintenance interval is determined by the manufacturer during testing.

Certification Protocol

At each stack where a monitor is installed, a calibration against the manual reference method must be performed and checked every three to five years. The calibration is used to establish a linear correlation between the instrument response and particulate matter mass loading. The calibration relation is only considered valid for the range of particulate matter loadings over which the calibration is performed, thus it is preferred to calibrate over a particulate matter range spanning approximately one-half to two times the emission standard. Natural plant variability provides sufficient variation in

particulate matter loading to obtain a calibration. A calibration is performed by making simultaneous manual measurements. Fifteen to 20 measurements are made (a minimum of 9 is required) in a network that provides spatial coverage of the duct. Typically one-hour samples are obtained and for comparison, CEMS measurements are integrated over the manual method sampling period.

For Chemetco's operation, low-range emissions can be obtained through triplicate 60-minute Method 5 runs during the latter portion of a heat cycle, mid-range emissions can be obtained through triplicate 60-minute runs during the mid portion of a heat cycle, and high-range emissions (span) can be obtained through triplicate 60-minute runs during the start of the heat cycle. All samples will be collected in replicate. Due to the difficulty of replicate triplicate sample runs, only one CPMMS will be tested initially. Upon determination of correlation status, the other three units can then be tested.

An initial certification test will be conducted within 30 days of initial startup of each CPMMS, and a second certification test will be conducted within 90 days of initial verification test for each CPMMS. Additionally, verification testing of the CPMMS systems should be performed at the first anniversary of the CPMMS startup, then as required by regulatory guidance.

Instrument availability is required to be >90 percent. It is further required that there be at least 20 minutes of valid measurements for each CPMMS per half-hour averaging period. The measurement range of the instrument should be from 10 percent of the emission limit to 2.5 times the emission limit (full scale). Upon installation, the CEMS must be calibrated against manual gravimetric measurements. Periodic recalibration is required at 3 to 5 year intervals depending on the type of facility. The uncertainty of the calibration relation (taken at the emission limit) gives the maximum measured value that is allowed (emission limit plus uncertainty). This value is determined for daily and hourly averages as well as single data points.

The calibration of particulate matter CEMS over a range of plant and APCD operating conditions allows a fit to a range of data that covers differing particulate matter properties and size distributions. The resulting correlation will have larger uncertainty than one derived from changes to particulate matter loading alone; this is known and taken into account by the statistical treatment of the data. For each individual type of particle, the calibration is obtained by varying loading only. A calibration obtained by varying plant parameters should result in a set of data encompassing all the points. Specific testing, calibration, and reporting procedures for the certifications can be found in the Consent Decree.

APPENDIX F

George M. von Stamwitz

ARMSTRONG TEASDALE LLP

MISSOURI | KANSAS | ILLINOIS | WASHINGTON, DC | SHANGHAI | SYDNEY

ATTORNEYS AT LAW

April 23, 2001

VIA UPS OVERNIGHT MAIL

Greg Sukys, Esq.
United States Department of Justice
Environmental Enforcement Section
1425 New York Ave., 13th Floor
Washington, DC 20005

Jeff Trevino, Esq.
USEPA, Region 5
77 W. Jackson
Chicago, Illinois 60604

RECEIVED
APR 5 2001
AIR ENFORCEMENT SECTION
U.S. EPA

Re: Chemetco - Air Consent Decree

Dear Greg and Jeff:

I am enclosing a project update from NPN Environmental on the activities over the past several months and the schedule going forward for the continuous air monitors. As you know, there has been a change in personnel at EPA and those familiar with the project have moved on. I further understand Mr. Marable recommended that the attorneys for the parties discuss the issue of schedule.

It was Chemetco's understanding that the research into, and selection of, the equipment was part of the first step and the schedule in the first submittal contained tasks for the selection of the appropriate equipment. Since Mr. Marable was not involved, he has requested confirmation that the parties contemplated a period of time for selection and testing for this unprecedented project.

We hope the enclosed brings all interested parties up to speed and sets the stage for a technical meeting at the facility to confirm we are all on the same page. If you have any questions concerning the foregoing, please do not hesitate to call.

Very truly yours,

George M. von Stamwitz

cc: Brent Marable
Kim Fock
Nick Neumann

NPN ENVIRONMENTAL

April 23, 2001
Contract C-00005.A

Mr. Kim Fock
Chemetco Inc.
P.O. Box 67
Hartford, IL 62048

Re: Project Status Report – April 2001
CPMMS Research and Implementation Project

Kim:

With all the recent activity at the facility and the tasks we have planned in the upcoming weeks, along with recent changes in regulatory contacts within the United States Environmental Protection Agency (USEPA), we felt it appropriate to provide you an overall summary and updated schedule of the *CPMMS Research and Implementation Project.*

In general, the scope of the project (developed by NPN Environmental, Chemetco, and EPRI) was based primarily on portions of Consent Decree No. 93-482-WDS entered into by Chemetco and USEPA signed into effect on January 4, 2000. Specifically, the scope of work developed and currently being implemented addresses:

1. Issues regarding USEPA's request for Chemetco to research the applicability and practicality of installing and successfully operating a Continuous Particulate Mass Monitoring System (CPMMS) on the exhaust stacks for the four furnaces; and

2. Baseline source testing to verify operation of the CPMMS system, validate an established calibration curve of the CPMMS once installed, and establish baseline operating ranges for pollution control devices.

One of the goals indicated in the Consent Decree is for the facility is to research and establish a credible emissions monitoring system for the purpose of continuously demonstrating compliance with applicable particulate emission limitations (in particular, Illinois' Process Weight Rule), as well as reduce the number of required source tests the facility must perform that would otherwise be necessary for determining "continuous compliance."

927 Horan Drive • St. Louis, MO 63026 • (636) 343-1300 • FAX (636) 343-8192 • www.npnenv.com

The scope of work being performed by NPN Environmental includes all coordination, research, and testing requirements of the proposed CPMMS system. Specifications, installation, operation, and maintenance of the pollution control devices, CPMMS system, and all other operational equipment and systems are being handled by Chemetco with the assistance of NPN Environmental. Sections of the Consent Decree not addressed as part of this project include any activities regarding the secondary particulate capture system as well as miscellaneous activities Chemetco must address throughout the facility not related to the CPMMS project or source testing of the furnace stacks.

To systematically address the requirements of the Consent Decree and facilitate their implementation, as well as meet the objectives outlined by the facility, the project team identified three significant phases of this project, including:

Phase I: Initial Applicability Research and Report
Phase II: Field Evaluation and Assessment
Phase III: Implementation and Operation

In this summary, we have provided the following documentation for each of the three phases of the project:

- Scope of work and Consent Decree requirements
- Project status of individual tasks
- Projected schedule for completion of remaining tasks

The following sections identify the activities, progress, and projected schedule for each of the three major project tasks.

PHASE I – INITIAL APPLICABILITY RESEARCH AND REPORT (COMPLETE)

Scope of Work

Anticipating the required CPMMS research report to be submitted to USEPA, two tasks were simultaneously undertaken during this phase of the project: an emissions characterization of the four furnace stacks at the facility and the initial applicability research of CPMMS technologies.

Project Status

For the purpose of evaluating potential CPMMS technologies and manufacturers, a series of emissions characterization tests was performed by NPN Environmental the weeks of

March 13 and 20, 2000. Characterization testing was completed on March 22, 2000. The testing consisted of quantifying the following pollutant concentrations and parameters on all four exhaust stacks: particulate matter, particle size distribution, nitrogen oxides, sulfur dioxide, hydrogen chloride, chlorine, moisture, dew point, temperature, and volumetric flow rate. Data generated during this testing was used to evaluate the applicability of specific CPMMS technologies and manufacturers. Based on the results of the testing, additional specific recommendations for or against particular CPMMS technologies and specific units were made.

Throughout the course of this phase of the project, evaluations of CPMMS technologies were made based on discussions between project team members and evaluations of vendor information, as well as emission data. Initially, 18 particulate mass monitoring units representing 4 major measurement technologies were identified by means of direct communication with equipment vendors, industry experts, academic experts, as well as reviewing product literature and searching the Internet. Following an initial screening process, 8 individual manufacturers were sent Request for Quotes on behalf of Chemetco. From this remaining list of technologies and manufacturers, NPN Environmental and Chemetco identified 3 viable candidates for field trials. Following review of characterization data, a decision was made on which units would likely meet operational criteria for the project.

NPN Environmental submitted a CPMMS research report to USEPA and US Department of Justice officials on May 3, 2000. This report detailed the initial findings of the CPMMS applicability research and emission characterization. As detailed in the May 2000 research report to USEPA, the three units were ranked in the order of preference by the project team as follows:

1. Peak Process Controls, Inc.
   Technology: Optical – Extractive Light Scattering
   Model: Sigrist CTNR

2. Jonas, Inc.
   Technology: Acoustic Shock
   Model: Particle Monitor

3. Altech Environment USA
   Technology: Beta Absorption
   Model: BETA 5M

The primary recommendations of this report were as follows:

1. Chemetco purchase one Peak Process Controls Sigrist CTNR unit to be installed at the Stack 3 location.

2. Upon installation and manufacturer calibration of the unit in accordance with the protocol in the Consent Decree and referenced in *Appendix E*, an initial field assessment should be performed to evaluate the performance and potential to pass the rigorous verification testing.

3. Should field assessment of the initial unit indicate the likelihood of passing verification testing, NPN Environmental should proceed with this testing. Should verification testing meet the requirements of the Consent Decree for the initial Sigrist unit, this unit should be installed on the remaining three stacks and verification testing performed on these units.

4. Should either the field assessment indicate or actual verification testing prove that the Sigrist unit cannot meet the requirements of the Consent Decree, a similar evaluation process for the remaining two CPMMS units identified as potential options for field assessment should be initiated.

Please refer to attached *Figure 1 – CPMMS Recommendations Decision Tree* (excerpted and enhanced from of our May 2000 report) illustrating these recommendations for *Phases II* and *III* of the project. Additionally, a request was made in this report to EPA to consider the current implementation schedule of the Consent Decree as it relates to the CPMMS installation and verification. As we noted, to properly specify, order, customize, install, calibrate, operate, field test, and verify a single CPMMS unit on an emission source such as a secondary smelting operation, a substantial amount of time is required to complete these tasks.

Upon submittal of this report to USEPA, *Phase I* of the project was deemed complete.

PHASE II – FIELD EVALUATION AND ASSESSMENT-STACK 3 (ONGOING)

Scope of Work

As you recall, because of the unique and varied conditions of the furnace emissions we identified in emission characterization efforts early in the project, the Sigrist CTNR particulate monitor (used in combination with the Air Monitor Corporation flow monitor) was identified in our initial report to EPA as a potentially viable CPMMS technology for

the Chemetco furnace emissions. We further recommended in our report that a single CPMMS be evaluated in field trials and assessments on a single stack (Stack 3) at the facility prior to recommendation of full installation and implementation of the CPMMS on all four stacks per the Consent Decree. The scope of work for Phase II (subsequently identified as this field evaluation and assessment) included the following tasks:

Task A – Delivery of Equipment
Task B – Flow Monitor Installation
Task C – Flow Monitor Calibration/RATA (Relative Accuracy Test Audit)
Task D – PM Monitor Installation
Task E – CEM Data System Development
Task F – PM Monitor Calibration Development
Task G – PM Monitor Initial RATA
Task H – Continuous Operation Monitoring
Task I – PM Monitor Secondary RATA
Task J – CPMMS Reporting Activities

The *Phase II* evaluation sequence for field calibration, assessment, and validation testing will be performed on the single Sigrist particulate monitor on Stack 3. Our goal is to execute reasonable means in an attempt to operate the initial unit so it meets the "credible evidence" data objectives of USEPA and this project, and so we may be able to proceed with the *Phase III* implementation and operation stage of the project.

Project Status

Because of the desire you and other operational personnel indicated in using the CPMMS as both an environmental emissions monitor and a process control device, NPN Environmental has, for the past 11 months, been implementing recommendations made to the USEPA in our research report. Because of the complexity of these recommendations and anticipated amount of time to specify, customize, install, calibrate, and operate a single CPMMS, these efforts were begun immediately following submittal of the report prior to receiving requested comments or guidance from USEPA. These efforts have included:

- Specifying and ordering the particulate and flow monitors
- Evaluating the structural integrity of all four exhaust stacks
- Performing recommended structural improvements to Stack 3
- Designing and installing a substantial monitor and testing platform on Stack 3

- Integrating the facility PLC system and data acquisition logistics for data analysis, reporting and archiving (ongoing)
- Installing pneumatic and electrical utilities for the monitoring equipment at the platform
- Installing the flow monitor probe in the stack and its support equipment on the platform

Further progress is currently being made in anticipation of completing installation of all components of the CPMMS on Stack 3. Specifically, the week of June 4, 2001 is scheduled for the Sigrist representative (Peak Process Control) to be on-site for installation of the particulate monitor. Once this is completed, calibration, assessment and verification testing of the CPMMS can begin.

Projected Schedule (2001)

Attached is our *Phase II* Projected Schedule (2001) for the remaining tasks through the end of the year. This schedule assumes timely execution of the listed tasks. The following sections further detail the status of individual *Phase II* tasks. This schedule assumes only minor delays but more importantly, assumes that both initial particulate and flow monitor technologies will not only function in this environment but also pass the rigid requirements of the relative accuracy and ISO protocols.

Task A – Delivery of Equipment

Stack upgrade and platform installation was completed in late February. The particulate and flow monitors have been delivered to the facility. This task has been completed.

Task B – Flow Monitor Installation

The Air Monitor Corporation flow monitor was purchased by Chemetco and delivered to the site on October 15, 2000. Chemetco and NPN Environmental personnel installed the unit during the week of April 9, 2001. Technical support and consulting will continue as the flow monitor is brought on-line and calibrated. Coordination between Chemetco and all CPMMS component vendors will also continue.

Task C – Flow Monitor Calibration/RATA (Relative Accuracy Test Audit)

Activity regarding this project task is scheduled for May 2001. After the installation described in *Task B*, the unit will be operated by plant personnel collecting data for approximately 30 days prior to RATA activity. Procedures detailed in 40 CFR Part 60

Appendix B Performance Specification 6 will be used to determine the relative accuracy performance of the flow monitor unit. The flow monitor can then be used to determine the particulate mass emission rates after installation of the CPMMS system. Additional flow RATAs will be performed when the initial and secondary particulate matter (PM) monitor RATAs are performed.

Task D – PM Monitor Installation

Sigrist, Chemetco, and NPN Environmental personnel are scheduled to install the PM monitor at Stack 3 location during the week of June 4, 2001. Technical support and consulting will continue as the flow monitor is installed, brought on-line, and calibrated. Coordination between Chemetco and all CPMMS component vendors will also continue.

Task E – CEM Data System Development

As with all new installations, a monitoring and data collection system and list of procedures will be developed and implemented for retrieval, recording, and storing of the collected data. The current time frame for this development follows the initial installation and precedes the PM monitor RATA scheduled for September 2001.

Task F – PM Monitor Calibration Development

The calibration curve testing referred to in the Consent Decree is currently scheduled for July 2001. A minimum of 12 PM test runs will be used to develop a curve for installation in the data recording system for accurate determination of PM emissions on a continuous basis.

Task G – PM Monitor Initial RATA

The initial RATA for the Stack 3 PM monitor is currently scheduled for September 2001. The procedures listed and referenced in the Consent Decree will be implemented to determine the relative accuracy performance of the PM monitor. An additional flow RATA will also be performed at this time.

Task H – Continuous Operation Monitoring

The time period from September to December 2001 will be used to continuously record the emission rate data for particulates required by the Consent Decree. The monitoring and data collection system and list of procedures developed and implemented for retrieval, recording, and storing of the collected data will be used on a continuous basis

for approximately 90 days prior to completion of the required secondary RATA. As noted on our research of CPMMS technologies, allowing this time period for continuous operation is critical for determining the functionality and durability of the CPMMS (both the flow monitor and PM monitor) in this environment prior to making the decision that the technology is applicable to this source.

Task I – PM Monitor Secondary RATA

The required secondary RATA (or confirmation RATA) is currently scheduled for December 2001. An additional flow RATA will also be performed at this time. The procedures listed and referenced in the Consent Decree will be implemented to determine the relative accuracy performance of the CPMMS.

Task J – CPMMS Reporting Activities

A report which summarizes and further details the completed tasks listed herein will be generated following the secondary RATA. Recommendations outlined in the May 2000 report will be made regarding the initial CPMMS performance. Recommendations may include a positive or negative determination regarding the operability and applicability of this technology at the facility. Under the current schedule, this report for all *Phase II* activities is expected to be completed by December 31, 2001.

Should the initial CPMMS technology not meet the objectives of the Consent Decree and this project, the *Phase II* report would document this negative evaluation. Per recommendations in our original *Phase I* research report, should the initial Sigrist particulate monitor not perform to the required standards after all reasonable attempts, a single unit of the second recommended particulate monitoring technology (Jonas Particle Monitor) will be evaluated on-site under the same criteria as the initial CPMMS technology. The same field calibration and validation testing sequence will be performed on the third recommended particulate technology (Altech Beta 5M), if necessary.

PHASE III – IMPLEMENTATION AND OPERATION-STACKS 1, 2, AND 4

Scope of Work

If a positive determination on the operability of this initial unit is made at the end of *Phase II* activities, our intent would be (again, per the May 2000 report) to begin efforts to procure, install, and test three additional and identical CPMMS units on the remaining three stacks. Once all units are installed and relative accuracy testing has successfully been completed, Chemetco should commence compliance activities for all operational,

recordkeeping, and periodic verification testing requirements for the CPMMS units outlined in the Consent Decree.

Project Status

Phase III of the project cannot commence until *Phase II* has been successfully completed and a positive applicability determination made from the CPMMS field evaluation and assessment.

The following section further details the status of individual *Phase III* tasks. Again, this schedule assumes only minor delays but more importantly, assumes that both initial particulate and flow monitor technologies will not only function in this environment but also pass the rigid requirements of the relative accuracy and ISO protocols.

Projected Schedule (2002)

Attached is our *Phase III* Projected Schedule (2002) for *Phase III* of the project should the initial Sigrist CPMMS technology prove to provide data in accordance with the Consent Decree. The schedule assumes timely execution of the listed tasks.

The earliest anticipated order date for the remaining three units is January 2002. A schedule similar to the 2001 schedule will then need to be implemented for the 2002 calendar year for the additional three CPMMS units, provided **both** components of the CPMMS system function properly and all data quality objectives of the Consent Decree are met. This schedule includes ordering the equipment in January 2002 with anticipated delivery in April 2002. During this time, Chemetco will need to make appropriate alterations to the remaining three stacks in preparation for installation of the three new units. Once the systems are installed, operability issues will be addressed and calibrations performed prior to an initial relative accuracy test, a continuous operations monitoring period and finally, a second relative accuracy test of each CPMMS. Provided delivery, installation, and testing of additional CPMMS proceed with only minor delays and minimal problems, the earliest date to completely implement installation of four operable CPMMSs at Chemetco per our plan is December 2002.

COMMENTS

To reiterate, this systematic evaluation of CPMMS technologies was described (verbally and graphically) in the accepted May 2000 report. This schedule, although seemingly extended, is fairly aggressive and assumes the initial chosen technologies (flow and PM) will operate well in the stack environments. If between now and the two scheduled

RATA tests for the initial CPMMS (September and December 2001), we determine that either or both initial technologies of the CPMMS do not adequately meet the requirements of the Consent Decree, a concerted effort will be required to re-evaluate the schedule based on proceeding with evaluation of a second CPMMS technology.

If you have any questions regarding the status of any of our tasks or the proposed schedule, please contact me at 636-343-1300. I look forward to continuing the efforts and progress we have made thus far on this project.

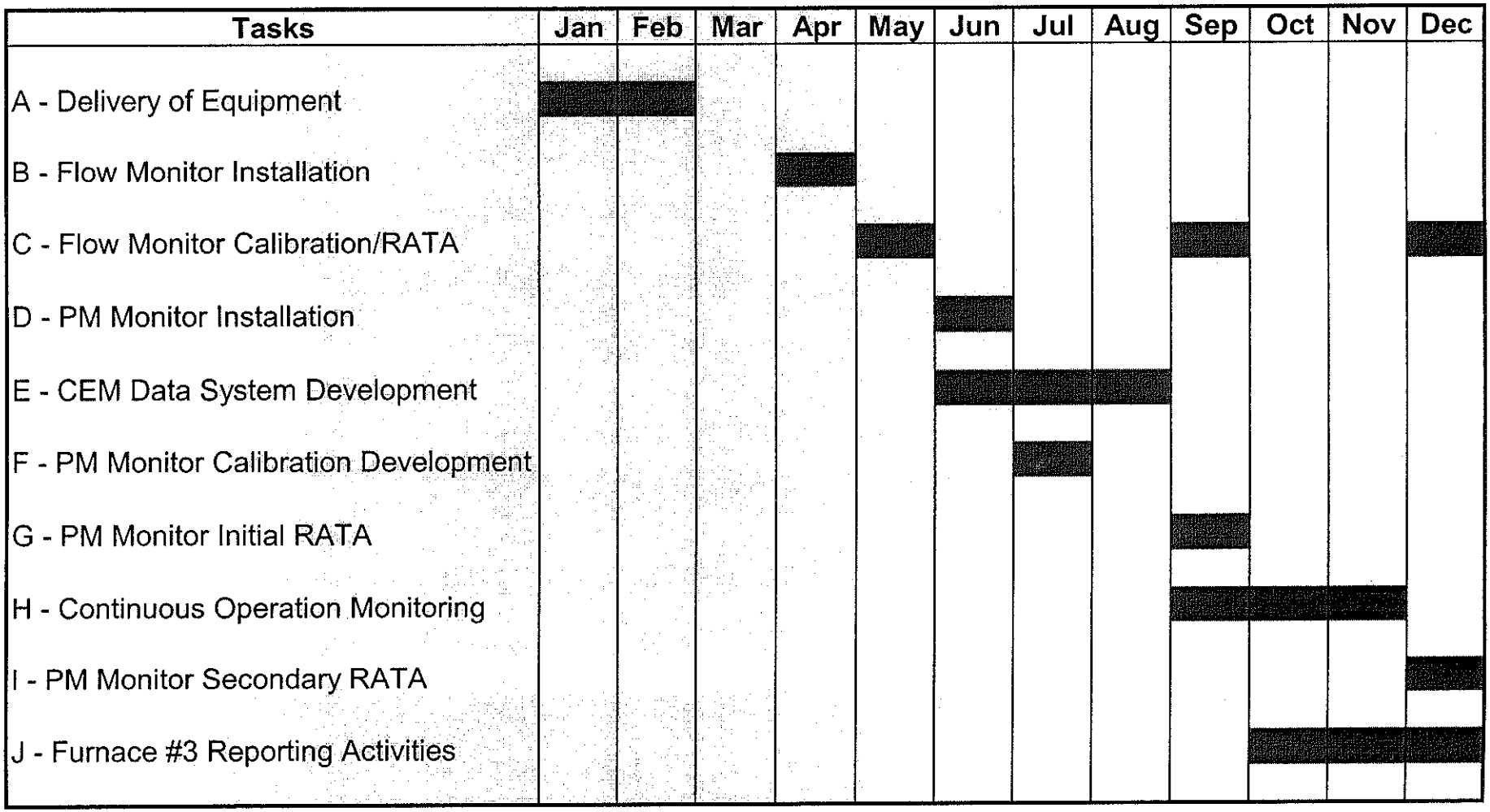
Sincerely,

Nicolaus P. Neumann, P.E., RG, DEE
Principal

Enclosures (3) *Phase II* Projected Schedule (2001)
Phase III Projected Schedule (2002)
Figure 1 – CPMMS Recommendations Decision Tree

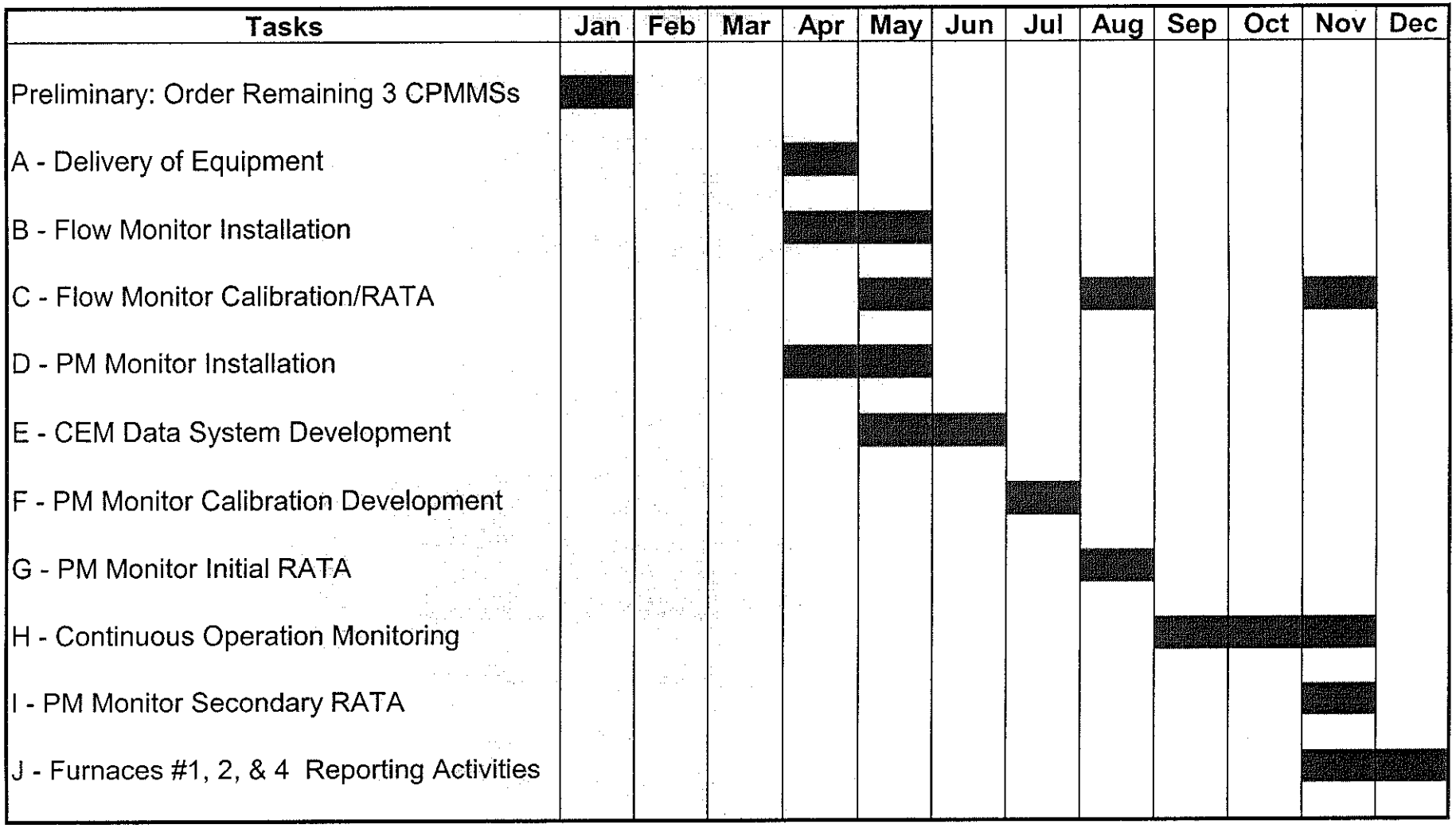
c: George von Stamwitz (Armstrong Teasdale)
Mike Wilkening (Chemetco)
Heather Young (Chemetco)
Ray Ehrhard (EPRI)

EPRI/Chemetco - Air Pollution Control Evaluation
Phase II - Projected Schedule (2001)
Stack 3



Note: RATA = Relative Accuracy Test Audit

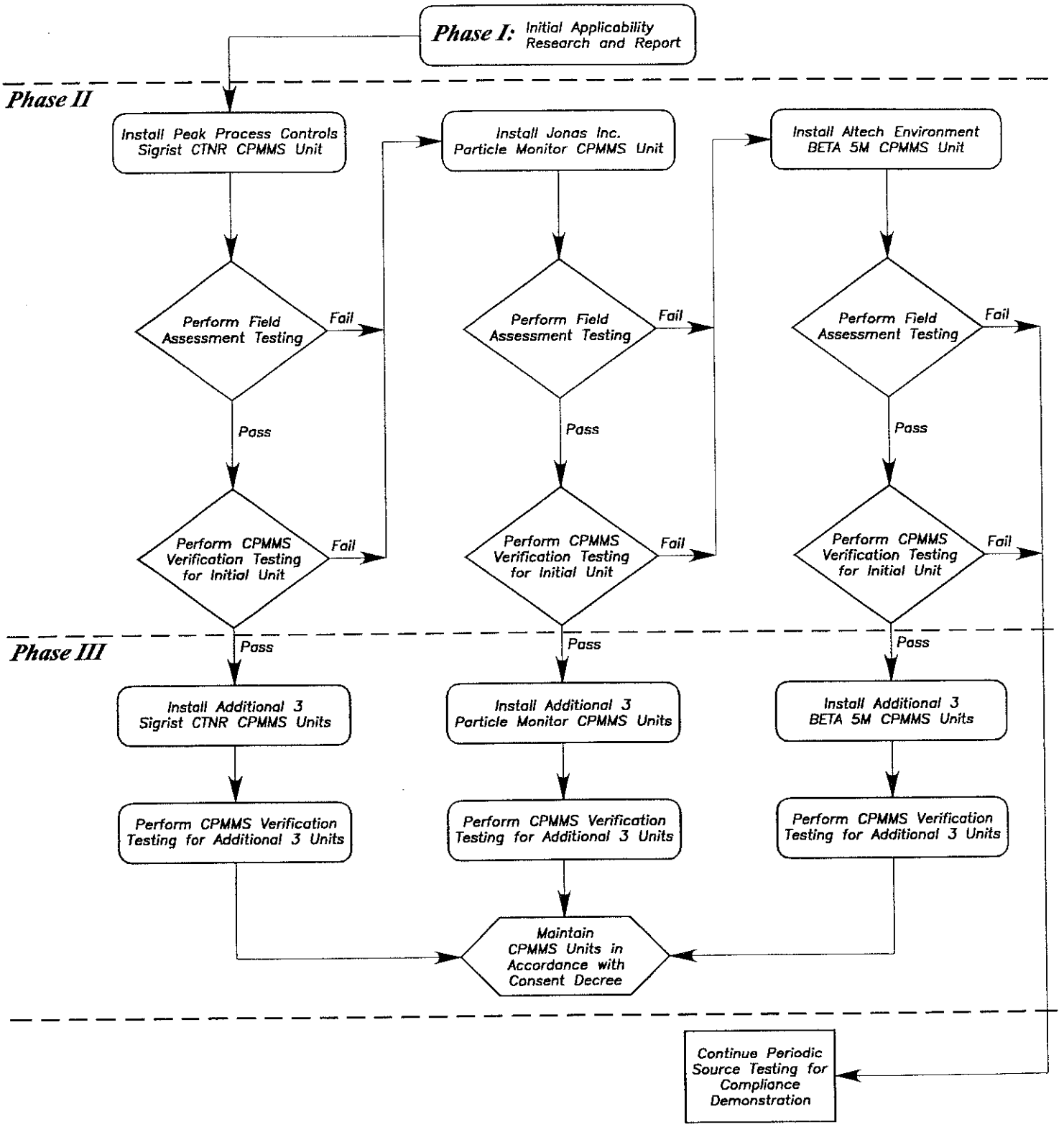
EPRI/Chemetco - CPMMS Research and Implementation Project
Phase III - Projected Schedule (2002)
Stacks 1, 2, & 4



Note: RATA = Relative Accuracy Test Audit

Schedule assumes positive recommendation for both components of initial CPMMS installed and three identical units will subsequently be installed.

FIGURE 1
CPMMS Recommendations
Decision Tree



NPN ENVIRONMENTAL

June 11, 2001
Contract C-00005

VIA OVERNIGHT DELIVERY

RECEIVED
JUN 12 2001 ETS/VB
AIR ENFORCEMENT BRANCH
U.S. EPA, REGION 5

Mr. Brent Marable, Chief
Air Enforcement and Compliance Assurance Section
USEPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Project Status Report
Chemetco Consent Decree No. 93-482-WDS

Brent:

On behalf of Chemetco Inc., I am enclosing the Project Status Report for May 2001 regarding activities associated with the CPMMS research and implementation. Additionally, significant activity associated with Phase II – Field Evaluation and Assessment is planned and will be implemented in June and July 2001.

Specifically, installation of the PM monitor at Stack 3 was completed last week. The flow monitor calibration and initial relative accuracy test audit (RATA) is scheduled for the week of June 11, 2001. During the flow monitor RATA, the PM monitor will be brought on-line for continuous operation. During the next 30 days, drift and linearity checks will be performed on the PM monitor. Source sampling for calibration curve development of the PM monitor will be conducted during the weeks of July 9 and 16.

I will continue to provide you with project status reports on a monthly basis and at significant and timely stages of this project. If you or your staff has interest in visiting the site during any of the upcoming field evaluation and assessment activities, please advise us. Additionally, we look forward to meeting with you and your staff to discuss CPMMS research and implementation status. If you have any questions, please contact me at 636-343-1300.

Sincerely,

Nicolaus P. Neumann

Nicolaus P. Neumann, P.E., R.G., DEE
Project Principal

Enclosure
c: Jeff Trevino (USEPA Region 5) w/enclosure
George von Stamwitz (Armstrong Teasdale) w/enclosure
Kim Fock (Chemetco) w/o enclosure

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FILE COPY

NPN ENVIRONMENTAL

May 25, 2001
Contract C-00005.A

Mr. Kim Fock
Chemetco Inc.
P.O. Box 67
Hartford, IL 62048

RE: Project Status Report – May 2001
CPMMS Research and Implementation Project

Kim:

The following is a report on the status and anticipated schedule for the *CPMMS Research and Implementation Project.* As we have addressed in the past, the project team has divided the project into three significant phases, including:

Phase I: Initial Applicability Research and Report (Completed)
Phase II: Field Evaluation and Assessment (Ongoing)
Phase III: Implementation and Operation (Future)

In this summary, we have provided the following documentation for the ongoing *Phase II* tasks of the field evaluation and assessment of the components of the CPMMS:

- Scope of work and Consent Decree requirements
- Project status of individual tasks
- Projected schedule for completion of remaining tasks

As *Phase I* of the project is complete and no activities have occurred which would have impacted the scope of work or schedule for *Phase III* implementation and operation of the CPMMS, only the following *Phase II* tasks are addressed in this status report.

PHASE II – FIELD EVALUATION AND ASSESSMENT-STACK 3 (ONGOING)

Scope of Work

As a review, the scope of work for *Phase II* (initial CPMMS field evaluation and assessment) included the following tasks:

Task	Scope	Status
A	Delivery of Equipment	Complete
B	Flow Monitor Installation	Complete
C	Flow Monitor Calibration/RATA	Future (June 2001)
D	PM Monitor Installation	Ongoing (May/June 2001)
E	CEM Data System Development	Future (Sept. 2001)
F	PM CEM Calibration Development	Future (July 2001)
G	PM CEM Initial RATA	Future (Sept. 2001)
H	Continuous Operation Monitoring	Future (Sept.-Dec. 2001)
I	PM CEM Secondary RATA	Future (Dec. 2001)
J	CPMMS Reporting Activities	Future (Dec. 2001)

The *Phase II* evaluation sequence for field calibration, assessment, and validation testing will be performed on the single Sigrist particulate monitor on Stack 3. Our goal is to execute reasonable means in an attempt to operate the initial unit so it meets the "credible evidence" data objectives of USEPA and this project and so we may be able to proceed with the *Phase III* implementation and operation stage of the project.

Project Status

The following efforts in the past month have included:

- Coordinating with Sigrist regarding installation of the particulate matter continuous emissions monitor (PM CEM) scheduled to occur during the week of June 4, 2001
- Developing a schedule and procedures for installation, initial calibration, and calibration curve development of the PM CEM

Projected Schedule (2001)

Again, I have attached the *Phase II* Projected Schedule (2001) for the remaining tasks through the end of the year. This schedule assumes timely execution of the listed tasks. The following sections further detail the status of individual *Phase II* tasks. The schedule assumes only minor delays but more importantly, assumes that both initial particulate and flow monitor technologies will not only function in this environment but also pass the rigid requirements of the relative accuracy and ISO protocols.

Task A – Delivery of Equipment

This task has been completed.

Task B – Flow Monitor Installation

Chemetco and NPN Environmental personnel installed the unit during the week of April 9, 2001. Technical support and consulting will continue as the flow monitor is brought on-line and calibrated. Coordination between Chemetco and all CPMMS component vendors will also continue.

Task C – Flow Monitor Calibration/RATA (Relative Accuracy Test Audit)

Activity regarding this project task is scheduled for the week of June 11, 2001. Procedures detailed in 40 CFR Part 60 Appendix B Performance Specification 6 will be used to determine the relative accuracy performance of the flow monitor unit. The flow monitor can then be used in part to determine the particulate mass emission rates after installation of the PM CEM system. Additional flow RATAs will be performed when the initial and secondary particulate matter (PM) monitor RATAs are performed.

Task D – PM Monitor Installation

Sigrist, Chemetco, and NPN Environmental personnel are scheduled to install the PM monitor at the Stack 3 location during the week of June 4, 2001. Technical support and consulting will continue as the flow monitor is installed, brought on-line, and calibrated. Coordination between Chemetco and all CPMMS component vendors will also continue.

No significant changes in the status or schedule for *Tasks E – J* have been made or are currently anticipated.

COMMENTS

To reiterate, this systematic evaluation of CPMMS technologies was described (verbally and graphically) in the accepted May 2000 report. This schedule, although seemingly extended, is fairly aggressive and assumes the initial chosen technologies (flow and PM) will operate well in the stack environments. If between now and the two scheduled RATA/verification tests for the initial CPMMS (September and December 2001), we determine that either or both initial technologies of the CPMMS do not adequately meet the requirements of the Consent Decree, a concerted effort will be required to re-evaluate the schedule based on proceeding with evaluation of a second CPMMS technology.

If you have any questions regarding the status of any of our tasks or the proposed schedule, please contact me at 636-343-1300. I look forward to continuing the efforts and progress we have made thus far on this project.

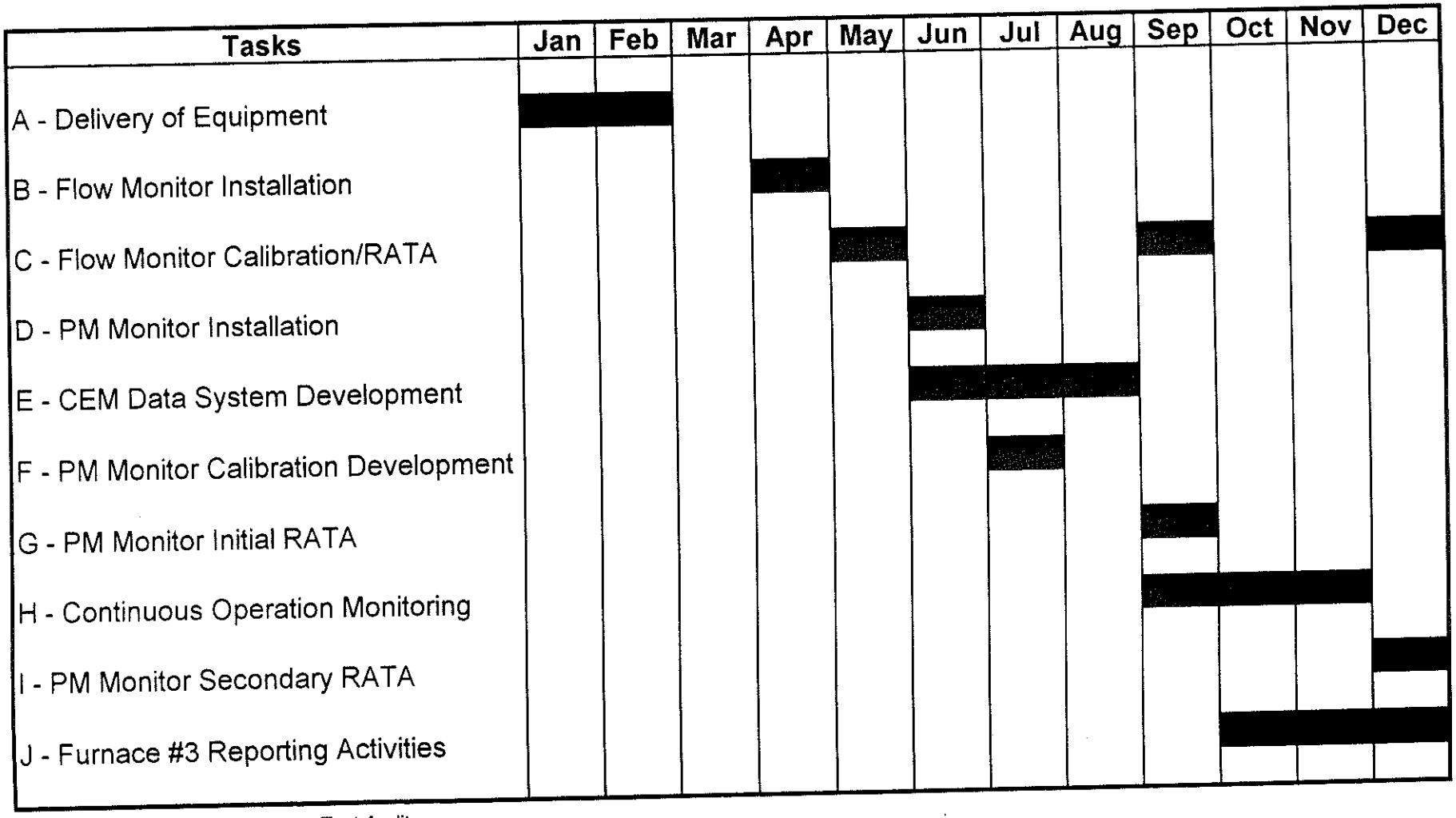
Sincerely,

Nicolaus P. Neumann, P.E., RG, DEE
Principal

Enclosure *Phase II* Projected Schedule (2001)

c: George von Stamwitz (Armstrong Teasdale)
Mike Wilkening (Chemetco)
Heather Young (Chemetco)
Ray Ehrhard (EPRI)

EPRI/Chemetco - Air Pollution Control Evaluation
Phase II - Projected Schedule (2001)
Stack 3



Note: RATA = Relative Accuracy Test Audit

NPN ENVIRONMENTAL

July 24, 2001
Contract C-00005

RECEIVED
JUL 26 2001
AIR ENFORCEMENT BRANCH
U.S. EPA, REGION 5

Mr. Brent Marable, Chief
Air Enforcement and Compliance Assurance Section
USEPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Project Schedule Change
Chemetco Consent Decree No. 93-482-WDS

Brent:

On behalf of Chemetco Inc., I am providing you with notice of a recent occurrence which has caused us to somewhat modify our calibration and testing schedule. Specifically, the operation of the PM CEM has proceeded smoothly with one exception. During the course of evaluating the unit's performance, a malfunction was noted in the purge air blower which supplies crucial clean air to the unit. After several conversations with the manufacturer's representative and field evaluations of the blower, the decision was made to simply replace the blower. The unit was rush shipped from Switzerland and installed by NPN Environmental representatives. The unit was subsequently brought back online July 16, 2001 and has been under surveillance since.

Currently, the unit is operating properly and as expected. Continued calibration evaluations and surveillance of the PM CEM are continuing. The previously scheduled calibration curve development of the PM CEM using reference Method 5 procedures has been tentatively rescheduled for August 1 through 9, 2001, provided the unit continues to perform properly.

As in the past, I will continue to provide you with project status reports on a monthly basis and at significant and timely stages of this project. Our next monthly project status report should be complete within the next week. As always, if you or your staff has interest in visiting the site during any of the upcoming field evaluation and assessment activities, please advise us. Additionally, we look forward to meeting with you and your staff to discuss CPMMS research and implementation status. If you have any questions, please contact me at 636-343-1300.

Sincerely,

Nicolaus P. Neumann, P.E., R.G., DEE
Project Principal

c: Jeff Trevino (USEPA Region 5)
George von Stamwitz (Armstrong Teasdale)
Kim Fock (Chemetco)

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NPN ENVIRONMENTAL

June 29, 2001
Contract C-00005

RECEIVED
JUL 03 2001
AIR ENFORCEMENT BRANCH
U.S. EPA, REGION 5

Mr. Brent Marable, Chief
Air Enforcement and Compliance Assurance Section
USEPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Project Status Report
Chemetco Consent Decree No. 93-482-WDS

Brent:

On behalf of Chemetco Inc., I am enclosing the Project Status Report for June 2001 regarding activities associated with the CPMMS research and implementation. Additionally, significant activity associated with Phase II – Field Evaluation and Assessment is planned and will be implemented in July and throughout the remaining portion of 2001.

Specifically, installation of the PM monitor at Stack 3 was completed on June 5 and 6 with the PM CEM brought online on June 15. Calibration and operational checks will be ongoing during the 30-day shakedown period with source sampling for initial PM CEM calibration curve development scheduled during the weeks of July 9 and 16. Regarding the Flow CEM, initial calibration procedures were performed on June 13 and 14. Calibration and operational checks of the Flow CEM will be ongoing during PM CEM assessment activities.

I will continue to provide you with project status reports on a monthly basis and at significant and timely stages of this project. If you or your staff has interest in visiting the site during any of the upcoming field evaluation and assessment activities, please advise us. Additionally, we look forward to meeting with you and your staff to discuss CPMMS research and implementation status. If you have any questions, please contact me at 636-343-1300.

Sincerely,

Nicolaus P. Neumann, P.E., R.G., DEE
Project Principal

Enclosure
c: Jeff Trevino (USEPA Region 5) w/enclosure
George von Stamwitz (Armstrong Teasdale) w/enclosure
Kim Fock (Chemetco) w/o enclosure

NPN ENVIRONMENTAL

June 25, 2001
Contract C-00005.A

Mr. Kim Fock
Chemetco Inc.
P.O. Box 67
Hartford, IL 62048

RE: Project Status Report – June 2001
CPMMS Research and Implementation Project

Kim:

The following is a report on the status and anticipated schedule for the *CPMMS Research and Implementation Project*. As we have addressed in the past, the project team has divided the project into three significant phases, including:

Phase I: Initial Applicability Research and Report (Completed)
Phase II: Field Evaluation and Assessment (Ongoing)
Phase III: Implementation and Operation (Future)

In this summary, we have provided the following documentation for the ongoing *Phase II* tasks of the field evaluation and assessment of the CPMMS components:

- Scope of work and Consent Decree requirements
- Project status of individual tasks
- Projected schedule for completion of remaining tasks

As *Phase I* of the project is complete and no activities have occurred which would have impacted the scope of work or schedule for *Phase III* implementation and operation of the CPMMS, only the following *Phase II* tasks are addressed in this status report.

PHASE II – FIELD EVALUATION AND ASSESSMENT-STACK 3 (ONGOING)

Scope of Work

As a review, the scope of work for *Phase II* (initial CPMMS field evaluation and assessment) included the following tasks:

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Task	Scope	Status
A	Delivery of Equipment	Complete
B	Flow Monitor Installation	Complete
C	Flow Monitor Calibration	Complete
D	PM Monitor Installation	Complete
E	CEM Data System Development	Future (Sept. 2001)
F	PM CEM Calibration Development	Future (July 2001)
G	PM/Flow CEM Initial RATAs	Future (Sept. 2001)
H	Continuous Operation Monitoring	Future (Sept.-Dec. 2001)
I	PM/Flow CEM Secondary RATAs	Future (Dec. 2001)
J	CPMMS Reporting Activities	Future (Dec. 2001)

The *Phase II* evaluation sequence for field calibration, assessment, and validation testing will be performed on the single Sigrist particulate monitor on Stack 3. Our goal is to execute reasonable means in an attempt to operate the initial unit so it meets the "credible evidence" data objectives of USEPA and this project and so we may be able to proceed with the *Phase III* implementation and operation stage of the project.

Project Status

The following efforts in the past month have included:

- Primary components of the particulate matter (PM) CEM were installed on Stack 3 on June 5 and 6. Initial operation of the unit occurred on June 7. Continuous operation of the unit did not commence at this time as support and sheltering equipment had yet to be installed. Installation of the remaining support and shelter equipment was completed on June 14.

- The unit was brought on line on June 15. An initial zero and span calibration was performed on the unit on this day and the intended 30-day shakedown period commenced.

- A calibration and operational check of the PM and flow CEMs was performed on June 21. All parameters of the flow unit were operational except the blowback system. It was noted that the valve (exterior to the unit) supplying plant air to the unit was closed. Once the valve was opened, the blowback system was operational. Two issues were noted upon evaluation of the PM CEM. The span value of the unit calibration exceeded the allowed tolerance for auto calibration. The unit was then

manually calibrated. Additionally, it was noticed the purge air blower was not running. The unit was manually restarted and the purge air blower started. Calibration procedures next week will allow for a possible adjustment to the internal calibration based on this occurrence. It is likely the purge air blower affected the span calibration.

- Initial calibration procedures for the flow CEM were performed on June 13 and 14. These tests and observations were designed to configure the flow CEM by calculating a K-factor for the unit, ensure instrument data matched the data calculation spreadsheet, report ACFM values to match PM CEM reporting parameters, and ensure reasonable operations and data when the relative accuracy is performed. All these goals were accomplished.

- Initial versions of data recording macros have been written and are planned to be installed into the data recording spreadsheet prior to calibration curve development and relative accuracy testing.

Projected Schedule (2001)

This schedule assumes timely execution of the listed tasks. The following sections further detail the status of individual *Phase II* tasks. The schedule assumes only minor delays but more importantly, assumes that both initial particulate and flow monitor technologies will not only function in this environment but also pass the rigid requirements of the relative accuracy and ISO protocols.

Task A – Delivery of Equipment

This task has been completed.

Task B – Flow Monitor Installation

This task has been completed.

Task C – Flow Monitor Calibration

The initial tests performed on the flow CEM (June 13 and 14) were performed to accomplish the aforementioned tasks. Flow RATAs will be performed when the initial and secondary PM monitor RATAs are performed.

Task D – PM Monitor Installation

Sigrist, Chemetco, and NPN Environmental personnel installed the PM CEM at the Stack 3 location on June 5 and 6. Technical support and consulting will continue during the shakedown and correlation test planning periods. Coordination between Chemetco and all CPMMS component vendors will also continue.

No significant changes in the status or schedule for *Tasks E – J* have been made or are currently anticipated.

COMMENTS

We are continuing to make observations regarding the operability and durability of the CPMMS components. To reiterate, this systematic evaluation of CPMMS technologies was described (verbally and graphically) in the accepted May 2000 report. Currently, all equipment is operational and functioning adequately. As we stated in past correspondence, if between now and the two scheduled RATA/verification tests for the initial CPMMS (September and December 2001) we determine that either or both initial technologies of the CPMMS do not adequately meet the requirements of the Consent Decree, a concerted effort will be required to re-evaluate the schedule based on proceeding with evaluation of a second CPMMS technology.

If you have any questions regarding the status of any of our tasks or the proposed schedule, please contact me at 636-343-1300. I look forward to continuing the efforts and progress we have made thus far on this project.

Sincerely,

Nicolaus P. Neumann, P.E., RG, DEE
Principal

c: George von Stamwitz (Armstrong Teasdale)
Greg Cotter (Chemetco)
Heather Young (Chemetco)
Ray Ehrhard (EPRI)

NPN ENVIRONMENTAL

July 31, 2001
Contract C-00005

RECEIVED
AUG 0 6 2001
AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

Mr. Brent Marable, Chief
Air Enforcement and Compliance Assurance Section
USEPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Project Status Report
Chemetco Consent Decree No. 93-482-WDS

Brent:

On behalf of Chemetco Inc., I am enclosing the Project Status Report for July 2001 regarding activities associated with the CPMMS research and implementation. Additionally, significant activity associated with Phase II – Field Evaluation and Assessment is planned and will be implemented in August and throughout the remaining portion of 2001.

Per my letter dated July 24, 2001, the purge air blower of the PM CEM was determined not to be operating correctly, therefore was replaced and brought back on-line on July 16, 2001. The PM CEM is currently operating properly and is under ongoing evaluation and surveillance. The calibration curve development of the PM CEM using reference Method 5 procedures is on schedule to commence August 1 through 9, 2001. Additionally, a temporary data acquisition system has been developed, tested, and is in-place. Once relative accuracy testing has been successfully conducted, data acquisition and calculations will be integrated into Chemetco's PLC system to record actual particulate mass emissions.

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I will continue to provide you with project status reports on a monthly basis and at significant and timely stages of this project. If you or your staff has interest in visiting the site during any of the upcoming field evaluation and assessment activities, please advise us. Additionally, we look forward to meeting with you and your staff to discuss CPMMS research and implementation status. If you have any questions, please contact me at 636-343-1300.

Sincerely,

Nicolaus P. Neumann, P.E., R.G., DEE
Project Principal

Enclosure
c: Jeff Trevino (USEPA Region 5) w/enclosure
George von Stamwitz (Armstrong Teasdale) w/enclosure
Kim Fock (Chemetco) w/o enclosure

8-7-01

EPA
U.S. Environmental Protection Agency
Region 5 - Air and Radiation Division

Enforcement Activity Tracking System

Milestone Status: Assigned to Staff for Evaluation
Enforcement Activity: Consent Decree
Date Issued: 01/04/2000

Company Name: **CHEMETCO, INC.**
Street Address: RT. 3 AND CHEMETCO LANE
City, State, Zip Code: HARTFORD, IL 62048

Technical Contact: Brent Marable/R5/USEPA/US
Attorney: Jeffery Trevino

Milestone(s):

Submit assessment of remainder of secondary capture system, specifically of baghouse and duct work.

Extension Requested?	Date Due:	Date Completed/Received:
	04/30/2001	08/06/2001
○ Yes ● No		
○ Yes ● No		

Incoming Response:

Date Assigned to Engineer/Scientist: 08/07/2001

Evaluation Due: 08/22/2001

Evaluation Completed:

Compliance Determination:

Next Step:

Attachment(s):

NPN ENVIRONMENTAL

August 29, 2001
Contract C-00005.A

Mr. Kim Fock
Chemetco Inc.
P.O. Box 67
Hartford, IL 62048

RE: Project Status Report – August 2001
CPMMS Research and Implementation Project

Kim:

The following is a report on the status and anticipated schedule for the *CPMMS Research and Implementation Project*. In this summary, we have provided the following documentation for the ongoing *Phase II* tasks of the field evaluation and assessment of the CPMMS components:

- Scope of work and Consent Decree requirements
- Project status of individual tasks
- Projected schedule for completion of remaining tasks

As *Phase I* of the project is complete and no activities have occurred which would have impacted the scope of work or schedule for *Phase III* implementation and operation of the CPMMS, only the following *Phase II* tasks are addressed in this status report.

PHASE II – FIELD EVALUATION AND ASSESSMENT-STACK 3 (ONGOING)

Scope of Work

As a review, the scope of work for *Phase II* (initial CPMMS field evaluation and assessment) included the following tasks:

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Task	Scope	Status
A	Delivery of Equipment	Complete
B	Flow Monitor Installation	Complete
C	Flow Monitor Calibration	Complete
D	PM Monitor Installation	Complete
E	CEM Data System Development	Ongoing
F	PM CEM Calibration Development	Complete
G	PM/Flow CEM Initial RATAs	Future (October 2001)
H	Continuous Operation Monitoring	Future (Oct. 2001-Jan. 2002)
I	PM/Flow CEM Secondary RATAs	Future (January 2002)
J	CPMMS Reporting Activities	Future (January 2002)

The *Phase II* evaluation sequence for field calibration, assessment, and validation testing is being performed on the single Sigrist particulate monitor on Stack 3. Our goal is to execute reasonable means in an attempt to operate the initial unit so it meets the "credible evidence" data objectives of USEPA and this project and so we may be able to proceed with the *Phase III* implementation and operation stage of the project.

Project Status

The following efforts in the past month have included:

Task E – CEM Data System Development

The temporary data acquisition system is in-place and was operational for the calibration curve testing. Future efforts will include full integration into the facility's PLC system.

Task F – PM CEM Calibration Development

The initial calibration of the PM CEM has been completed. Calibration testing was conducted on the following days: August 3, 6, 7, 16, and 17, 2001. Initial data reduction from the Reference Method 5 testing and unadjusted PM CEM milliamp output has been completed. An initial correlation of the data sets indicates a correlation of 0.79. Final QA/QC checks of the data are currently being performed. Two of the 15 data points collected were identified as outliers and discarded from the analysis because their values were so far skewed from the set, they were easily considered not reasonable values. Further analysis of the data, filters, and operational data may reveal the cause of these outliers; nevertheless, they are not being considered as part of the data set.

Dates and times of the individual runs have been provided to Greg Cotter who is gathering operational data on the various charges and conditions of the pollution control devices. This information is critical in documenting the range of conditions of the furnaces and control devices during the calibration curve development.

As we have discussed, this testing was designed to establish a "calibration curve" for the PM CEM. This calibration will be applied to the data acquisition system to condition the milliamp signal to read a "calibrated" or "adjusted" particulate matter concentration. This field calibration is necessary for light scattering PM CEM technologies (according to EPA PM CEM documents) to account for the variability in size, morphology, density, and color of an individual source's particulate matter composition. This adjusted concentration is what will be evaluated in subsequent relative accuracy testing (October 2001 and January 2002).

Similar calibration calculations are being performed for the flow monitor based on the Method 2 data collected during the PM CEM testing.

Electrical transformer problems caused both CEM units to shut down last week. Supply to the 480 VAC transformer and both 220 circuits leading to the stack CEM units was restored on August 27. These circuits supply power for the Sigrist unit which was subsequently operational once the circuits were re-energized. The 120 circuit needs to be ordered and replaced. Ron Cooper indicated this replacement will not happen until later this week. The 120 circuit supplies power to the flow CEM. Efforts to restore this unit will occur once full power is restored to the stack. We do not anticipate this power outage will have a significant effect on the CEM units or on our current schedule.

The status and schedule for *Tasks F – J* have not changed since the last Project Status Report (July 31, 2001).

COMMENTS

Successful completion of the calibration curve testing is encouraging in the continuation of the field evaluation of the PM CEM and flow CEM. Currently, all equipment is operational and functioning adequately with the noted exception of the flow monitor. The next step after finalizing the calibration curve data and applying it to the data acquisition system is monitoring the system until October 2001 when the first scheduled RATA and calibration verification test is to occur. We will continue to keep you updated on the status of the CPMMS.

If you have any questions regarding the status of any of our tasks or the proposed schedule, please contact me at 636-343-1300. I look forward to continuing the efforts and progress we have made thus far on this project.

Sincerely,

Nicolaus P. Neumann, P.E., RG, DEE
Principal

c: George von Stamwitz (Armstrong Teasdale)
Greg Cotter (Chemetco)
Heather Young (Chemetco)
Ray Ehrhard (EPRI)

NPN ENVIRONMENTAL

August 31, 2001
Contract C-00005

RECEIVED
SEP 04 2001
AIR ENFORCEMENT BRANCH, U.S. EPA, REGION 5

Mr. Brent Marable, Chief
Air Enforcement and Compliance Assurance Section
USEPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Project Status Report
Chemetco Consent Decree No. 93-482-WDS

Brent:

On behalf of Chemetco Inc., I am enclosing the Project Status Report for August 2001 regarding activities associated with the CPMMS research and implementation. Additionally, significant activity associated with Phase II – Field Evaluation and Assessment is planned and will be implemented in September and throughout the remaining portion of 2001.

The calibration curve development of the PM CEM using Reference Method 5 procedures was conducted on August 3, 6, 7, 16, and 17. Initial data reduction from the Reference Method 5 testing and unadjusted PM CEM milliamp output has been completed. An initial correlation of the data sets indicates a correlation of 0.79. Upon final review, the calibration data will be applied to the data acquisition system to condition the milliamp signal to read a "calibrated" or "adjusted" particulate matter concentration. Similar calibration calculations are being performed for the flow monitor based on the Reference Method 2 data collected during the PM CEM testing. The next step after finalizing the calibration curve data and applying it to the data acquisition system is monitoring the system until October 2001 when the first scheduled RATA and calibration verification test is scheduled.

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I will continue to provide you with project status reports on a monthly basis and at significant and timely stages of this project. If you or your staff has interest in visiting the site during any of the upcoming field evaluation and assessment activities, please advise us. Additionally, we look forward to meeting with you and your staff to discuss CPMMS research and implementation status. If you have any questions, please contact me at 636-343-1300.

Sincerely,

Nicolaus P. Neumann, P.E., R.G., DEE
Project Principal

Enclosure
c: Jeff Trevino (USEPA Region 5) w/enclosure
George von Stamwitz (Armstrong Teasdale) w/enclosure
Kim Fock (Chemetco) w/o enclosure

NPN ENVIRONMENTAL

October 2, 2001
Contract C-00005

RECEIVED
OCT 0 5 2001
AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

Mr. Brent Marable, Chief
Air Enforcement and Compliance Assurance Section
USEPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Project Status Report
Chemetco Consent Decree No. 93-482-WDS

Brent:

On behalf of Chemetco Inc., I am enclosing the Project Status Report for September 2001 regarding activities associated with the CPMMS research and implementation. Additionally, significant activity associated with Phase II – Field Evaluation and Assessment is planned and will be implemented in October, throughout the remaining portion of 2001, and through completion of Phase II activities in 2002.

Final QA/QC checks of the calibration data have been completed. The calibration curve equation for the PM CEM has been developed and will be used as the PM CEM standard to which the reference Method 5 data will be compared in the upcoming initial RATA and calibration verification testing scheduled for late October 2001. Currently, all equipment is operational and functioning adequately.

I will continue to provide you with project status reports on a monthly basis and at significant and timely stages of this project. If you or your staff has interest in visiting the site during any of the upcoming RATA testing activities, please advise us. Additionally, we look forward to meeting with you and your staff to discuss CPMMS research and implementation status. If you have any questions, please contact me at 636-343-1300.

Sincerely,

Nicolaus P. Neumann, P.E., R.G., DEE
Project Principal

Enclosure
c: Jeff Trevino (USEPA Region 5) w/enclosure
Jeff Benbenek (IEPA) w/enclosure
George von Stamwitz (Armstrong Teasdale) w/o enclosure
Kim Fock (Chemetco) w/o enclosure

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NPN ENVIRONMENTAL

September 27, 2001
Contract C-00005.A

Mr. Kim Fock
Chemetco Inc.
P.O. Box 67
Hartford, IL 62048

RE: Project Status Report – September 2001
CPMMS Research and Implementation Project

Kim:

The following is a report on the status and anticipated schedule for the *CPMMS Research and Implementation Project*. In this summary, we have provided the following documentation for the ongoing *Phase II* tasks of the field evaluation and assessment of the CPMMS components:

- Scope of work and Consent Decree requirements
- Project status of individual tasks
- Projected schedule for completion of remaining tasks

As *Phase I* of the project is complete and no activities have occurred which would have impacted the scope of work or schedule for *Phase III* implementation and operation of the CPMMS, only the following *Phase II* tasks are addressed in this status report.

PHASE II – FIELD EVALUATION AND ASSESSMENT-STACK 3 (ONGOING)

Scope of Work

As a review, the scope of work for *Phase II* (initial CPMMS field evaluation and assessment) included the following tasks:

Task	Scope	Status
A	Delivery of Equipment	Complete
B	Flow Monitor Installation	Complete
C	Flow Monitor Calibration	Complete
D	PM Monitor Installation	Complete
E	CEM Data System Development	Complete
F	PM CEM Calibration Development	Complete
G	PM/Flow CEM Initial RATAs	Future (October 2001)
H	Continuous Operation Monitoring	Ongoing (Sep. 2001-Jan. 2002)
I	PM/Flow CEM Secondary RATAs	Future (January 2002)
J	CPMMS Reporting Activities	Future (February 2002)

The *Phase II* evaluation sequence for field calibration, assessment, and validation testing is being performed on the single Sigrist particulate monitor on Stack 3. Our goal is to execute reasonable means in an attempt to operate the initial unit so it meets the "credible evidence" data objectives of USEPA and this project and so we may be able to proceed with the *Phase III* implementation and operation stage of the project.

Project Status

The following efforts in the past month have included:

Task F – PM CEM Calibration Development

Final QA/QC checks of the data have been performed. Two of the 15 data points collected were identified as outliers and discarded from the analysis because their values were so far skewed from the set, they were easily considered not reasonable values. The calibration curve equation for the PM CEM has been developed and will be used as the PM CEM standard to which the reference Method 5 data will be compared in subsequent RATA testing (October 2001 and January 2002). This calibration will be applied to the data acquisition system to condition the milliamp signal to read a "calibrated" or "adjusted" particulate matter concentration. This field calibration is necessary for light scattering PM CEM technologies (according to EPA PM CEM documents) to account for the variability in size, morphology, density, and color of an individual source's particulate matter composition.

Dates and times of the individual runs have been provided to Greg Cotter who is gathering operational data on the various charges and conditions of the pollution control devices. This information is critical in documenting the range of conditions of the

furnaces and control devices during the calibration curve development. Greg has provided us with average hourly charge data for 14 of the 15 runs. We strongly recommend that all process data be collected and identified for the calibration testing done in August and subsequent RATA testing should this data be needed or requested by regulatory agencies in the future.

Efforts to restore all power to the stack have been completed. Based on this week's calibration results and our assessment of the monitor, we do not believe this power outage has had a significant effect on the CEM units or on our current schedule.

The status and schedule for *Tasks G – J* have not changed since the last Project Status Report (August 29, 2001).

COMMENTS

Currently, all equipment is operational and functioning adequately. NPN Environmental will continue monitoring the system until October 2001 when the first scheduled RATA and calibration verification test is to occur. We will continue to keep you updated on the status of the CPMMS.

If you have any questions regarding the status of any of our tasks or the proposed schedule, please contact me at 636-343-1300. I look forward to continuing the efforts and progress we have made thus far on this project.

Sincerely,

Nicolaus P. Neumann, P.E., RG, DEE
Principal

c: George von Stamwitz (Armstrong Teasdale)
Greg Cotter (Chemetco)
Heather Young (Chemetco)
Ray Ehrhard (EPRI)

EPA
U.S. Environmental Protection Agency
Region 5 - Air and Radiation Division

Enforcement Tracking System
Activity Form

Enforcement Activity:	**Case Closed**
Company Name:	**CHEMETCO, INC.**
Street Address:	**RT. 3 AND CHEMETCO LANE**
City, State, Zip Code	**HARTFORD, IL 62048**
Technical Contact:	**Bonnie Bush**
Attorney:	**Jeffery Trevino**

Case Closed:	06/19/2002
Reviewed/Signed by Section Chief:	06/19/2002
Document Number:	CAA-93-482-WDS
Compliance Status:	Other

Comments/Justification for Close Out:

Chemetco shut down on October 31, 2001, after laying off most of the employees. On November 13, 2001, Chemetco filed Chapter 7 bankruptcy. On December 4, 2001, the site was sealed by the Illinois Environmental Protection Agency, until rescinded by the IEPA. Chemetco remains closed and sealed. The air case is considered closed until such time as Chemetco may re-open.

Attachment(s):