



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 20 2006

THE ADMINISTRATOR

Ms. Carol A. Couch, Ph.D.
Director
Environmental Protection Division
Georgia Department of Natural Resources
2 Martin Luther King, Jr. Drive, S.E.
Suite 1152, East Tower
Atlanta, GA 30334-9000

Dear Dr. Couch:

Thank you for your letter of June 10, 2005, concerning fine particulate matter (PM 2.5) designations for the Chattanooga Area. With your letter, you provided information intended to demonstrate that exceptional events influenced PM2.5 monitor values in the Chattanooga Area (Area) on fifteen days in 2003 and 2004, as well as information regarding the Area's Early Action Compact for ozone. You asked the Environmental Protection Agency (EPA) to review this information and revise the designation for the Chattanooga Area to unclassifiable. EPA has reviewed the information provided with your letter and, for the reasons discussed herein, your request to reconsider the fine particulate matter designations for the Chattanooga Area is denied.

We view your letter as a twofold request. First, you asked EPA to do a complete analysis of the data you provided relating to fifteen claimed exceptional event days in 2003 and 2004, and to concur with your conclusions. Second, you asked EPA to reconsider the designation of the Chattanooga Area based on the status of the data after our analysis of the exceptional event requests, and with consideration of the Chattanooga Area's Early Action Compact for ozone.

Your reconsideration request asks EPA to find that exceptional events affected both the Walker County, Georgia and the Hamilton County, Tennessee monitors, as your desired outcome could not be reached without changes to the Hamilton County monitor data set. Your letter is, however, somewhat ambiguous on the point of whether the Chattanooga-Hamilton County Air Pollution Control Bureau (APCB) has joined your petition. While the attachment to your letter states that it is a joint petition, your letter does not make this clear, and we did not receive a letter from APCB stating its intent to join your petition. It is our understanding, based on prior communications among the Georgia Environmental Protection Division (EPD), Chattanooga-Hamilton County APCB, and EPA Region 4, that APCB did intend to join this petition. Therefore, we are acting with the assumption that the Chattanooga-Hamilton County Air Pollution Control Bureau has joined the petition.

Flagged Data

EPA has received several exceptional event requests from the Chattanooga-Hamilton County Air Pollution Control Bureau for days in 2002-2004. These requests included ten days in 2002, seven days in 2003 and eight days in 2004, for PM_{2.5}. (Most letters also included requests relating to ozone also, but not always for the same days). One request dated November 11, 2004, which was for seven days in 2003, stated that it was also on behalf of the State of Georgia regarding Walker County. EPA responded to several requests in a letter dated March 2, 2004, in which we denied requests for the flagged days in 2002 and 2003. EPA responded to subsequent requests and submittals of additional information related to days in 2003 and 2004 in our April 5, 2005, Supplemental Federal Register Notice of final designations for fine particulate matter and the related technical support document. In the April 5, 2005 notice, EPA stated that the Agency did not concur with seven of the requested days and found that it was not necessary to reach a final determination on the remaining eight days because even if EPA invalidated all of those days, the Area would have still violated the standard. Georgia has now submitted additional information, for the same fifteen days in 2003-2004, to support a claim that there was a significant influence of exceptional events on PM_{2.5} monitor data in the Chattanooga Area.

In approaching the data submitted with this petition, we sought to use the best tools at our disposal to evaluate thoroughly the data on these flagged days. Therefore, in addition to examining the available data carefully ourselves, we contracted with a third party experienced in evaluation and research on atmospheric transport of air pollutants to provide an independent analysis of the voluminous data submitted by Georgia as well as other available information. In evaluating Georgia's request, EPA reviewed the results of the third party analysis and found that it confirms our previous decision not to concur on seven of the fifteen flagged days. For these seven days, EPA previously conducted a trajectory analysis and concluded that the data did not support the contention that the monitored violation was caused or significantly impacted by the cited fires. After reevaluating our former analysis and closely examining Georgia's data and the third party analysis, EPA again concludes that the claimed events did not cause or significantly contribute to the PM_{2.5} NAAQS violations on these days, and therefore that they should not be flagged as exceptional events.

EPA also reviewed available data and the third party analysis with respect to the remaining eight days upon which the Agency had not previously reached a formal conclusion. Based on our evaluation of this information, we find that the claimed events did not cause or significantly contribute to the PM_{2.5} NAAQS violations on these days. On one day, April 15, 2003, our analysis shows that smoke impacts from the stated source were possible; however, impact on the measured concentration of PM_{2.5} would have been relatively small. While it is possible that smoke contributed to the elevated PM_{2.5} level on that day, other emission sources are more important and appear to dominate. The information available does not demonstrate that the potential contribution of smoke from the Kansas fires was significant enough to be considered an exceptional event. Even if EPA concurred with flagging this day as impacted by an exceptional event, discounting from the data set all or a portion of the PM_{2.5} mass for this day would not change the nonattainment designation status for the Area.

The Agency may only make an unclassifiable designation where it lacks sufficient information upon which to make a judgement whether an area is attaining the PM_{2.5} NAAQS. Section 107(d) of the Clean Air Act provides that the unclassifiable designation is reserved for “any area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant.” On January 5, 2005, EPA published in the Federal Register a final fine particulate matter designation of nonattainment for the Chattanooga Area based on what we determined was sufficient information upon which to make that designation. EPA based that designation decision on 2001 – 2003 data. Your request for an unclassifiable designation, based on incomplete 2002-2004 data, would require EPA to ignore our previous finding that the 2001-2003 data set provided an appropriate basis upon which to designate the Area as nonattainment. Even if we concurred with the 2003 and 2004 data flags, the action you requested would be inconsistent with the Clean Air Act’s definition of unclassifiable, as we continue to believe the 2001-2003 data set provides sufficient basis to support the Area’s nonattainment designation. Because we do not concur with the 2003 and 2004 data flags, your request the reconsider the Area’s designation is denied as lacking basis.

Early Action Compact

Your letter also argued that EPA should revise the designation for the Chattanooga Area because the jurisdictions in this Area have entered into an Early Action Compact as a strategy to achieve the 8-hour ozone NAAQS. Under this agreement, the parties have agreed voluntarily to implement certain measures in order to reduce ambient ozone concentrations in the Area. The EAC explicitly provides that the effectiveness of the nonattainment designation for ozone would be deferred. It did not make any reference to the PM 2.5 NAAQS.

EPA recognizes that the Area is participating in the ozone Early Action Compact, and appreciates the proactive approach taken in the Tennessee and Georgia counties to further reduce ozone precursor emissions. The existence of the ozone Early Action Compact should be helpful for reductions in certain precursors to ambient PM 2.5 concentrations, but the pollutants are different and behave differently in the atmosphere. Ozone and PM 2.5 will likely require different attainment strategies. PM 2.5 has precursors in addition to those of ozone which will require different controls. The existence of the EAC for ozone is thus not relevant to the PM 2.5 designation process. The statute requires that EPA designate a nonattainment area for PM 2.5 that includes both those areas that violate the standards and those areas that contribute to violations of the standards in nearby areas.

Your letter suggested that the Chattanooga Area is “unique” in that it has both an Early Action Compact for ozone and a nonattainment designation for PM 2.5 in conjunction with pending exceptional events flags. For the reasons described above, EPA has carefully evaluated the flagged days and reached the conclusion that the flags do not justify a change in the designation. The existence of an ozone Early Action Compact, providing for a deferral of the effectiveness of a nonattainment designation for ozone, provides no support for a designation of unclassifiable for PM 2.5.

Enclosed with this letter is a summary of EPA's analysis and conclusions for the fifteen flagged days in 2003-2004, with consideration of the data submitted with the subject petition, EPA's prior analysis, and the independent assessment conducted by the third party contractor. The full report of the contractor's independent assessment is available in the fine particulate matter designations docket (docket # EPA-HQ-OAR-2003-0061) at www.regulations.gov.

Request to Reconsider Designation

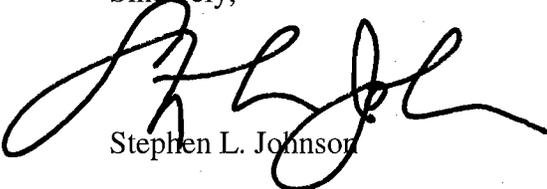
Your letter requested that EPA revise the Chattanooga Area fine particulate matter designation from nonattainment to unclassifiable based on the lack of three complete years of data. The premise of your request was that EPA would have incomplete monitoring data upon which to base a designation for the Area if we concurred with the fifteen data flags for 2003 and 2004, and this would compel EPA to designate the Area unclassifiable. You also assert that validation of some number of flags would result in attainment at the Walker County monitor, which would leave the area's nonattainment designation solely reliant on the Hamilton County monitor (which EPA has found receives contribution from Walker County and Catoosa County, Georgia). Because EPA does not concur with the fifteen flags, as explained above and in the attachment, the monitoring data does not support your premise that an unclassifiable designation is warranted for the Chattanooga Area due to an incomplete data set. Therefore, EPA will not reconsider its designation decision on the basis you have suggested.

The outcome you seek in your petition for reconsideration is a change in the designation of the Chattanooga Area from nonattainment to unclassifiable. We view this request as inconsistent with EPA's decision to consider 2002-2004 data, the Clean Air Act's definition of unclassifiable, and the intent of the Clean Air Act. As you know, on January 5, 2005, EPA issued its final designations for all areas around the country based on 2001-2003 data. In EPA's January 5, 2005 Federal Register Notice, we provided states the opportunity to submit complete, quality assured, certified 2004 data if it suggested a change in the designation status for an area was appropriate. EPA stated that if it agreed the data showed that a change in designation status was appropriate, we would withdraw the designation and issue another designation that reflected the 2004 data. We stated that, if inclusion of 2004 data changed an area's designation from nonattainment to attainment, we would change the designation only if every county in the area was neither monitoring nonattainment nor contributing to nonattainment in another area. In making that decision, EPA did not intend for states to submit 2004 data for the purpose of demonstrating that the 2002-2004 data set was incomplete. In fact, we specifically asked for data that was "complete" according to EPA's data handling regulations at 40 C.F.R. Part 50, Appendix N. Therefore, your assertion that the data set for 2002-2004 is incomplete, had we agreed with it, would have rendered your data submittal inconsistent with our offer to consider complete 2002-2004 data. More importantly, even if we concurred with your assertion that the 2002-2004 data set is incomplete, we would be precluded by the Clean Air Act's definition of "unclassifiable" from accommodating your request.

EPA understands your concerns about the Chattanooga Area designation and your reasons for requesting a change in designation. The Agency has carefully evaluated the information you have provided and has considered your arguments. However, we have found that the information does not persuade us to reconsider our decision. Therefore, your petition for reconsideration is denied.

EPA recognizes the importance of evaluating the impacts of exceptional events in connection with the NAAQS. The Agency will soon be issuing a proposed rule to address issues concerning exceptional events, and EPA would appreciate your participation in that process. The Agency looks forward to working with you in the SIP process to ensure achievement of the NAAQS.

Sincerely,



Stephen L. Johnson

Enclosure

cc: Robert H. Colby, Director
Chattanooga-Hamilton County Air Pollution Control Bureau

Ronald Methier, Chief
Air Protection Branch
Environmental Protection Branch
Georgia Department of Natural Resources

James H. Fyke, Commissioner
Tennessee Department of Environment and Conservation

Barry R. Stephens, P.E., Director
Division of Air Pollution Control
Tennessee Department of Environment and Conservation

EPA Evaluation of 15 Days in 2003-2004 Flagged by Tennessee and Georgia as Exceptional Events

January 2006

Background

Over the past few years, EPA has received several requests from Chattanooga-Hamilton County and Georgia to flag PM_{2.5} monitoring data as exceptional events. The data was flagged due to the belief that smoke transported from forest and agricultural fires impacted the monitors on flagged days. EPA has previously denied the requests for dates in 2002-2003. In EPA's April 5, 2005, Supplemental Federal Register Notice of final designations for fine particulate matter and the related technical support document (TSD), EPA responded to requests and submittals of information related to fifteen days in 2003 and 2004. In the April 5 Notice, EPA stated that it did not concur with seven of the requested days and found that it was not necessary to reach a determination on the remaining eight days. On June 10, 2005, Georgia submitted additional information for the same fifteen days in 2003-2004 which purportedly demonstrates the influence of exceptional events on PM_{2.5} monitor data in the Chattanooga area.

Evaluation of Each of the Fifteen Flagged Days in 2003-2004

This document provides a summary of EPA's evaluation of the fifteen days in 2003-2004 flagged by Chattanooga-Hamilton County and/or Georgia EPD for the Chattanooga Area as exceptional events. EPA has reviewed the information submitted by Georgia on June 10, 2005. The attached memorandum, dated August 17, 2005, contains a summary of issues identified from EPA's review of Georgia's June 10, 2005 submittal. Additionally, EPA contracted with a third-party experienced in evaluation and research relating to atmospheric transport of air pollutants. The contractor has conducted an independent assessment of the fifteen days in 2003-2004. The details of the contractor's assessment are contained a report titled: "Exceptional PM_{2.5} Event Analysis for TN, GA, and SC, 2002-2004," dated January 2006. This report was authored by Rudolf B. Husar, Janja D. Husar and Erin Robinson, with Lantern Corporation and Washington University. For the remainder of this document, the contractor's report will be referred to as the "Husar Report."

The following section presents a summary of EPA's evaluations for each of the fifteen days. The summary contains a brief discussion of EPA's previous evaluation contained in the April 5, 2005, TSD, followed by a summary of the findings presented in the Husar Report, and then an overall conclusion about the potential for smoke impacts.

The discussion of the findings from the Husar Report includes reference to parameters called SmokeBioMass and SmokeBio%. These parameters were developed by the report authors to provide a quantitative estimate of the percentage of measured PM_{2.5} consisting of smoke and biogenic organic compounds. Unfortunately, there is not a simple way to distinguish between

biomass smoke and biogenic organic emissions. The details regarding the development and use of the SmokeBioMass and SmokeBio% parameters are contained in the Husar Report. For the purposes of this document, a greater than average SmokeBio% is an indication of the potential for smoke contributing to an elevated PM2.5 level. An elevated SmokeBio% should be considered along with other information in determining if impact from smoke was possible and if so, whether the impact was significant.

The SmokeBioMass and SmokeBio% parameters associated with the limited PM 2.5 chemical speciation data are only one of the pieces of evidence that were evaluated and presented in the Husar Report. Additional evidence includes observed fire and smoke transport (typically satellite images), the spatial pattern of smoke (satellite data and spatial coverage of elevated PM 2.5 levels) and the temporal pattern of smoke (distinct spikes in measured PM2.5 levels). A more detailed discussion of these lines of evidence is contained in the Husar Report.

EPA's decisions regarding each of the flagged days were made by considering all the available evidence from previous analyses and the independent analysis presented in the Husar Report.

Day-by-Day Evaluation

1. April 15, 2003

The April 2005 TSD contains the results of a trajectory analysis and an evaluation of chemical speciation data from the Chattanooga speciation site (AIRS ID # 470654002) for this day. The trajectory analysis was inconclusive, but indicated a potential for smoke from agricultural fires in Kansas to be transported over the Chattanooga monitors. The speciation data shows a higher than average level of organic carbon (OC) on this day and that the measured OC level was greater than the sulfate level.

The independent evaluation of the chemical speciation data from the Chattanooga site contained in the Husar Report indicates a greater than average SmokeBio% parameter and that the SmokeBioMass was greater than the sulfate level. Back-trajectories indicate the potential for smoke transport from Kansas fires. The spatial pattern of PM2.5 measurements indicates an aerosol plume moving from Kansas toward the Southeast. The temporal pattern of PM2.5 measurements shows an aerosol peak on April 15, 2005. See the Husar Report for additional details on each of these types of evidence.

The body of evidence indicates that some degree of smoke impact was possible on this day. However, the fact that the difference between the SmokeBio% value on April 15, 2005, versus the seasonal average SmokeBio%, was only 19% indicates that the impact on the measured concentration of PM2.5 would have been relatively small. While it is possible that smoke contributed to the elevated PM2.5 level, other emissions sources are important and appear to dominate.

2. June 26, 2003

The April 2005 TSD contains the results of a trajectory analysis and an evaluation of chemical speciation data from the Chattanooga speciation site (AIRS ID # 470654002) for this day. The trajectory analysis does not support the theory that smoke transported from fires in Canada impacted the monitors in Chattanooga on this day. The speciation data shows that the OC mass is slightly less than sulfate mass. The conclusion of this analysis was that this day should not be flagged as an exceptional event.

The independent evaluation of the chemical speciation data from the Chattanooga site contained in the Husar Report indicates that there were elevated levels of both SmokeBioMass and sulfate mass, with the SmokeBioMass levels slightly less than the sulfate mass. The SmokeBio% parameter was approximately equal to the seasonal average from the years 2002-2004. Back trajectories and other data, including satellite images, do not support transport of smoke from Canadian fires to the Southeast U.S. Based on an evaluation of the chemical speciation data and the spatial/temporal patterns of PM_{2.5}, it is believed that the elevated PM_{2.5} levels were caused mainly by an anti-cyclonic stagnation event covering most of the Southeastern U.S.

The body of evidence indicates that smoke transport from Canada was unlikely and that the high PM_{2.5} levels were likely the result of a large stagnation event in the Eastern U.S. Therefore, June 26, 2003, should not be flagged as an exceptional event.

3. June 29, 2003

The April 2005 TSD contains the results of a trajectory analysis. No chemical speciation data at the Chattanooga speciation site were available for this day. The trajectory analysis was inconclusive, but indicated a potential for some unknown quantity of smoke transported from fires in Ontario to pass over the monitors in Chattanooga.

The independent evaluation contained in the Husar Report indicates a low potential for smoke transport from fires in Ontario. Even though speciation data was not available at the Chattanooga site for this day, other sites around the Southeast did have speciation data available. The spatial pattern of SmokeBioMass and sulfate indicates that sulfates were greater than or equal to SmokeBioMass over a large area in the Eastern U.S indicative of a stagnation event.

The body of evidence indicates that smoke transport from Ontario was unlikely and that the slightly elevated PM_{2.5} levels were likely the result of a large stagnation event in the Eastern U.S. Therefore, June 29, 2003, should not be flagged as an exceptional event.

4. August 19, 2003

The April 2005 TSD contains the results of a trajectory analysis and an evaluation of chemical

speciation data from the Chattanooga speciation site (AIRS ID # 470654002) for this day. The trajectory analysis was inconclusive, but indicated a potential for atmospheric transport from south-central Canada. However, there was no evidence provided showing fires or smoke in that area. The speciation data shows that the OC mass is much less than sulfate mass.

The independent evaluation of the chemical speciation data from the Chattanooga site contained in the Husar Report indicates that the elevated PM2.5 episode was dominated by sulfate mass; sulfate levels were much greater than SmokeBioMass. The SmokeBio% parameter was below the seasonal average from the years 2002-2004. The spatial and temporal patterns of PM2.5 point to the episode being caused by a stagnation event.

The body of evidence indicates that long distance smoke transport causing significant impacts on the Chattanooga monitors was unlikely and that the elevated PM2.5 levels were likely the result of a large stagnation event. Therefore, August 19, 2003, should not be flagged as an exceptional event.

5. August 22, 2003

The April 2005 TSD contains the results of a trajectory analysis. No chemical speciation data at the Chattanooga speciation site were available for this day. The trajectory analysis does not support the theory that smoke transported from Canadian fires impacted the monitors in Chattanooga on this day. The conclusion of this analysis was that this day should not be flagged as an exceptional event.

The independent evaluation contained in the Husar Report indicates a low potential for smoke transport from fires in Canada. Even though speciation data was not available at the Chattanooga site for this day, other sites around the Southeast did have speciation data available. The spatial pattern of SmokeBioMass and sulfate indicates that sulfates were greater than SmokeBioMass. Back trajectories presented in the Husar Report do not support transport of smoke from Canadian fires. The spatial and temporal patterns of PM2.5 point to the episode being caused by a stagnation event.

The body of evidence indicates that long distance smoke transport causing significant impacts on the Chattanooga monitors was unlikely and that the elevated PM2.5 levels were likely the result of a large stagnation event. Therefore, August 22, 2003, should not be flagged as an exceptional event.

6. August 25, 2003

The April 2005 TSD contains the results of a trajectory analysis and an evaluation of chemical speciation data from the Chattanooga speciation site (AIRS ID # 470654002) for this day. The trajectory analysis was inconclusive, but indicated a potential for an unknown quantity of smoke

from Canadian fires to be transported over the Chattanooga monitors. However, the speciation data shows that the OC mass is much less than the sulfate mass.

The independent evaluation of the chemical speciation data from the Chattanooga site contained in the Husar Report indicates that the elevated PM2.5 episode was dominated by sulfate mass; the sulfate levels were almost two times the SmokeBioMass levels. The SmokeBio% parameter was below the seasonal average from the years 2002-2004. The spatial and temporal patterns of PM2.5 point to the episode being caused by a stagnation event.

The body of evidence indicates that long distance smoke transport causing significant impacts on the Chattanooga monitors was unlikely and that the elevated PM2.5 levels were likely the result of a large stagnation event. Therefore, August 25, 2003, should not be flagged as an exceptional event.

7. August 28, 2003

The April 2005 TSD contains the results of a trajectory analysis. No chemical speciation data at the Chattanooga speciation site were available for this day. The trajectory analysis does not support the theory that smoke transported from Canadian fires impacted the monitors in Chattanooga on this day. The conclusion of this analysis was that this day should not be flagged as an exceptional event.

The independent evaluation contained in the Husar Report indicates a low potential for smoke transport from fires in Canada. Even though speciation data was not available at the Chattanooga site for this day, other sites around the Southeast did have speciation data available. The spatial pattern of SmokeBioMass and sulfate indicates that sulfates were greater than SmokeBioMass. Back trajectories presented in the Husar Report do not support transport of smoke from Canadian fires. The spatial and temporal patterns of PM2.5 point to the episode being caused by a stagnation event.

The body of evidence indicates that long distance smoke transport causing significant impacts on the Chattanooga monitors was unlikely and that the elevated PM2.5 levels were likely the result of a large stagnation event. Therefore, August 28, 2003, should not be flagged as an exceptional event.

8. June 8, 2004

The April 2005 TSD contains the results of a trajectory analysis and an evaluation of chemical speciation data from the Chattanooga speciation site (AIRS ID # 470654002) for this day. The trajectory analysis does not support the theory that smoke transported from fires in Arkansas impacted the monitors in Chattanooga on this day. The speciation data shows that the OC mass is approximately equal to the sulfate mass. The conclusion of this analysis was that this day

should not be flagged as an exceptional event.

The independent evaluation of the chemical speciation data from the Chattanooga site contained in the Husar Report indicates that there were elevated levels of both SmokeBioMass and sulfate mass, with the sulfate mass slightly higher than the SmokeBioMass. The SmokeBio% parameter was slightly above the seasonal average from the years 2002-2004. Back trajectories and other data, including satellite images, indicate a potential for transport of an unknown quantity of smoke from the lower Mississippi Valley region to pass over the Chattanooga monitors.

The body of evidence indicates that smoke impacts were possible. However, the fact that the difference between the SmokeBio% value on this day versus the seasonal average SmokeBio%, was only 8% indicates that the impact on the measured concentration of PM2.5 would have been small. The fact that the levels of sulfates were higher than the SmokeBioMass indicates that sources other than long distance transport of smoke are more significant on this day. Therefore, June 8, 2004, should not be flagged as an exceptional event.

9. June 11, 2004

The April 2005 TSD contains the results of a trajectory analysis. No chemical speciation data at the Chattanooga speciation site were available for this day. The trajectory analysis does not support the theory that smoke transported from fires in Arkansas impacted the monitors in Chattanooga on this day. The conclusion of this analysis was that this day should not be flagged as an exceptional event.

The independent evaluation contained in the Husar Report indicates a low potential for smoke transport from fires in Arkansas. Even though speciation data was not available at the Chattanooga site for this day, other sites around the Southeast did have speciation data available. The spatial pattern of SmokeBioMass and sulfate indicates that sulfates were greater than SmokeBioMass. Additionally, the low speed of surface level winds on this day indicates a possible stagnation event.

The body of evidence indicates that smoke transport from Arkansas was unlikely. The elevated sulfate levels around the Southeast U.S. and low wind speeds indicate a possible stagnation event. Therefore, June 11, 2004, should not be flagged as an exceptional event.

10. July 17, 2004

The April 2005 TSD contains the results of a trajectory analysis. No chemical speciation data at the Chattanooga speciation site were available for this day. The trajectory analysis does not support the theory that smoke transported from Alaskan fires impacted the monitors in Chattanooga on this day. The conclusion of this analysis was that this day should not be flagged as an exceptional event.

The independent evaluation contained in the Husar Report indicates a low potential for smoke transport from fires in Canada. Even though speciation data was not available at the Chattanooga site for this day, other sites around the Southeast did have speciation data available. The spatial pattern of SmokeBioMass and sulfate indicates that sulfates were greater than SmokeBioMass. The spatial and temporal patterns of PM2.5 point to the episode being caused by a stagnation event.

The body of evidence indicates that long distance smoke transport causing significant impacts on the Chattanooga monitors was unlikely and that the elevated PM2.5 levels were likely the result of a stagnation event. Therefore, July 17, 2003, should not be flagged as an exceptional event.

11. July 20, 2004

The April 2005 TSD contains the results of a trajectory analysis and an evaluation of chemical speciation data from the Chattanooga speciation site (AIRS ID # 470654002) for this day. The trajectory analysis was inconclusive, but indicated a potential for an unknown quantity of smoke from Alaskan fires to be transported over the Chattanooga monitors. However, the speciation data shows that the OC mass is much less than the sulfate mass.

The independent evaluation of the chemical speciation data from the Chattanooga site contained in the Husar Report indicates that the elevated PM2.5 episode was dominated by sulfate mass; the sulfate levels were more than two times the SmokeBioMass levels. The SmokeBio% parameter was below the seasonal average. The spatial and temporal patterns of PM2.5 point to the episode being caused by a stagnation event.

The body of evidence indicates that long distance smoke transport causing significant impacts on the Chattanooga monitors was unlikely and that the elevated PM2.5 levels were likely the result of a large stagnation event. Therefore, July 20, 2004, should not be flagged as an exceptional event.

12. August 4, 2004

The April 2005 TSD contains the results of a trajectory analysis. No chemical speciation data at the Chattanooga speciation site were available for this day. The trajectory analysis was inconclusive, but indicated a potential for some unknown quantity of smoke transported from fires in Alaska and Canada to pass over the monitors in Chattanooga.

The independent evaluation contained in the Husar Report indicates a low potential for smoke transport from fires in Alaska and Canada. Even though speciation data was not available at the Chattanooga site for this day, other sites around the Southeast did have speciation data available. The spatial pattern of SmokeBioMass and sulfate indicates that sulfates were greater than

SmokeBioMass over a large area in the Eastern U.S indicative of a stagnation event. Back trajectories presented in the Husar Report do not support transport of smoke from Alaskan and Canadian fires.

The body of evidence indicates that smoke transport from Alaska and Canada was unlikely and that the elevated PM2.5 levels were more likely the result of a stagnation event in the Eastern U.S. Therefore, August 4, 2004, should not be flagged as an exceptional event.

13. August 10, 2004

The April 2005 TSD contains the results of a trajectory analysis. No chemical speciation data at the Chattanooga speciation site were available for this day. The trajectory analysis does not support the theory that smoke transported from Alaskan and Canadian fires impacted the monitors in Chattanooga on this day. The conclusion of this analysis was that this day should not be flagged as an exceptional event.

The independent evaluation contained in the Husar Report indicates a low potential for smoke transport from fires in Canada. Even though speciation data was not available at the Chattanooga site for this day, other sites around the Southeast did have speciation data available. The spatial pattern of SmokeBioMass and sulfate indicates that sulfates were greater than SmokeBioMass.

The body of evidence indicates that long distance smoke transport causing significant impacts on the Chattanooga monitors was unlikely and that the elevated PM2.5 levels were likely the result of a stagnation event. Therefore, August 10, 2004, should not be flagged as an exceptional event.

14. August 16, 2004

The April 2005 TSD contains the results of a trajectory analysis. No chemical speciation data at the Chattanooga speciation site were available for this day. The trajectory analysis was inconclusive, but indicated a potential for some unknown quantity of smoke transported from fires in Alaska and Canada to pass over the monitors in Chattanooga.

The independent evaluation contained in the Husar Report indicates a low potential for smoke transport from fires in Alaska and Canada. Even though speciation data was not available at the Chattanooga site for this day, other sites around the Southeast did have speciation data available. The spatial pattern of SmokeBioMass and sulfate indicates that sulfates were greater than SmokeBioMass over a large area in the Eastern U.S indicative of a stagnation event. Back trajectories presented in the Husar Report do not support transport of smoke from Alaskan and Canadian fires.

The body of evidence indicates that smoke transport from Alaska and Canada was unlikely and that the elevated PM2.5 levels were more likely the result of a stagnation event in the Eastern

U.S. Therefore, August 16, 2004, should not be flagged as an exceptional event.

15. August 19, 2004

The April 2005 TSD contains the results of a trajectory analysis and an evaluation of chemical speciation data from the Chattanooga speciation site (AIRS ID # 470654002) for this day. The trajectory analysis does not support the potential for smoke transport from fires in Alaska and Canada. The speciation data shows that the OC mass is approximately equal to the sulfate mass. The conclusion of this analysis was that this day should not be flagged as an exceptional event.

The independent evaluation of the chemical speciation data from the Chattanooga site contained in the Husar Report indicates that there were elevated levels of both SmokeBioMass and sulfate mass, with the sulfate mass approximately equal to the SmokeBioMass. The SmokeBio% parameter was slightly above the seasonal average from the years 2002-2004. Satellite images indicate small fires scattered throughout the Southeastern U.S. which could have the potential for transport of an unknown quantity of smoke to pass over the Chattanooga monitors. Even if smoke did pass over Chattanooga, it is not possible to determine from the satellite images if smoke was mixed down to the surface level to impact the monitors.

The body of evidence indicates that smoke impacts from small fires scattered throughout the Southeastern U.S. were possible. However, the fact that the difference between the SmokeBio% value for this day versus the seasonal average SmokeBio%, was only 4% indicates that any impact on the measured PM_{2.5} concentration would have been small. The fact that the levels of sulfates were as least as high as the SmokeBioMass indicates that sources other than long distance transport of smoke are significant on this day. Therefore, June 8, 2004, should not be flagged as an exceptional event.

Conclusion

EPA has reviewed the information submitted with Georgia's June 10, 2005, petition for reconsideration and has conducted an independent analysis of the potential for atmospheric transport of smoke from forest and agricultural fires to impact the measured PM_{2.5} concentrations in the Chattanooga Area. After a thorough review of available evidence, EPA has determined that fourteen of the fifteen days should not be flagged as exceptional events. On one day, April 15, 2003, our analysis shows that smoke impacts from the stated source were possible; however, impact on the measured concentration of PM_{2.5} would have been relatively small. While it is possible that smoke contributed to the elevated PM_{2.5} level, other emission sources are important and appear to dominate.

Attachment

Office Memorandum **Air Quality Modeling and Transportation Section**

To: Richard Guillot

Information: Joel Huey
Rick Gillam
Brenda Johnson

From: Stan Krivo

Date: 17 August 2005

Subject: Petition for Reconsideration of PM2.5 Nonattainment Designation for
Chattanooga Area
Georgia Department of Natural Resources (GEPD)
June 10, 2005

The following are my review comments on the information provided in the referenced GEPD letter and attachments to support their request for exemption of fourteen (14) periods of elevated PM2.5 monitored measurements during the 2003 and 2004.

- I. Exception Events - This petition requests additional review of 17 days during the 2003-2004 period. Previously 25 days were submitted for exceptional event consideration due to apparent long-range transport of fire emissions. [Note: Previous submitted documents were not available for this review.] The requested 14 events of 17 days with elevated PM2.5 emissions for reconsideration are given below.

- Event 1 15 April 2003
- Event 2 26 June 2003
- Event 3 29 June 2003
- Event 4 19 August 2003
- Event 5 22 August 2003
- Event 6 25 August 2003
- Event 7 28 August 2003
- Event 8 11 June 2004 [TN also requested 8 June for Chattanooga]
- Event 9 17-20 July 2004
- Event 10 20 July 2004
- Event 11 4 August 2004
- Event 12 10 August 2004
- Event 13 16 August 2004

It appears that the selected days for exemption were based on the elevated magnitude of the measured PM_{2.5} concentrations. The exemptions are based on the possibility that emissions from distant fires could have contributed to the concentrations. Because the location of the fires range from northern Canada, Alaska, to Mexico, it is likely that a fire would have occurred somewhere in this large region during the period of concern. Therefore, it is most important that a transport mechanism exist for each event and the possible contribution from the fires be large enough to significantly impact the measured values.

It should be noted that, with the exception of 8 June 2004, the GEPD days are the same days the Chattanooga-Hamilton County Air Pollution Control Bureau (APCB) requested flagged as exceptional events in their monitoring record. Therefore, EPA's previous exceptional event analyses for Chattanooga, TN (provided in Attachment 1) is applicable for this petition request.

- II. Fire Events - The petition indicates fire events located in Kansas, Western US, Alaska, Western Ontario, Canada, and Mexico affected the PM_{2.5} measurements on selected days. The specific fire events were not identified and described. [It is noted that previous submittal may have included fire event descriptions.] Only the 15 April 2003 event included specific references to NAAPS model maps, satellite images, and CMB modeling to support the contention that fire smoke were either in the trajectory region or in the Chattanooga area. Other maps were also included in the petition package to demonstrate the presents of fire smoke (i.e., AIRNOW.pmfine, SeaWif, and GOES) but these maps and model outputs were not discussed or explained. It is important to note that the lack of specific references to supporting figures or maps in the discussions of the other events is a serious deficiency in the provided analyses.
- III. Petition Content - The petition contains voluminous number of maps and figures. With the exception of the first event (04/15/03), these maps and figure were not organized for the reviewer. Many of the maps and figures are provided in duplicates. Because Attachment 2 of the petition does not direct the reviewer to particular maps/figures to support the provided conclusions and observations, and because the maps/figures generally lack legends and descriptions, the document leaves the reviewer with the task of finding the appropriate materials for a particular event as well as analyze its relevance - a task that was not performed. Finally, the provided illustrations are of poor quality making review and analysis difficult.
- IV. Causes for Elevated Observations - For all the events only distant fires were noted as the reasons for the elevated measurements. Nothing was provided concerning the possibility of more local/regional causes for the elevated measurements. To understand and more conclusively attribute the elevated ground level measurements to these distant fires, the following studies or information would be of value. [Note: The previous submittal

documents requesting exemption were not available for review. These document may contain some of the following information.]

- Dates and locations of the fire events identified as affecting the measurements should be provided to correlate with periods of high measurements in region.
- Historical time plots of all Chattanooga area ambient PM_{2.5} measurements to illustrate normal/expected measurement characteristics and to determine the uniqueness of these identified events.
- Magnitude of the contribution of the distant fire emissions to the elevated Chattanooga measurements should be addressed. Comparisons of the PM_{2.5} measurements during the requested exception days to adjacent concentrations indicate the distant fire emissions would have to contribute 15 to 30 ug/m³ to the PM_{2.5} measurements to make the event outside the normal range of measurement. Considering the large distance, it appears unlikely that this large a contribution would come from such a distant source.
- More local/regional causes for the identified elevated measurements must be investigated and eliminated. For example, the large power plants in NW Georgia and NE Alabama, and local/regional forest and agricultural fires should be eliminated as possible cause for these elevated measurements.
- PM_{2.5} measurements from other areas of the SE should be reviewed for these same exceptional event days. If plumes from the distant fires affected the Chattanooga area, they should have also affected other measurements in the SE (e.g., Knoxville, Nashville, and Atlanta). Have these areas also requested exceptional events for the identified days?

- V. Chattanooga-Hamilton County, TN Request - As indicated above, the Chattanooga-Hamilton County Air Pollution Control Bureau (APCB) has also requested exception event status for these same days. The information APCB provided to support their request has been considered in this petition review. This previous review and supporting information for the requested events is provided in Attachment 1.

It should be noted that for the 19 August 2004 event, APCB's analysis indicated fire emissions from Alaska and Canada caused the elevated PM_{2.5} measurements. GEPD's analysis for this same event at Chattanooga indicates the high concentrations were caused by fires in Mexico with only minor contributions from Canada and Alaska. This indicates the need for a more detailed consequence assessment which includes the identification of definitive transport mechanism to the ground level monitor and determination of the possible magnitude of the contribution, rather than the exceptional event status relying on the general back trajectory calculations discussed below.

- VI. Back Trajectories - The back trajectory calculations are used to show that the transport mechanism exists during the period of elevated measurement. Given the transport mechanism exists, the fire's emissions could contribute to the measured concentration. The provided back trajectory calculations were not performed in a consistent manner for each event. It appears that the only justification needed to show that a fire contributed to an observed elevated measurement is a back trajectory calculation from any atmospheric

level passing near the location of any area where a fire or fire plume was located during some period near the time of the measurement. The atmospheric levels used in the back trajectory calculations range from 500 to 9,000 meters. It should be noted that even give this broad, liberal criteria, the provided trajectories for some events still do not past close enough to the fire(s) to support the conclusion that transport of fire emissions to the monitor is possible. The fact that APCB and GEPD identified different causes for the same 19 August 2004 event demonstrates the danger of using such broad justification criteria. APCB identified fire emissions from Alaska and Canada while GA DNR credits Mexico fires for the elevated PM2.5 measurements during this event.

- VII. Speciation Data - Graphs (Figure 1) of speciation data (K/SO4 ratios) were provided for 2003 and 2004 from the Hamilton County, TN monitor. Very little use is made of these data in discussions of the exceptional events. Only the description of the 17-20 July 2004 event makes reference to speciated data. It appears the speciation data do not support the contention that fire smoke significantly contributed to the selected elevated PM2.5 events.

In summary, the information provided in the GEPD 10 June 2005 petition for reconsideration is not sufficiently to support the designation of the events as exceptional because of emissions transport from distant fires. Analyses of possible local/regional causes for the elevated measurements is an important consideration. Given these local/regional analyses leave only distant fires as a possible cause of the elevated measurements, the petition must include a detailed consequence analysis of each identified event. The consequence analyses should including specific references to selected supporting figures, diagrams, and back trajectories that demonstrate a creditable transport mechanism to the Chattanooga ground level monitors. Other valuable supporting information includes the possible magnitude of the fire contribution to observed PM2.5 measurements and results of speciation analyses for each event.

Please let me know if you have any questions.

Attachment 1
EPA's Previous Analyses of Chattanooga-Hamilton County Identified
Exceptional Events

**[This Attachment consists of Section 3 of the April 5, 2005,
Technical Support Document for the Supplemental Federal Register
Notice of Final Designations for Fine Particulate Matter]**

Section 3. Chattanooga, TN request to invalidate multiple monitoring samples and change status to attainment.

3.A. Summary

In December 2004, EPA designated Hamilton County, TN, and Catoosa and Walker Counties, GA as nonattainment. The monitors in Hamilton and Walker counties had three years (01 - 03) of data showing design values above the standard. Catoosa was included due to its contribution to both Hamilton and Walker Counties. As allowed by EPA's final designations rule, both TN and GA submitted their 2004 quality assured and certified PM air quality data to EPA for the counties in question. The States requested that fifteen days during 2003 and 2004 of data be "flagged" due to influence from agricultural fires and wildfires. Previously, TN had requested that 10 days in 2002 be flagged and Region 4 rejected the flags. This new submittal included a request that the revised monitoring data be considered and the designation of the area changed to attainment or unclassifiable prior to April 5, 2005.

EPA has determined that at least 7 of these fifteen days should not be flagged as exceptional events. The trajectory analyses conducted by OAQPS do not support the contention that these data are affected by the cited agricultural or wildfires. For the remaining seven days, trajectory analyses do not immediately rule out the possibility that agricultural fires and wildfires had an effect on the air quality monitors in the Chattanooga area. However, EPA does not have sufficient supporting data from the State to determine whether the fires on these days affected air quality in Chattanooga and if they did, whether they should be flagged as exceptional events and removed from the data set of air quality considered for designation purposes. Moreover, even if these 7 days were flagged and removed from the air quality data set because EPA agreed that they should qualify as exceptional events that may properly be excluded from designation decisions, the Hamilton County monitor would continue to be nonattainment.

On those seven days that EPA's trajectory analysis indicated that there may have been impacts resulting from a fire event, EPA looked at speciation data that was available. Of the seven days that may have been impacted, only three of those days had speciation data available. The sulfates on those three days ranged from 12 to 15 $\mu\text{g}/\text{m}^3$ while the organic carbon (a wildfire marker) ranged from 5 to 9 $\mu\text{g}/\text{m}^3$. Neither of these ranges was unusual as compared to any other summer day with high values. Wildfires are not the only source of organic carbon. Chattanooga also used potassium as a wildfire marker. The use of potassium

has been questioned by EPA scientists, but even if it were used, the potassium levels were not any higher on a percentage basis on these alleged event days than other days with high values. Since the speciation data did not support Chattanooga's request, we determined the data to be inconclusive. It is more plausible to believe that these days were typical summer days, high temperatures resulting in the conversion of SO₂ to sulfates. If one assumes that the sulfates and nitrates were ammonium sulfates and nitrates, their contribution would be even greater than the ranges given above.

The supporting data provided by Chattanooga to qualify the elevated and/or exceedance measurements as exceptional events is neither sufficient nor conclusive for this determination. The frequency of fires, the distant locations for the fires, and the lack of specific detailed consequence analysis for each fire-measurement event make the provided justification insufficient and/or inconclusive to exempt the measured data as exceptional fire-caused events. Additional, more detailed consequence specific information is needed to make this determination. The new information in the November 4, 2004, Chattanooga-Hamilton County Air Pollution Control Bureau letter does not change the conclusions provided in EPA's December 1, 2003, memorandum on the original request. The evidence provided is insufficient to conclusively support the request to define the April, June, and August 2003 events as exceptional because of the influence of distant agricultural and wild fires. Additional detailed analyses and information are needed to support this exceptional event request. See EPA's November 30, 2004, memorandum, and forward and back trajectories, for detailed information.

The information submitted by Chattanooga in support of their request for the June, July, and August 2004 events was inadequate. Among the problems with their request are: the trajectory analyses were done at such high levels of the atmosphere that mixing of fire emissions with ground level air was highly improbable; there was no comprehensive analysis of the speciated air quality data in the Chattanooga area and receptor modeling techniques were not used to try and identify the sources of the PM_{2.5} mass in the area; and there was no assessment of the impact of regional and local sources of emissions on PM_{2.5} concentrations in Chattanooga.

EPA includes the following documents in support of the decision for the Chattanooga area:

3.B. Chattanooga design value analysis

SECTION 3.B. OF TECHNICAL SUPPORT DOCUMENT FOR PM2.5 DESIGNATIONS SUPPLEMENTAL NOTICE -- APRIL 5, 2005

CHATTANOOGA DESIGN VALUE ANALYSIS FOR 2002-4

Not including invalidation of any data

Area	ST	COU	State	County	Site	Design Value 2001-3	Status 2001-3	Design Value 2002-4	Status 2002-4	Notes 2002-4
Chattanooga	147	065	Tennessee	Hamilton	470650031	16.1		15.7		Meets completeness w/ 'minv' substitution test.
Chattanooga	113	295	Georgia	Walker	132950002	15.5		15.2		
Chattanooga	147	065	Tennessee	Hamilton	470654002	15.2		14.7		
Chattanooga	147	065	Tennessee	Hamilton	470650032	14.2	a	14.2	a	Only 1 partial quarter of data Meets completeness w/ 'maxq' substitution test.
Chattanooga	147	065	Tennessee	Hamilton	470651011	14.1	a	13.8		

After requested flag processing - assuming all requested flags were to be approved

Area	ST	COU	State	County	Site	Design Value 2001-3	Status 2001-3	Design Value 2002-4	Status 2002-4	Notes 2002-4
Chattanooga	147	065	Tennessee	Hamilton	470650031	15.5		14.9	a	Does not meet completeness requirements. Fails 'maxq' substitution test; substituting max quarterly value of 32.5 for missing 2002-Q1 samples yields test DV of 15.5.
Chattanooga	113	295	Georgia	Walker	132950002	15.0		14.5		
Chattanooga	147	065	Tennessee	Hamilton	470654002	15.0		14.2		
Chattanooga	147	065	Tennessee	Hamilton	470650032	14.2	a	14.2	a	Only 1 partial quarter of data Meets completeness w/ 'maxq' substitution test.
Chattanooga	147	065	Tennessee	Hamilton	470651011	13.6	a	13.3		

Design values if 8 exclusions were allowed

Area	ST	COU	State	County	Site	Design Value 2001-3	Status 2001-3	Design Value 2002-4	Status 2002-4	Notes 2002-4
Chattanooga	147	065	Tennessee	Hamilton	470650031	15.9		15.4		Meets completeness w/ 'minv' substitution test.
Chattanooga	113	295	Georgia	Walker	132950002	15.3		14.8		
Chattanooga	147	065	Tennessee	Hamilton	470654002	15.1		14.4		
Chattanooga	147	065	Tennessee	Hamilton	470650032	14.2	a	14.2	a	Only 1 partial quarter of data Meets completeness w/ 'maxq' substitution test.
Chattanooga	147	065	Tennessee	Hamilton	470651011	13.9	a	13.6		

Notes

- All means and design values exclude daily samples invalidated by the State and EPA for various reasons (e.g. equipment malfunction, nearby wildfire, etc.).
- Data completeness: a site is complete for purposes of showing "attainment" if valid samples are obtained for 75% of the scheduled sampling days each quarter for a three-year period.
- The design value "status" columns (for 2001-3 and 2002-4) also take into account data substitution tests to show that a site has complete data. For example, if during a particular quarter, a site has 2 samples less than the number needed to have 75% data capture, one approach provides for the substitution of the maximum quarterly value for the two missing samples. If the design value is below the level of the standard after substituting these higher values, then the site can be deemed to have complete data and be in attainment.

The codes used in the design value status columns are:

NA' = complete, violates NAAQS;

'A' = complete, meets NAAQS;

'na' = incomplete, partial DV exceeds NAAQS;

'a' = incomplete, partial DV meets NAAQS;

'x' = microscale / source oriented, not compared to annual NAAQS

3.C. Memorandum from Stanley Krivo, EPA Region 4, to Richard Guillot, EPA Region 4, Regarding Exceptional Events for Exceedances/Elevated Ozone and PM2.5 Measurements, Jefferson County, AL and Chattanooga-Hamilton County, TN; December 1, 2003

Office Memorandum
Air Quality Modeling and Transportation Section

To: Richard Guillot

Information: Scott Davis
Rick Gillam
Brenda Johnson

From: Stan Krivo

Date: 01 December 2003

Subject: Exceptional Events for Exceedances/Elevated Ozone and PM2.5 Measurements (Jefferson County, AL and Chattanooga-Hamilton County, TN)

The following are my review comments on the justification provided to exempt the monitored measurements of ozone and/or PM2.5 because measurements are considered exceptional events.

October 2000 for Jefferson County, AL

1. Time Series Measurements - The provided measurements of PM2.5 for the Wylam and N. Birmingham monitors reveals similar pattern of measurements for 21-28 October 2000. These measurements do not appear to be outliers. If the ozone 8-hour measurements follow the same pattern as the 24-hour PM2.5, the exceedance measurements of concern will also not be outliers.
2. Fire Locations - The surface winds for the dates of concern show very little transport so only local fires could contribute to the concentration measurements. The specific location of the fire and the start/stop dates and times were not provided to relate to the time series measurements. To determine the affect of the fires on the measurements, the total time series of measurements for all Jefferson monitors should be review for the period when the fires were occurring.

Based on the information provided, only local fires could possibly affect the measurements of concern. More specific information on the fire(s) location, start time and end time are needed to relate the fire emissions to measurements of ozone and PM in the Birmingham area. The provided supporting information is not sufficient nor conclusive enough to eliminate the elevated/exceedance measurements.

2002/2003 for Chattanooga-Hamilton County, TN.

1. Number of Exception Events/Region of Concern - It appears that every elevated or exceedance measurement of ozone or PM is being exempted based on the potential that emissions from fires could have contributed to the concentrations. Because the location of the fires range from the local county to northern Canada, Minnesota, to Mexico, it is likely that a fire would have occurred somewhere in this large region during the period of concern. Therefore, it is most important that the transport mechanism exist and the resultant contribution from the fires be large enough to significantly impact the measured values.
2. Back Trajectories - The back trajectory calculations are used to show that the transport mechanism exists during the period of elevated measurement. Given the transport mechanism exists, the fire's emissions could contribute to the measured concentration. Back trajectories calculations were not performed in a consistent manner for each event. It appears that the only justification needed to show that a fire contributed to an observed elevated measurement is that a back trajectory calculation from any atmospheric level must pass near the location of a fire during some period near the time of the measurement. The atmospheric levels used in the back trajectory calculations range from the surface to 5,000 meters. It should be noted that even given this broad, liberal criteria, the provided trajectories for some events still do not pass close enough to the fire(s) to support the conclusion that transport of fire emissions to the monitor is possible.
3. Concentrations - The back trajectories and the fire maps with the location of possible smoke plumes are not detailed enough to provide conclusive transport information and provide no information of the magnitude of the potential contribution. Given the large distances that the fire emissions must travel to reach the location of concern, the magnitude of the fire plume's concentrations must be small.
4. Routine Fires - The fires in KS and OK that are indicated to have affected the April 2003 measurements in Chattanooga-Hamilton County are annual events. These same fires should have caused problem measurements in the past but the report indicates that since 1990 no other year's measurements were a problem. One exceedance in this period (on 04/25/98) was noted and it was attributed to fires in Mexico. The annual nature of the fires and the lack of past impacts to the measurements, along with the large distances between the fires and Chattanooga-Hamilton County, bring into question the source as well as the magnitude of concentration contributions associated with the KS/OK fires.
5. Time Series Measurements - To support the request for exemption, seasonal time series plots of all measurements should be provided to demonstrate that the requested values are outliers from the rest of the measurements and that their large magnitudes are caused by the noted fires. Should the time series plots show that the requested elevated concentrations or exceedances are within the normal range of measurements, then the events may not be exceptional events.

In summary, I believe the supporting data provided to qualify the elevated and/or exceedance

measurements as exceptional events is not sufficient nor conclusive for this determination. It appears from the frequency of fires, the distant locations for the fires, and the lack of specific detailed consequence analysis for each fire-measurement event make the provided justification insufficient and/or inconclusive to exempt the measured data as exceptional fire-caused events. Additional, more detailed consequence specific information is needed to make this determination.

Please let me know if you have any questions.

3.D. Memorandum from Stanley Krivo, EPA Region 4, to Richard Guillot, EPA Region 4, Regarding 2003 Exception Events for Exceedances/Elevated Ozone and PM2.5 Measurements, Chattanooga-Hamilton County Air Pollution Control Bureau (APCB) November 4, 2004 Letter; December 2, 2004

Office Memorandum
Air Quality Modeling and Transportation Section

To: Richard Guillot

Information: Joel Hansel
Rick Gillam
Brenda Johnson

From: Stan Krivo

Date: 02 December 2004

Subject: 2003 Exception Events for Exceedances/Elevated Ozone and PM2.5 Measurements
Chattanooga-Hamilton County Air Pollution Control Bureau (APCB)
November 4, 2004 Letter

The following are my review comments on the additional information provided in the referenced APCB letter to justification the exemption of three 2003 periods of monitored ozone and PM2.5 measurements because they are considered exceptional events. The original December 2003 exemption request included additional periods.

1. Exception Events/Region of Concern - Three events during 2003 with elevated or exceedance measurements of ozone or PM2.5 are requested for exemption based on the belief that emissions from distance fires caused or significantly contributed to the measured concentrations. The three periods are:

- Ozone April 12, 14, and 15

PM2.5	April 15
- Ozone	June 24, 25, 26
PM2.5	June 26, 29
- Ozone	August 26
PM2.5	August 19, 22, 25, 28

It appears that the selected days for exemption were based on the elevated magnitude of the measured concentrations (e.g., top 10 measurements during year or values exceeding the standards).

For all the events only distant fires were noted as significant reasons for the elevated measurements. Review of more local causes for these measurements were not indicated to have been performed. To understand and more conclusively attribute the elevated measurements to these distant fires, the following are suggested needed studies or information.

- Dates and locations of the identified controlled Kansas fires and Canadian wildfires to correlate with periods of high measurements in region.
- Identification of any other Kansas and Canadian fires during 2003 and corresponding Chattanooga area ambient ozone and PM2.5 measurements to determine the uniqueness of these events to ambient Chattanooga conditions.
- Duration of the elevated pollutant measurements in Chattanooga area needs to be supported. The start and end dates for the burns were not provided. TOMS aerosol observations during each of these events do not provided conclusive evidence of fire plumes transportation to the Chattanooga area.
- Magnitude of the Kansas and Canadian fires contribution to Chattanooga's measurements should be considered. When comparing the ozone and PM2.5 measurements, provided in the new time series plots, on either side of the requested exemption periods to the maximum values on the requested exception days, the distance fires would have to contribute 20 to 40 ppb to the ozone measurements and 15 to 30 ug/m³ to the PM2.5 measurements. Considering the large distance, it appears unlikely that this large a contribution would come from such a distant source.
- More local causes for the identified elevated measurements must be investigated and eliminated. For example, the large power plants in NW Georgia and NE Alabama should be eliminated as possible cause for these elevated measurements. [Note: The TOMS visual for April event indicated large aerosol concentrations in an area of NE Alabama/NW Georgia, general location of large power plants - a possible source of pollutants that could be transported to the Chattanooga area causing the April elevated measurements. The TOMS observations should be related to the back trajectory analyses for a more conclusive argument.]
- Synoptic analyses of the weather events during the identified exceptional periods should be provided. The synoptic conditions along the expected transportation pathways during the events would provide additional information that would be of value in evaluating the possibility of long range transport of pollutants from controlled and wildfire burns.

- Other areas of the SE should be reviewed for these same exceptional event days. If plumes from the distant fires affected the Chattanooga area, they should have also affected other measurements in the SE (e.g., Knoxville, Nashville, and Atlanta). Have these areas also requested exceptional events for the identified days?
2. TOMS Observations - Review of the TOMS videos did not conclusively demonstrate transport of burn emissions to the Chattanooga area. This is especially true considering the TOMS observations are at 10,000 feet or more elevation. The analysis appears to assume that high TOMS concentrations on the days of concern over SE TN are representative of surface concentrations. It also assumes that low TOMS concentrations over SE TN on the days of concern just mean that the fire plume is lower than 10,000 feet - a can't lose situation. Left unanswered is the question of magnitude of the fire plume's contribution to the measurements.
 3. Back Trajectories - Nothing new was provided on the back trajectory calculations. Our previously provided comments on the back trajectory analysis are still applicable. Back trajectory calculations were not performed in a consistent manner for each event. It appeared that the only justification needed to show that a fire contributed to an observed elevated measurement is that a back trajectory calculation from any atmospheric level must pass near the location of a fire during some period near the time of the measurement.
 4. Routine Fires - The fires in KS and OK that are indicated to have affected the April 2003 measurements in Chattanooga-Hamilton County are annual events. These same fires should have caused problem measurements in the past but the report indicates that since 1990, no other year's measurements were a problem. One exceedance in this period (on 04/25/98) was noted and it was attributed to fires in Mexico. The annual nature of the fires and the lack of past impacts to the measurements, along with the large distances between the fires and Chattanooga-Hamilton County, bring into question this source as the cause of the elevated measurement event. This is especially true when more local causes of the elevated concentrations were not eliminated.
 5. Speciation Data - Graphs of speciation data were provided for the 2003 ozone season. It was indicated that the biomass markers were provided however there is no discussion indicating support or non-support for the fires causing the elevated measurements on the requested exceptional event days.

In summary, I believe the new information in the 4 November 2004 Chattanooga-Hamilton County Air Pollution Control Bureau letter does not change the conclusions provided in my 1 December 2003 memorandum on the original request. The evidence provided is insufficient to conclusively support the request to define the April, June, and August 2003 events as exceptional because of the influence of distance agricultural and wild fires. Additional detailed consequence specific analyses and information, such as that suggested in item 1 above, are needed to support this exceptional event request.

Please let me know if you have any questions.

3.E. EPA Review of Trajectory Analysis, March 29 2005

April 15, 2003 Kansas Agricultural Fires

Chattanooga Tennessee did not provide any trajectory analyses.

Back trajectory analysis was performed using start heights of 500 m, 1500 m and 2468 m. The trajectories indicate that except at the top of the mixed layer, air within the mixed layer over Chattanooga came from Georgia and circled around back through Tennessee, Kentucky and Illinois but did not originate in Kansas. The top trajectory indicates it could have originated over Kansas 4 to 5 days prior to April 15. Fires over Kansas around April 10, 2003 would need to be shown in order to provide any evidence of an impact upon Chattanooga.

June 26, 2003 Canadian Fires from Western Ontario

Chattanooga did not provide any trajectory analyses.

Back trajectory analysis was performed using start heights of 500 m, 1000 m and 1908 m. The trajectories indicate air within the mixed layer over Chattanooga was rather stagnant and came from the south and southeast around Georgia and Florida coastal areas, not from Canada.

June 29, 2003 Canadian Fires from Western Ontario

Chattanooga did not provide any trajectory analyses.

Back trajectory analysis was performed using start heights of 500 m, 1000 m and 2020 m. The trajectories indicate that air at low levels of the atmosphere was nearly stagnant and meandered around Alabama and Georgia. However, near the top of the mixed layer the air was shown to have come from central Canada. Although only one trajectory supports it, it does indicate that smoke from the fires in Ontario could have transported down to Tennessee and could have entrained into the mixed layer to the surface in Chattanooga.

August 19, 2003 Canadian Fires

Chattanooga did not provide any trajectory analyses.

Back trajectory analysis was performed using start heights of 500 m, 1000 m, and 1679 m. Trajectories do indicate that the air within the mixed layer over Chattanooga may have originated in south central Canada 3 to 5 days prior to August 19. However, there were no satellite photographs in the supporting documentation to indicate whether smoke was over south central Canada or not during that same time period.

August 22, 2003 Canadian Fires

Chattanooga did not provide any trajectory analyses.

Back trajectory analysis was performed using start heights of 500 m, 1000 m and 1697 m. The trajectories do not show any evidence of originating in Canada within the 120 hour run. They remain within the southeast and midwestern regions of the U.S. Although TOMS satellite photographs show smoke from Canada traveling near Tennessee, the trajectory evidence does not support the smoke entraining down into the mixed layer.

August 25, 2003 Canadian Fires

Chattanooga did not provide any trajectory analyses.

Back trajectory analysis was performed using start heights of 500 m, 1000 m and 1294 m. This analysis does provide evidence that smoke from the Canadian fires may have impacted Chattanooga. Trajectories originate in south central Canada 3 to 5 days prior to their potential impact with Tennessee. The TOMS satellite photographs indicate smoke in south central Canada at the same location as the trajectories at the same time 3 to 5 day period prior to the potential impact over Tennessee. It is uncertain whether the smoke over that region was at the same height as the trajectories though.

August 28, 2003 Canadian Fires

Chattanooga did not provide any trajectory analyses.

Back trajectory analysis was performed using start heights of 500 m, 1000 m and 1723 m. The trajectories do not show any evidence of originating in Canada. They remain within the southeast and midwestern regions of the U.S.

June 8, 2004 Arkansas Agricultural Wheat Fires

Chattanooga performed a trajectory analysis using FNL low resolution data which is not the recommended data set for this analysis. They used start heights of 7000 m, 6500 m and 6750 m. These start heights are inappropriate because they are well above the calculated mixed layer.

More appropriate back trajectories were performed using EDAS high resolution data and start heights of 500 m, 1000 m and 1834 m. These trajectories show evidence against any smoke from Arkansas moving over Chattanooga and affecting the mixed layer. The trajectories come from a southeast direction near the Georgia and Florida coasts, not from a westward direction from Arkansas.

June 11, 2004 Arkansas Agricultural Wheat Fires

Chattanooga performed a trajectory analysis using FNL low resolution data which is not the recommended data set for this analysis. They used start heights of 9000 m, 8000 m and 7000 m. These start heights are inappropriate because they are well above the calculated mixed layer.

More appropriate back trajectories were performed using EDAS high resolution data and start heights of 500 m, 1500 m and 2154 m. These trajectories do not show any evidence of originating in Arkansas. They indicate that the air meandered throughout eastern Tennessee, Alabama and Georgia within 3 days prior to June 11.

July 17, 2004 Alaskan Fires

Chattanooga performed a trajectory analysis using FNL low resolution data which is not the recommended data set for this analysis. They used start heights of 4000 m, 5000 m and 7000 m. These start heights are inappropriate because they are well above the calculated mixed layer.

More appropriate back trajectories were performed using EDAS high resolution data and start heights of 500 m, 1000 m and 1484 m. These trajectories originate over south central Canada about 5 days prior to July 17. TOMS satellite data shows smoke from Alaska traveling down into south central Canada about 2 to 3 days prior to July 17. According to the trajectories, the timing appears to be off to provide evidence that the Alaskan smoke impacted Chattanooga.

July 20, 2004 Alaskan Fires

Chattanooga performed a trajectory analysis using FNL low resolution data which is not the recommended data set for this analysis. They also used inappropriate start heights of 3000 m, 7000 m and 9000 m, which are all above the calculated mixed layer height.

Appropriate back trajectory analysis was performed using high resolution EDAS data and start heights of 500 m, 1000 m and 1834 m. This analysis does provide evidence that smoke from the Alaskan fires may have impacted Chattanooga Tennessee. Trajectories originate in south central Canada 5 days prior to their potential impact with Tennessee. The TOMS satellite photographs indicate smoke from Alaska at the same location in south central Canada as the trajectories at the same time 5 days prior to the potential impact over Tennessee. It is uncertain whether the smoke over that region was at the same height as the trajectories though.

August 4, 2004 Alaskan and Canadian Fires

Chattanooga performed a trajectory analysis using FNL low resolution data which is not the recommended data set for this analysis. They also used inappropriate start heights of 2000 m, 3000 m and 4000 m, which are all above the calculated mixed layer height.

Appropriate back trajectory analysis was performed using start heights of 500 m, 1000 m and 1516 m. Comparing these trajectories with the satellite photographs does indicate that the smoke from the Alaskan and Canadian fires could have impacted Chattanooga. The trajectories intersect the smoke on the photographs. There is some uncertainty about the height of the smoke and whether it was at the same levels as the trajectories.

August 10, 2004 Alaskan and Canadian Fires

Chattanooga performed a trajectory analysis using FNL low resolution data which is not the recommended data set for this analysis. They also used one inappropriate start height of 4000 m, which is above the calculated mixed layer height.

More appropriate back trajectory analysis was performed using start heights of 500 m, 1500 m and 2138 m, all within the calculated mixed layer height. The trajectories do not provide evidence that smoke from the Alaskan and Canadian fires impacted Chattanooga based on the satellite photographs provided. The day before, on August 9, the trajectories meandered to the south and east of Chattanooga when the satellite photographs indicate the smoke was north and west of Chattanooga that day. Satellite photographs show the smoke moving across the state of Tennessee from the northwest to the southeast which appear to be more indicative of the winds at higher heights above the mixed layer. There is some uncertainty that the trajectories could have intersected the smoke several days before since they came from the north, but satellite photographs were not provided for the previous days so it could not be verified.

August 16, 2004 Alaskan and Canadian Fires

Chattanooga performed a trajectory analysis using high resolution EDAS data. They used an inappropriate start height of 6000 m, well above the mixed layer.

Appropriate back trajectory analysis was performed using start heights of 500 m, 1000 m and 1784 m. One trajectory does originate from south central Canada but two trajectories do not and they remain in the southeast region of the U.S. This indicates that smoke from Canada could have transported south to Tennessee although only one trajectory at one level supports it.

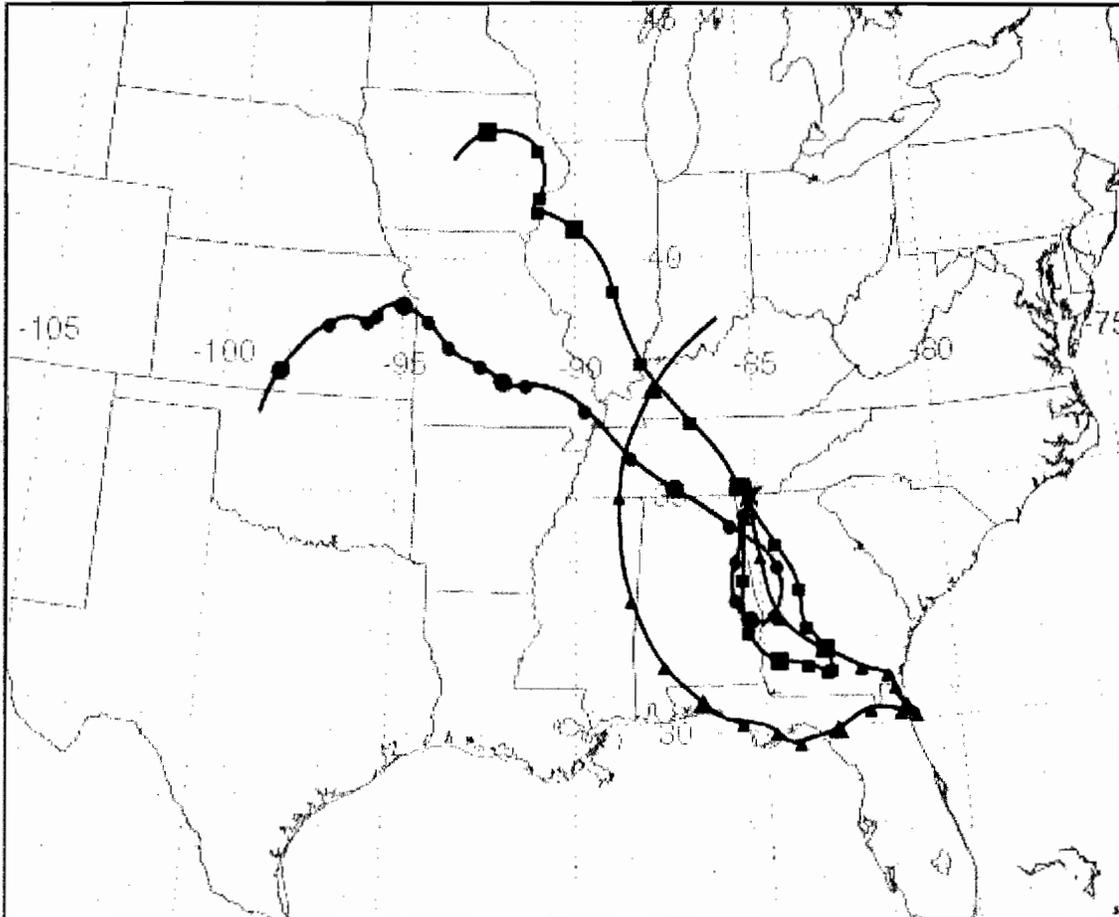
August 19, 2004 Alaskan and Canadian Fires

Chattanooga performed a trajectory analysis using FNL low resolution data which is not the recommended data set for this analysis. They used start heights of 1000 m, 2000 m and 3000 m. The 3000 m start height is inappropriate because it is above the calculated mixed layer. The 3000 m start height trajectory is the only trajectory that originated in Canada. The other lower level trajectories remained in the southern U.S.

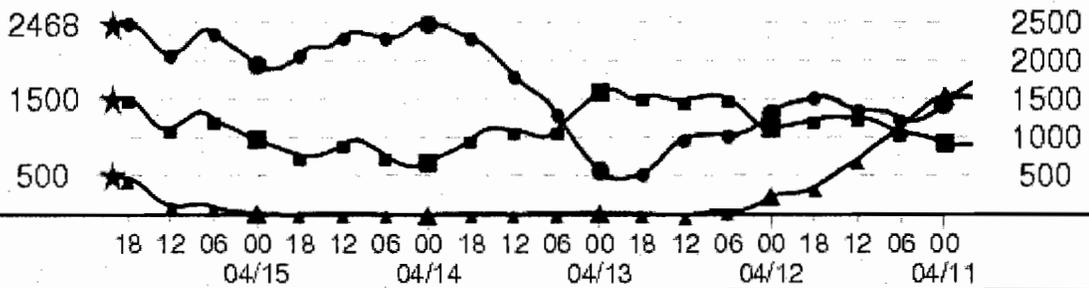
More appropriate back trajectory analysis was performed using start heights of 500 m, 1000 m and 2234 m. These trajectories were also performed using high resolution EDAS data. These trajectories do not provide any evidence of smoke transport from Canada or Alaska and the trajectories remained in the south and central regions of the U.S.

NOAA HYSPLIT MODEL
 Backward trajectories ending at 20 UTC 15 Apr 03
 EDAS Meteorological Data

Source ★ at 35.02 N 85.18 W



Meters AGL

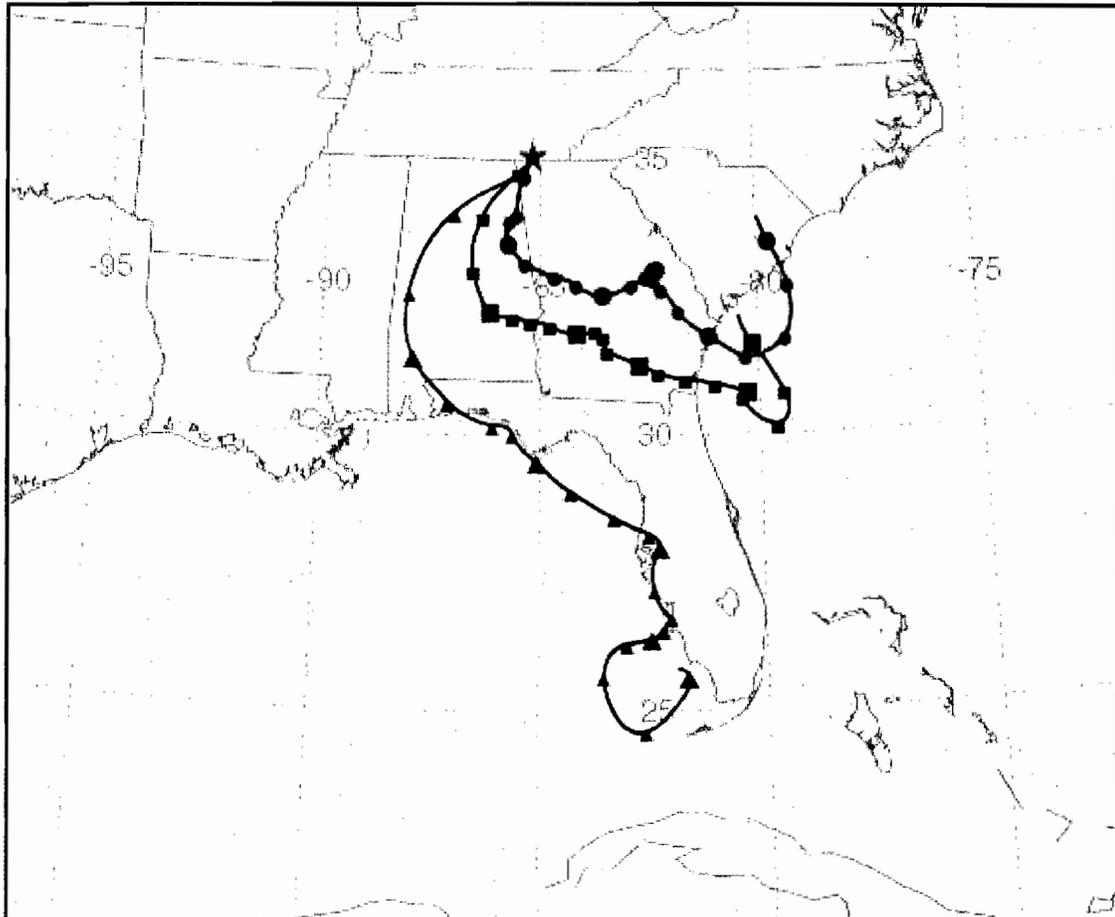


Job ID: 328802 Job Start: Mon Mar 28 21:20:20 GMT 2005
 lat.: 35.02 lon.: -85.18 hgts: 500, 1500, 2468 m AGL

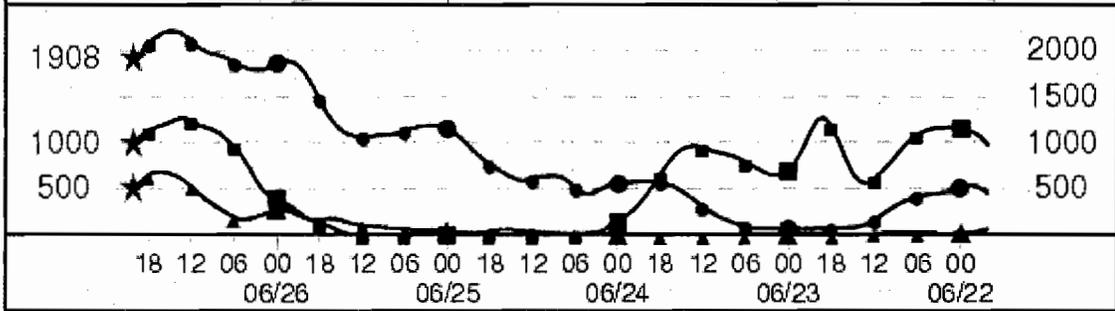
Trajectory Direction: Backward Duration: 120 hrs Meteo Data: EDAS
 Vertical Motion Calculation Method: Model Vertical Velocity
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

NOAA HYSPLIT MODEL
 Backward trajectories ending at 20 UTC 26 Jun 03
 EDAS Meteorological Data

Source ★ at 35.02 N 85.18 W



Meters AGL

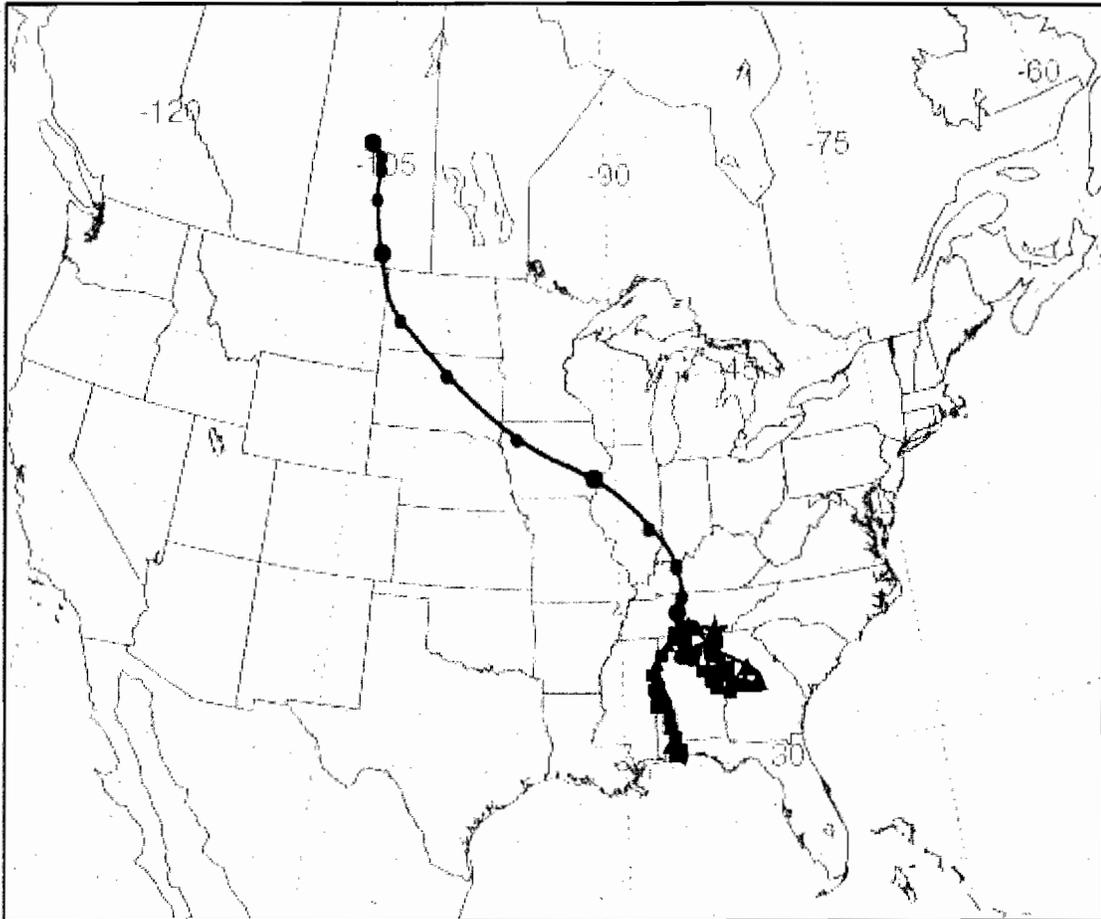


Job ID: 328623 Job Start: Mon Mar 28 20:54:11 GMT 2005
 lat: 35.02 lon.: -85.18 hghts: 500, 1000, 1908 m AGL

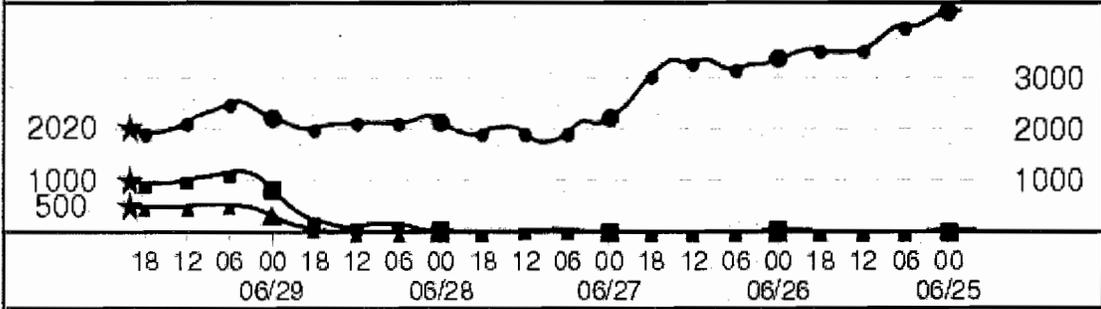
Trajectory Direction: Backward Duration: 120 hrs Meteo Data: EDAS
 Vertical Motion Calculation Method: Model Vertical Velocity
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

NOAA HYSPLIT MODEL
 Backward trajectories ending at 20 UTC 29 Jun 03
 EDAS Meteorological Data

Source ★ at 35.02 N 85.18 W

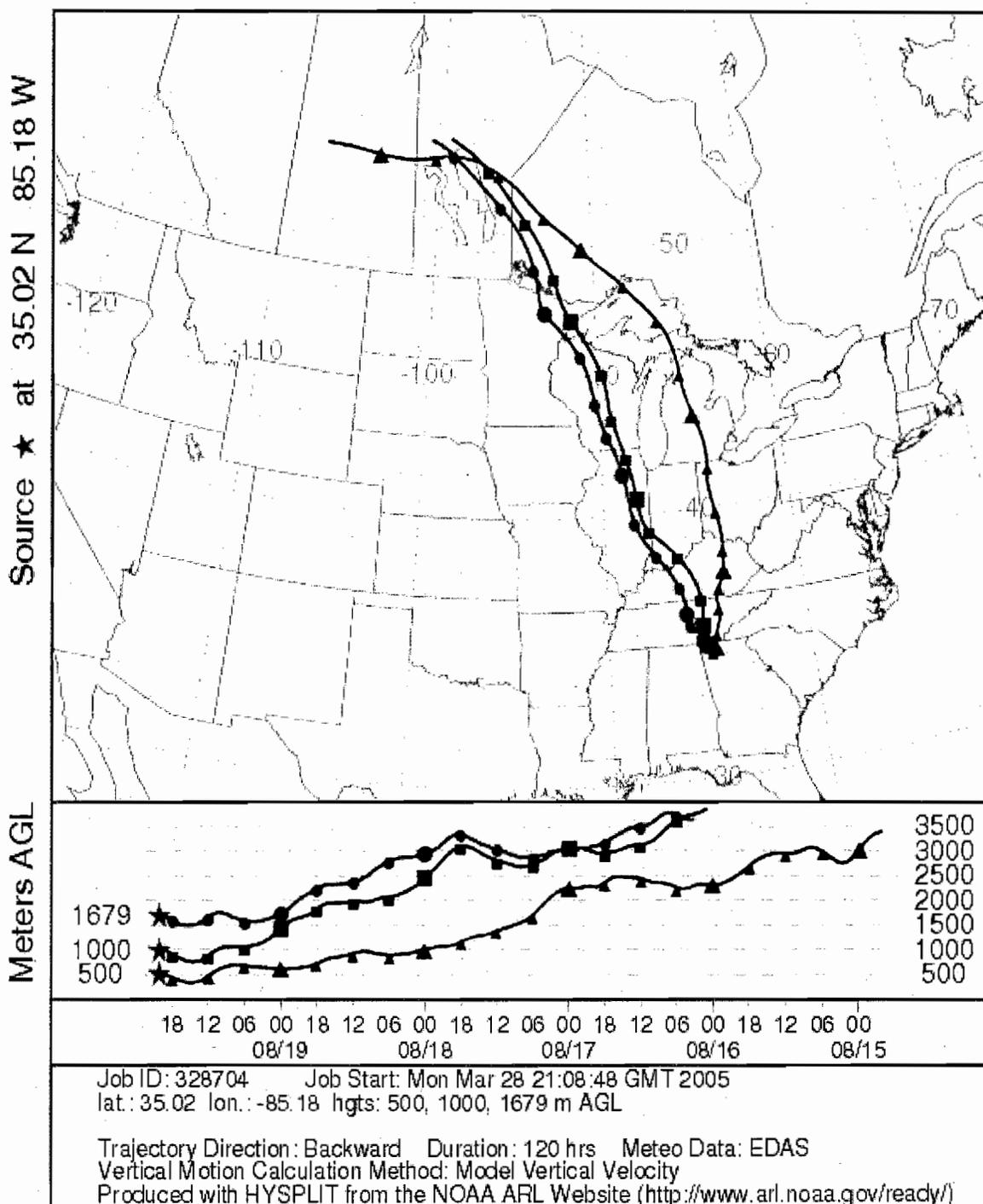


Meters AGL

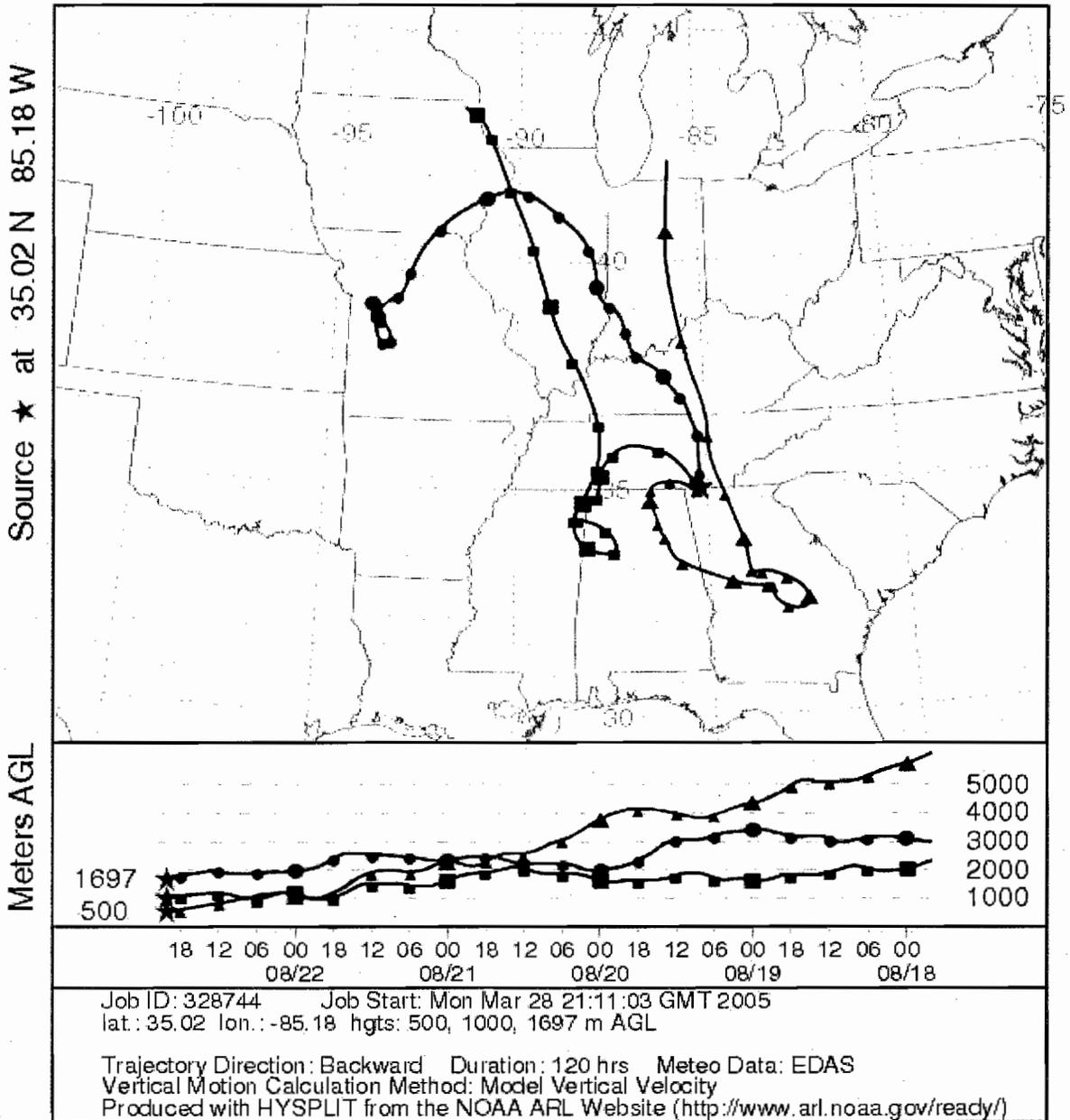


Job ID: 328679 Job Start: Mon Mar 28 21:00:18 GMT 2005
 lat: 35.02 lon.: -85.18 hgts: 500, 1000, 2020 m AGL
 Trajectory Direction: Backward Duration: 120 hrs Meteo Data: EDAS
 Vertical Motion Calculation Method: Model Vertical Velocity
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

NOAA HYSPLIT MODEL
 Backward trajectories ending at 20 UTC 19 Aug 03
 EDAS Meteorological Data

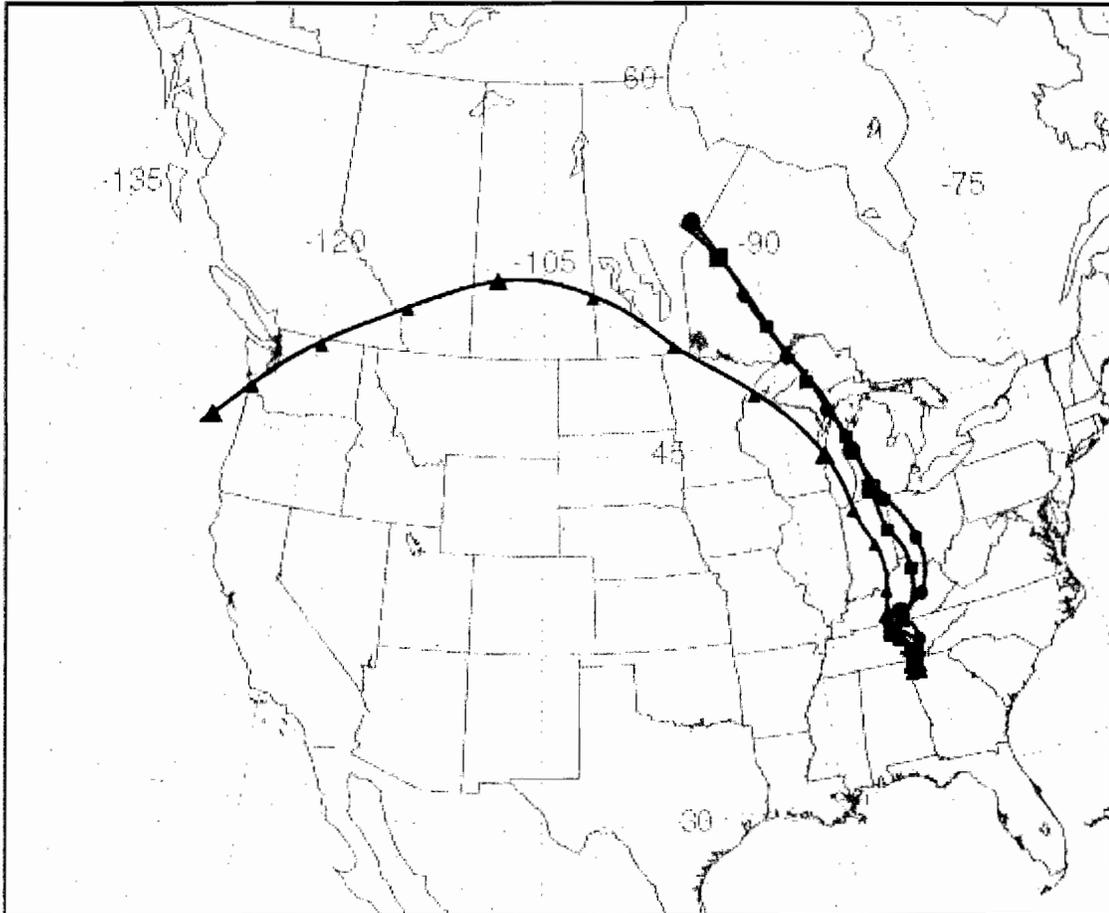


NOAA HYSPLIT MODEL
 Backward trajectories ending at 20 UTC 22 Aug 03
 EDAS Meteorological Data

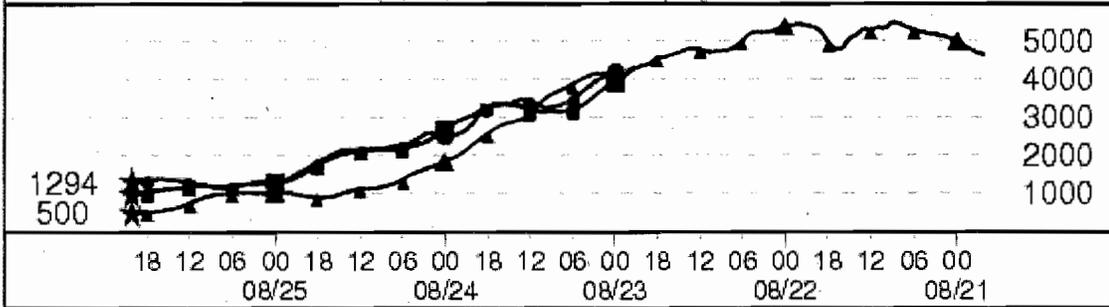


NOAA HYSPLIT MODEL
 Backward trajectories ending at 20 UTC 25 Aug 03
 EDAS Meteorological Data

Source ★ at 35.02 N 85.18 W



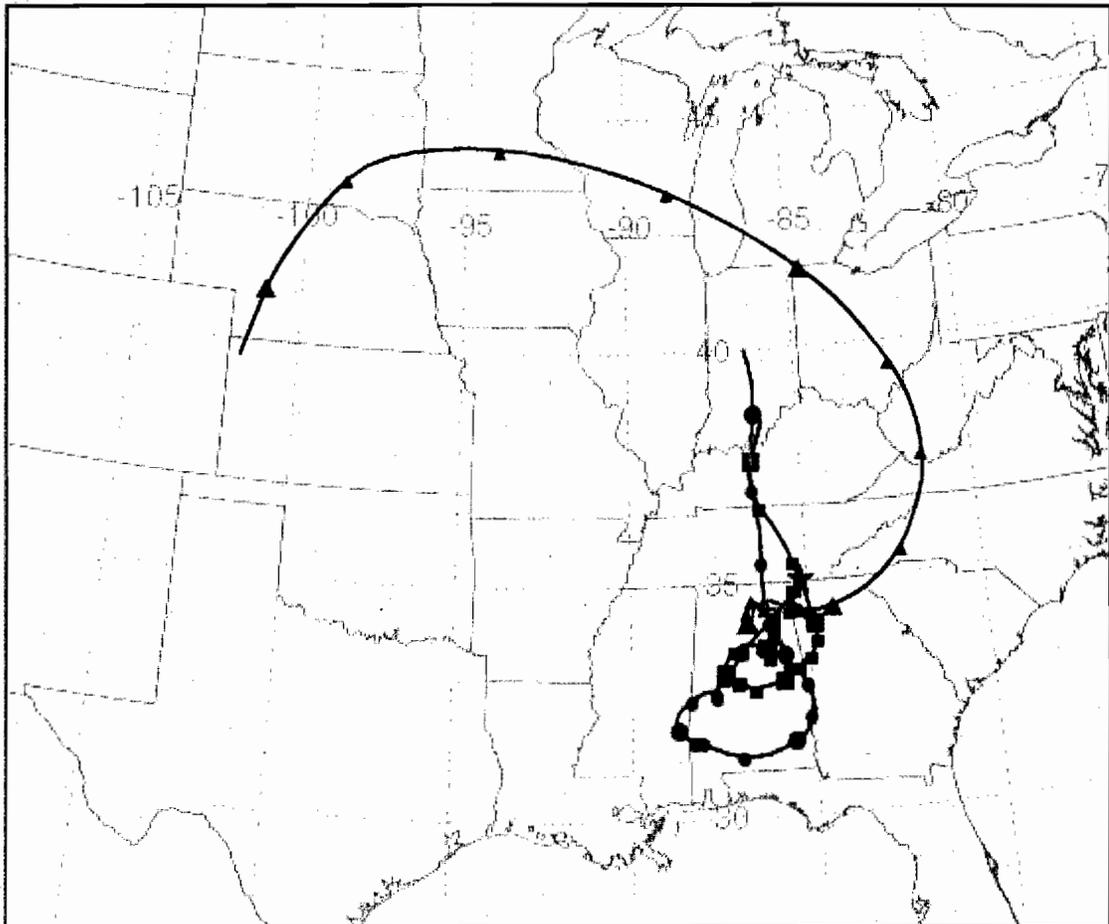
Meters AGL



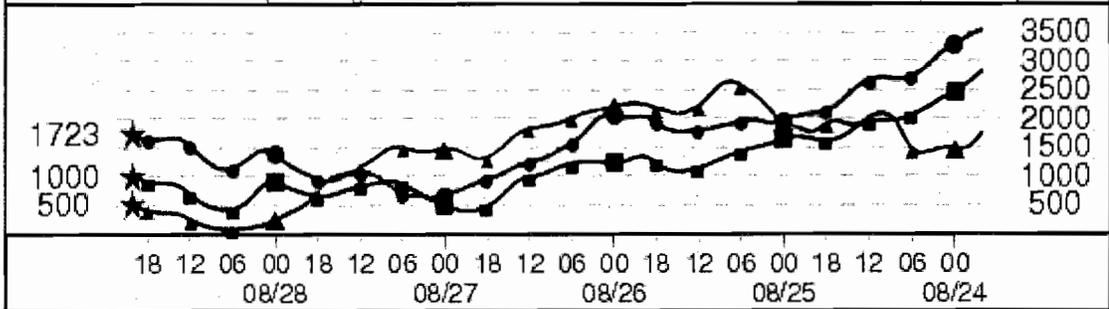
Job ID: 328759 Job Start: Mon Mar 28 21:12:50 GMT 2005
 lat: 35.02 lon.: -85.18 hgts: 500, 1000, 1294 m AGL
 Trajectory Direction: Backward Duration: 120 hrs Meteo Data: EDAS
 Vertical Motion Calculation Method: Model Vertical Velocity
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

NOAA HYSPLIT MODEL
 Backward trajectories ending at 20 UTC 28 Aug 03
 EDAS Meteorological Data

Source ★ at 35.02 N 85.18 W



Meters AGL

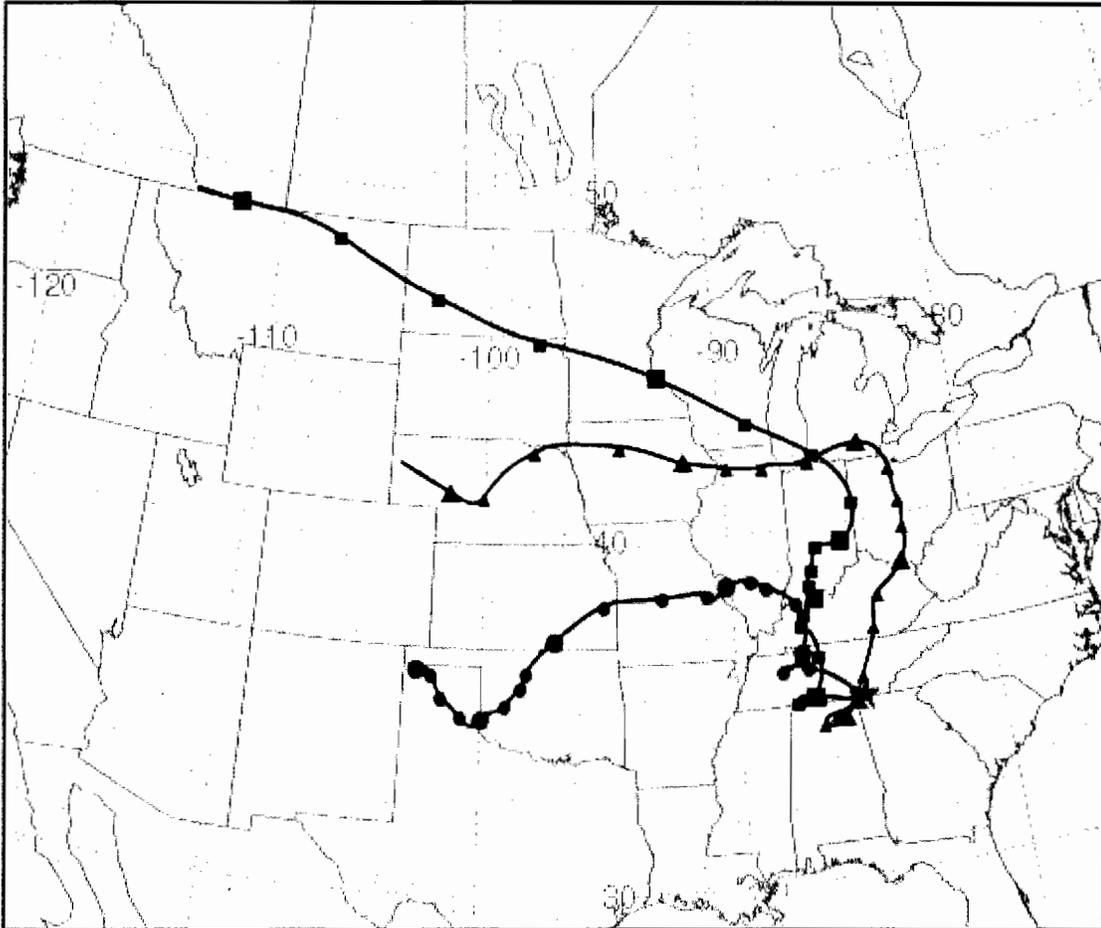


Job ID: 328786 Job Start: Mon Mar 28 21:15:35 GMT 2005
 lat: 35.02 lon.: -85.18 hgts: 500, 1000, 1723 m AGL

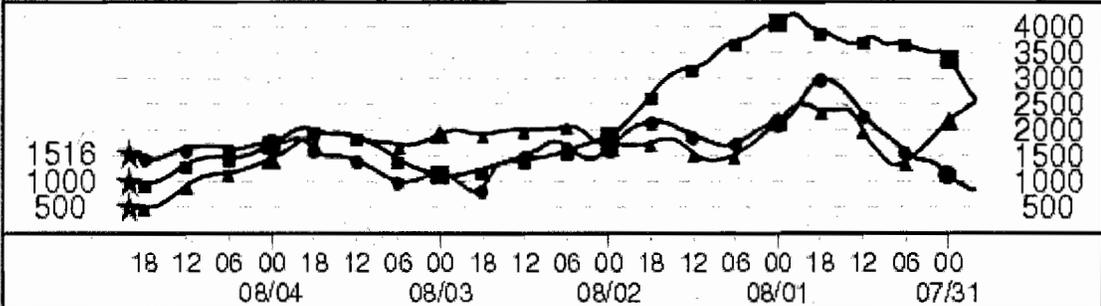
Trajectory Direction: Backward Duration: 120 hrs Meteo Data: EDAS
 Vertical Motion Calculation Method: Model Vertical Velocity
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

NOAA HYSPLIT MODEL
 Backward trajectories ending at 20 UTC 04 Aug 04
 EDAS Meteorological Data

Source ★ at 35.02 N 85.18 W



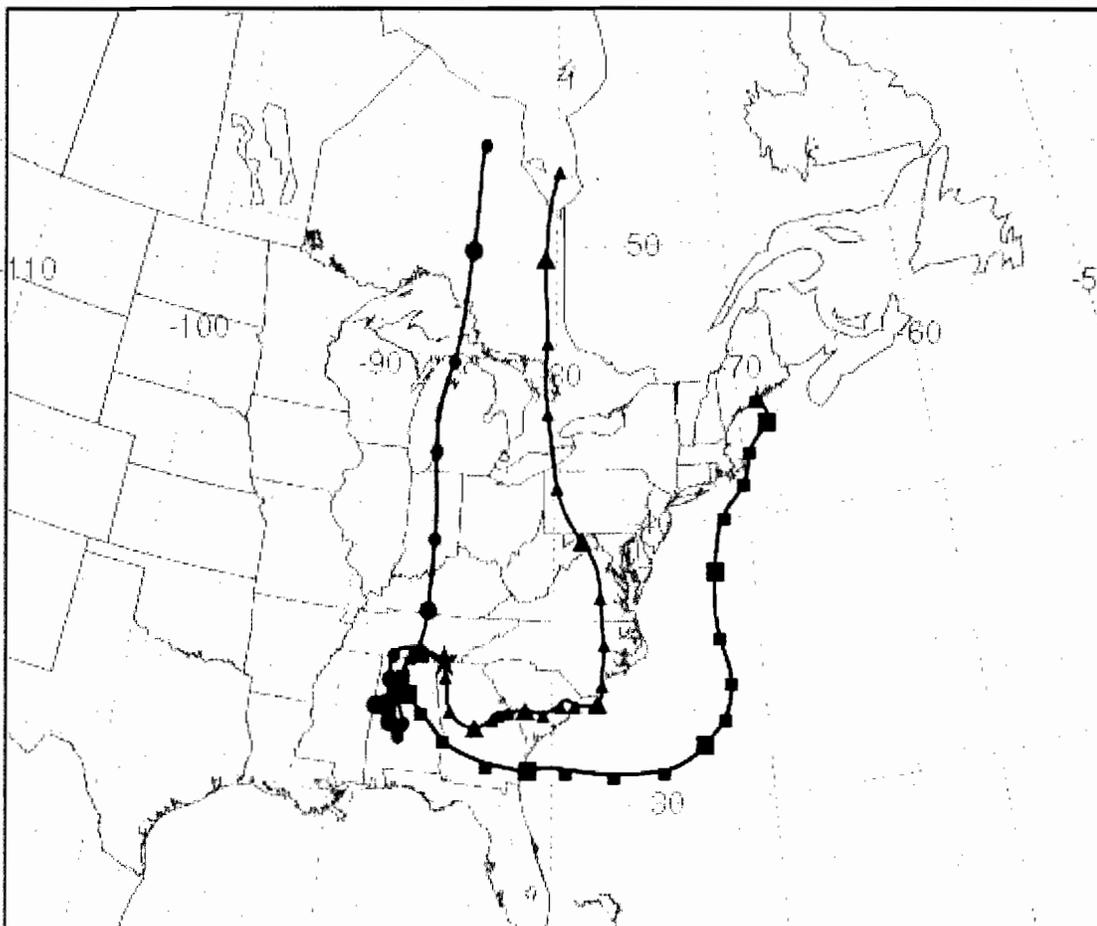
Meters AGL



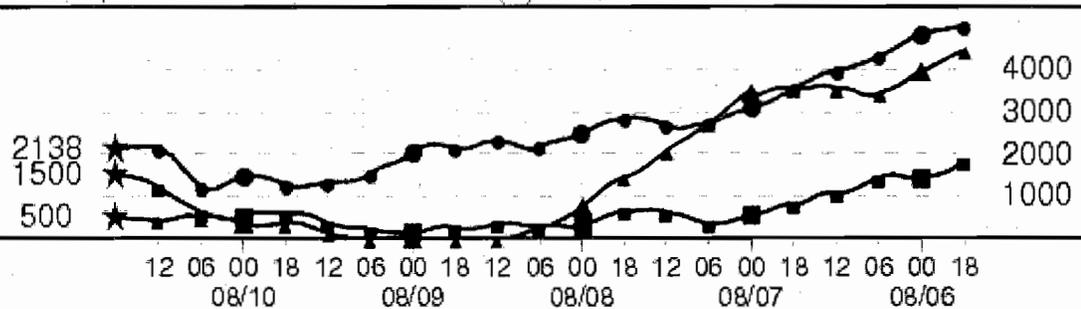
Job ID: 335233 Job Start: Tue Mar 29 15:46:37 GMT 2005
 lat.: 35.02 lon.: -85.18 hgts: 500, 1000, 1516 m AGL
 Trajectory Direction: Backward Duration: 120 hrs Meteo Data: EDAS40
 Vertical Motion Calculation Method: Model Vertical Velocity
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

NOAA HYSPLIT MODEL
 Backward trajectories ending at 18 UTC 10 Aug 04
 EDAS Meteorological Data

Source ★ at 35.02 N 85.18 W



Meters AGL

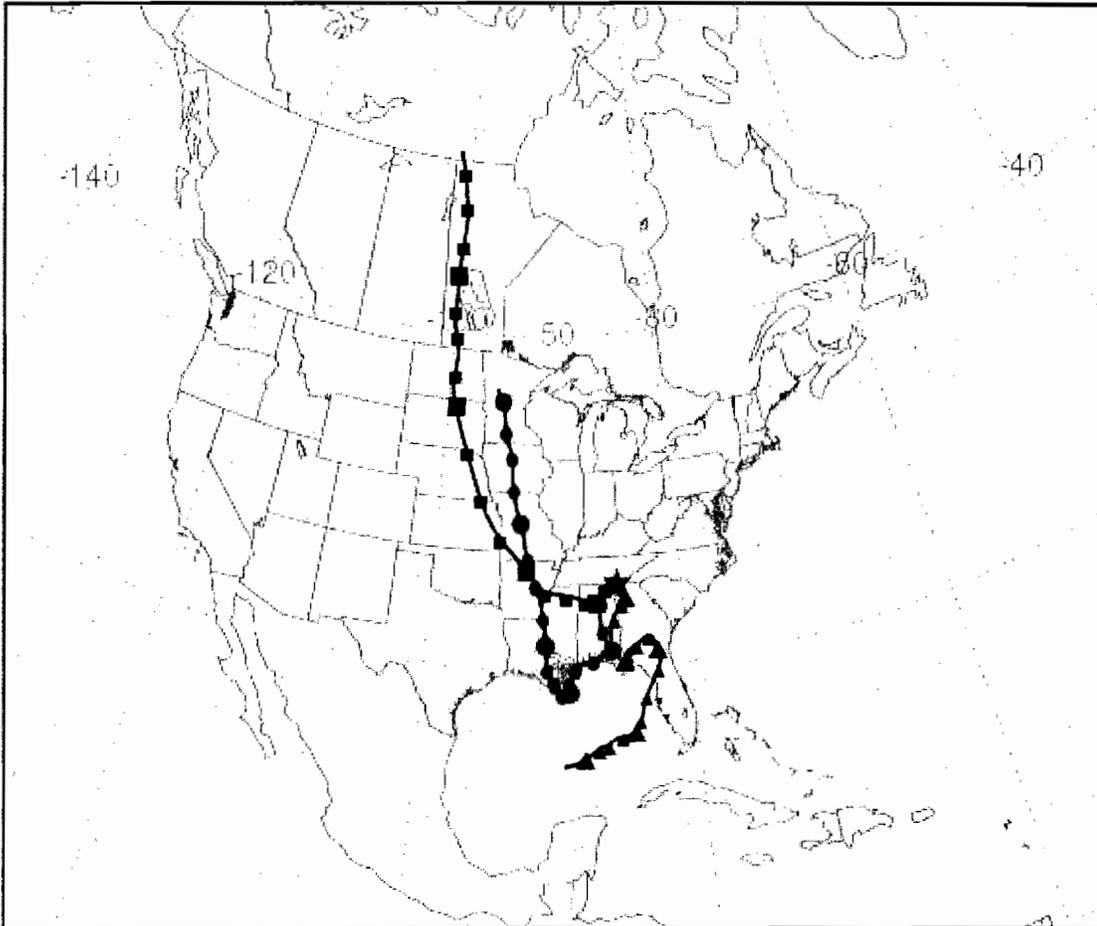


Job ID: 335272 Job Start: Tue Mar 29 15:50:11 GMT 2005
 lat: 35.02 lon.: -85.18 hgts: 500, 1500, 2138 m AGL

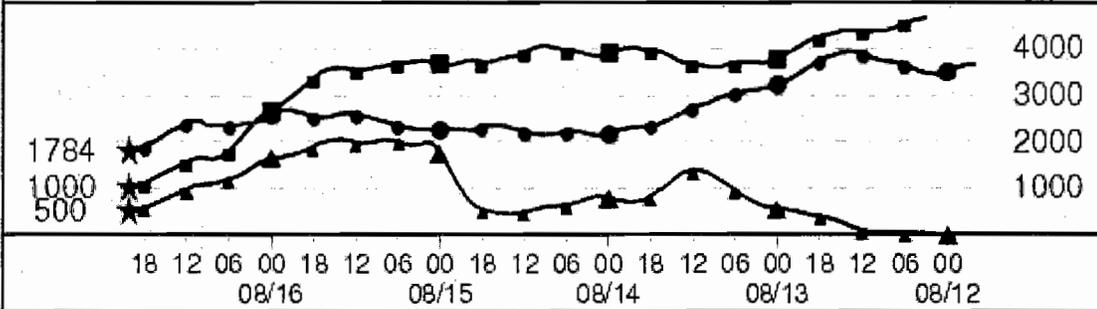
Trajectory Direction: Backward Duration: 120 hrs Meteo Data: EDAS40
 Vertical Motion Calculation Method: Model Vertical Velocity
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

NOAA HYSPLIT MODEL
 Backward trajectories ending at 20 UTC 16 Aug 04
 EDAS Meteorological Data

Source ★ at 35.02 N 85.18 W



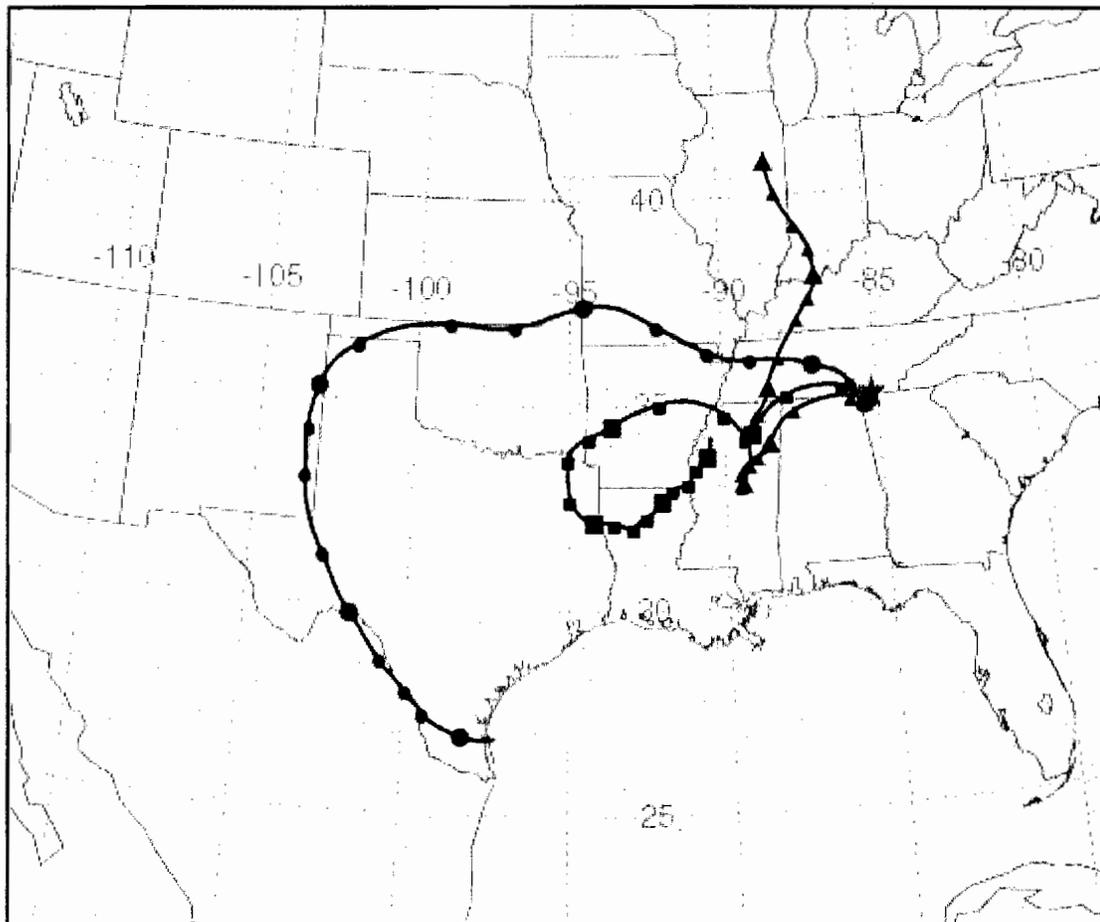
Meters AGL



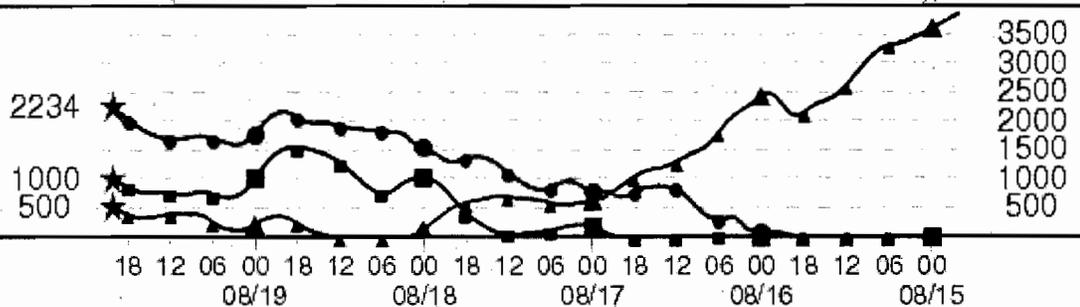
Job ID: 335848 Job Start: Tue Mar 29 16:14:06 GMT 2005
 lat: 35.02 lon.: -85.18 hgts: 500, 1000, 1784 m AGL
 Trajectory Direction: Backward Duration: 120 hrs Meteo Data: EDAS40
 Vertical Motion Calculation Method: Model Vertical Velocity
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

NOAA HYSPLIT MODEL
 Backward trajectories ending at 20 UTC 19 Aug 04
 EDAS Meteorological Data

Source ★ at 35.02 N 85.18 W



Meters AGL



Job ID: 335976 Job Start: Tue Mar 29 16:20:59 GMT 2005
 lat.: 35.02 lon.: -85.18 hgts: 500, 1000, 2234 m AGL

Trajectory Direction: Backward Duration: 120 hrs Meteo Data: EDAS40
 Vertical Motion Calculation Method: Model Vertical Velocity
 Produced with HYSPLIT from the NOAA ARL Website (<http://www.arl.noaa.gov/ready/>)

**SECTION 3.E. ANALYSES OF CHEMICAL COMPOSITION DATA FOR
CHATTANOOGA.**

Analysis of Speciation Data in Chattanooga, TN for Flagged Days in 2003 and 2004

U.S. EPA

April 5, 2005

Dates

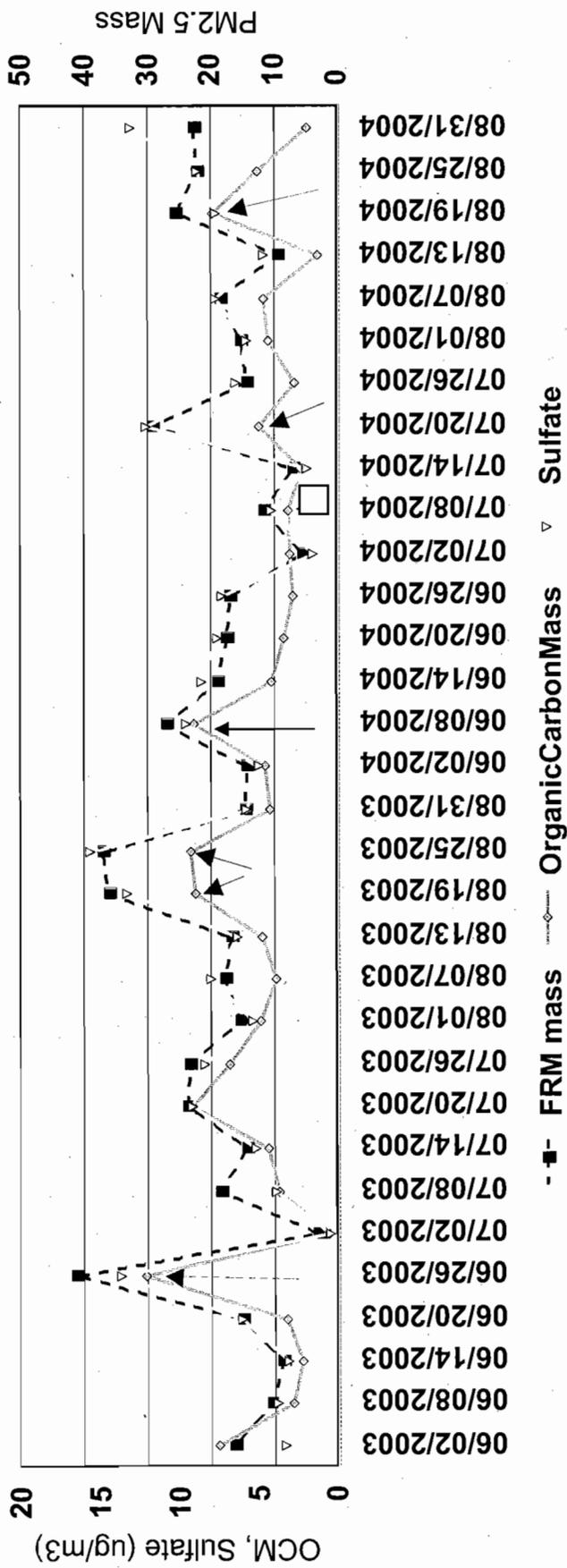
- Fifteen dates in 2003 and 2004 identified by Chattanooga for possible fire impacts:
 - 4/15/03; 6/26/03; 6/29/03; 8/19/03; 8/22/03; 8/25/03; 8/28/03; 6/8/04; 6/11/04; 7/17/04; 7/20/04; 8/4/04; 8/10/04; 8/16/04; and 8/19/04.
- Out of these fifteen, we have identified 8 days as being more possible fire days than the other 7:
 - 4/15/03; 6/29/03; 8/19/03; 8/25/03; 7/20/04; 8/4/04; 8/10/04; and 8/16/04.

When are speciation data available?

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- At the Chattanooga speciation site (AIRS ID: 470654002), data are available (during summers of 2003 and 2004) for the following subset of days that were identified in the previous slide as fire days:
 - 6/26/03; 8/19/03; 8/25/03; 6/8/04, 7/20/04, and 8/19/04
 - Though not in the summer of 2003, speciation data is also available on 4/15/03, which was previously identified as a possible fire date by Chattanooga.
- The Chattanooga speciation site monitors on a 1-in-6 day schedule.

Q3 2003 and 2004, Chatanooga



Chattanooga Summary

Summary of Fire Dates	FRM Mass	OCM	EC	Potassium	Sulfate
06/26/2003	41.4	12.138	0.8	0.1	12.7
08/19/2003	36.1	8.974	0.69	0.063	13.3
09/05/2003	37.2	9.226	0.97	0.07	13.7
09/23/2004	27	9.058	0.67	0.10	9.7
07/20/2004	29.2	4.97	0.51	0.33	22.1
08/13/2004	25.6	7.532	0.74	0.155	7.5
04/15/2003	31	14.8	1.58	0.173	7.81

Note: Mass shown in yellow for 8/19/03 is gravimetric mass not FRM mass.

Some Summary Stats

Q3 2003 and 2004	FRM Mass	OCM	EC	Potassium	Sulfate
Fire Days (n=6)	32.75	8.71	0.73	0.08	12.00
Non Fire Days (n=26)	15.08	3.90	0.51	0.06	5.82

Max on nonFire Days
Min on nonFire Days

23.70	9.21	0.82	0.22	13.10
3	0.588	0.12	0.0207	0.47

Observations

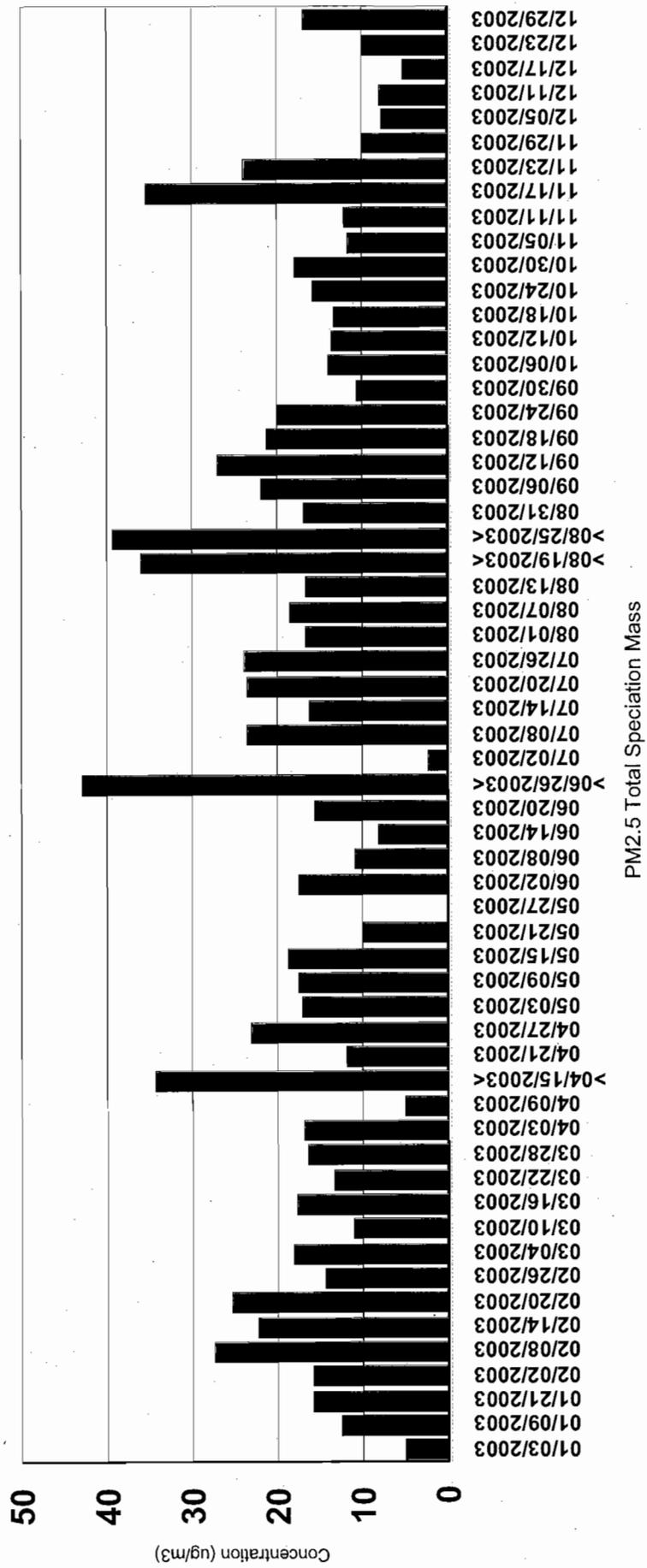
- 1. Comparison of Chattanooga data to historical fire events (like the Quebec fires) indicates the impacts are rather small and inconclusive.
- 2. Analyses of past fire events haven't shown high values for sulfates. For the days analyzed here, we do see high sulfate values.
- 3. Potassium is slightly higher on some flagged dates, but not conclusively so, as some non-flagged dates also have high potassium levels. There is also some uncertainty about the use of potassium measurements as a marker for fire. Elevated organic carbon levels is the most accepted marker of fire events.
- 4. There appears to be enough evidence to say that on these dates the elevated PM_{2.5} seems to be caused by the combination of higher sulfate levels driven by regional emissions and high temperatures, and by increases in organic carbon levels (potentially from fire events, but not conclusively from such events).
- 5. Comparison of Chattanooga speciation data to nearby Nashville speciation data shows similar patterns for these flagged days compared to non-flagged days during the same period of time.

Additional Analysis of Chattanooga PM_{2.5} Chemical Composition Data for 2003-2004

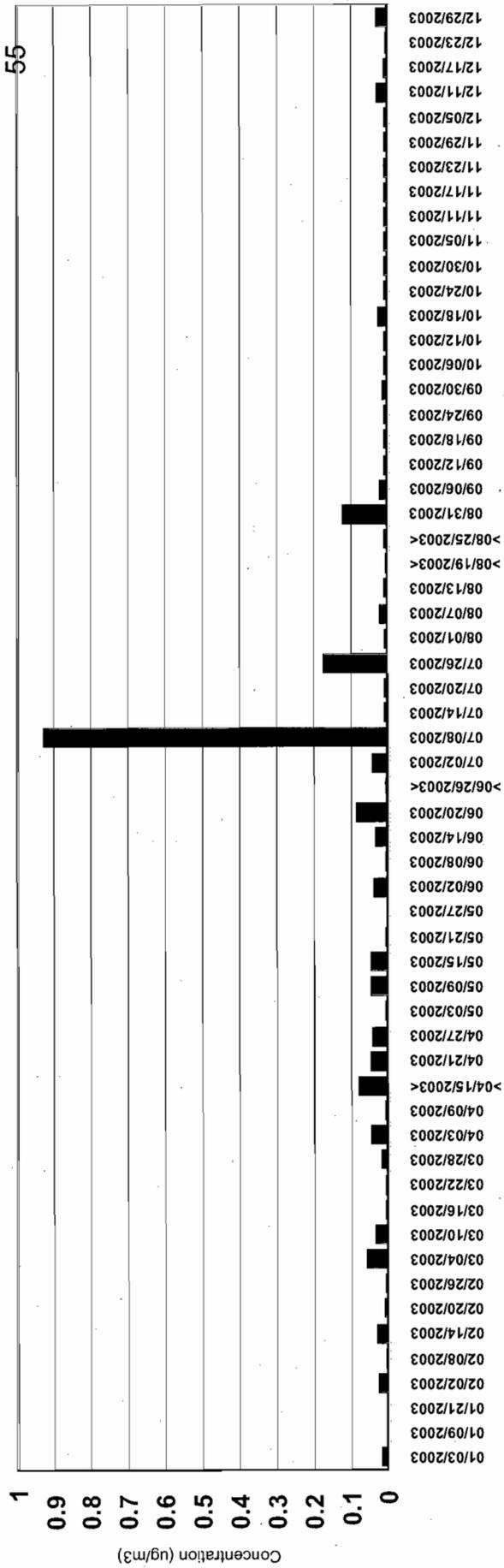
U.S. EPA

Chattanooga PM2.5 Chemical Composition Data for 2003

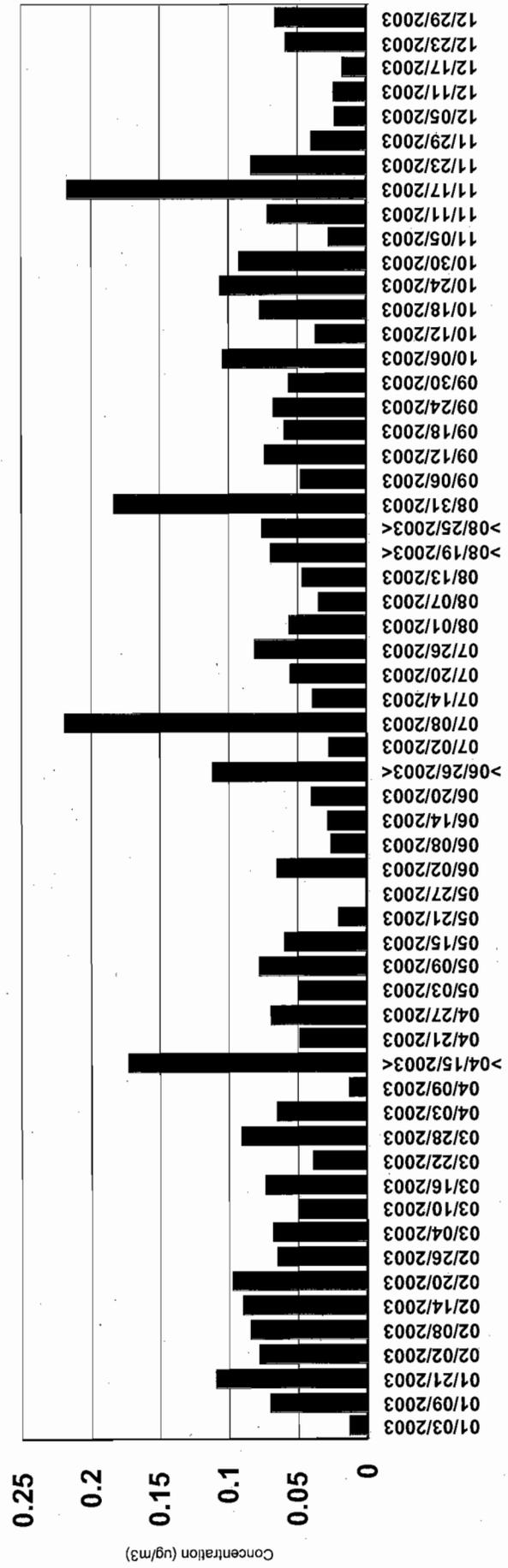
Chattanooga, TN - 2003



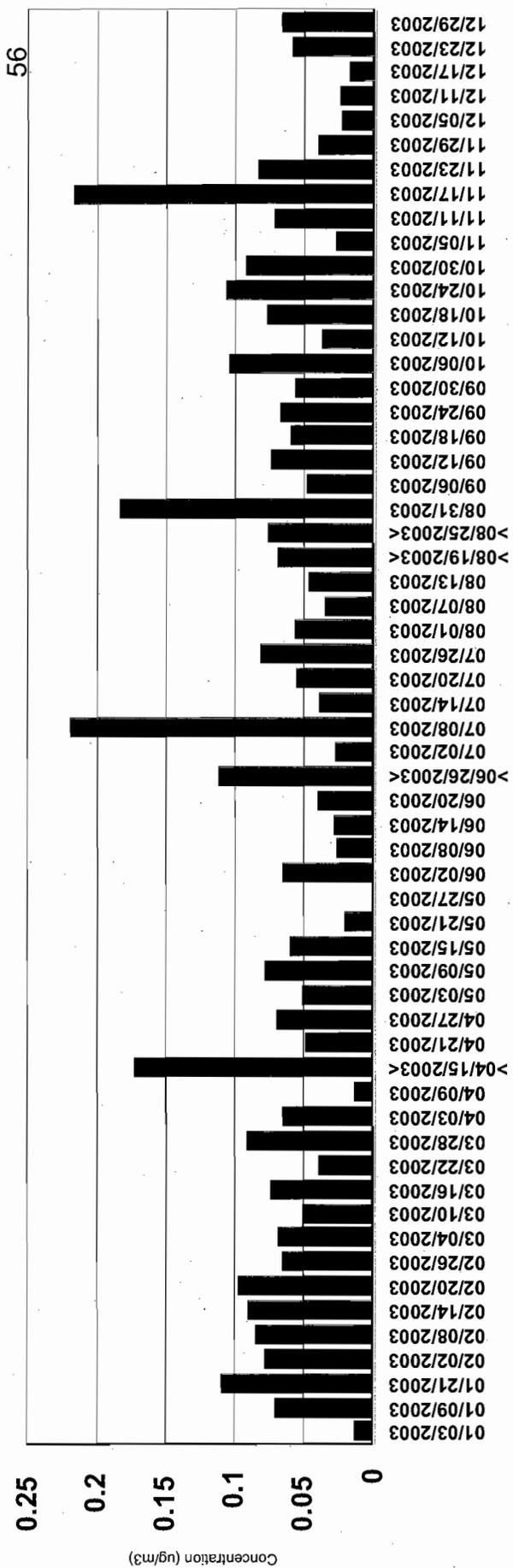
Aluminium - 2003 - Chattanooga



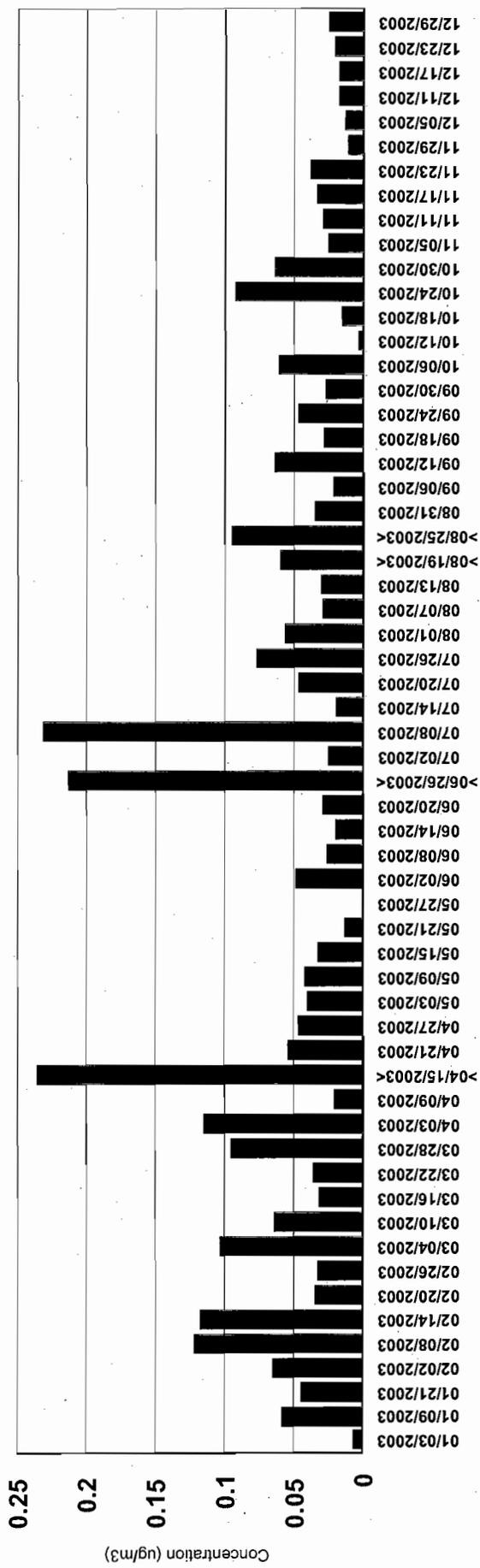
Chattanooga, TN - Potassium 2003



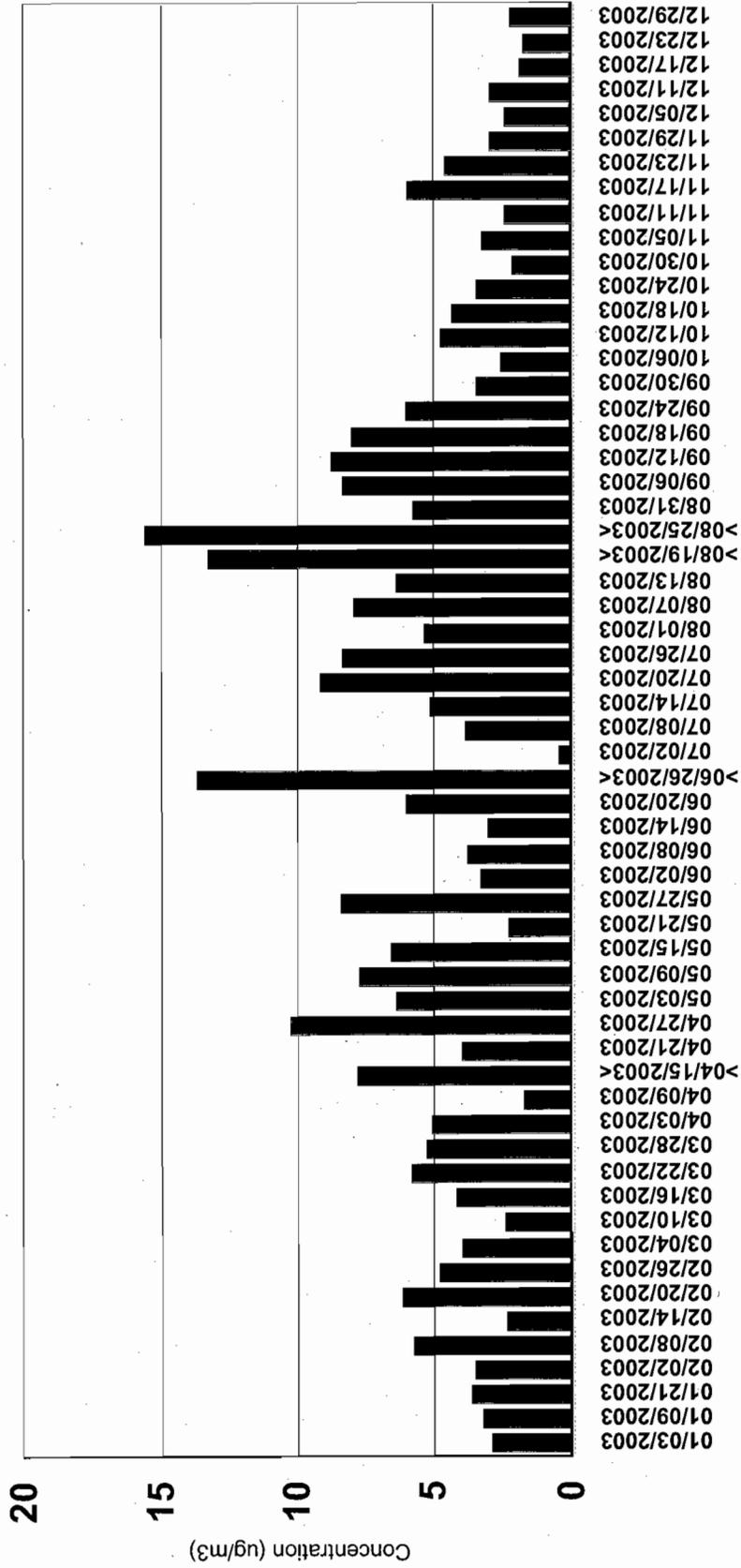
Chattanooga, TN - Potassium 2003



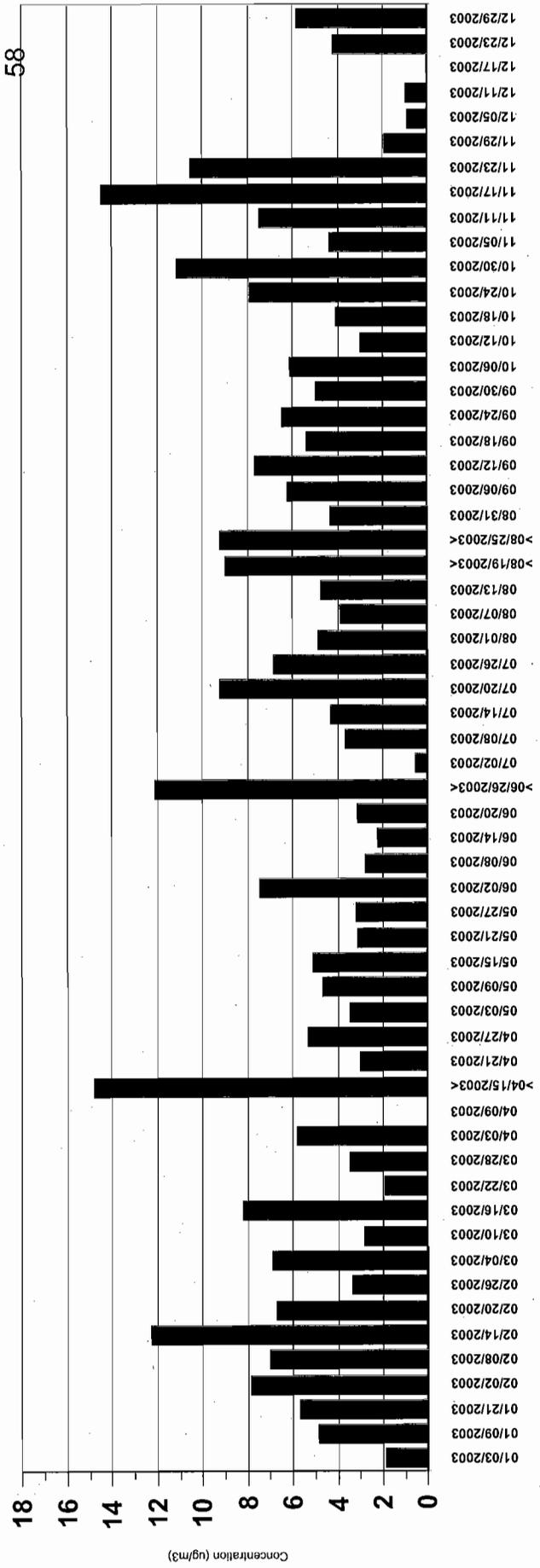
Chattanooga, TN - Calcium 2003



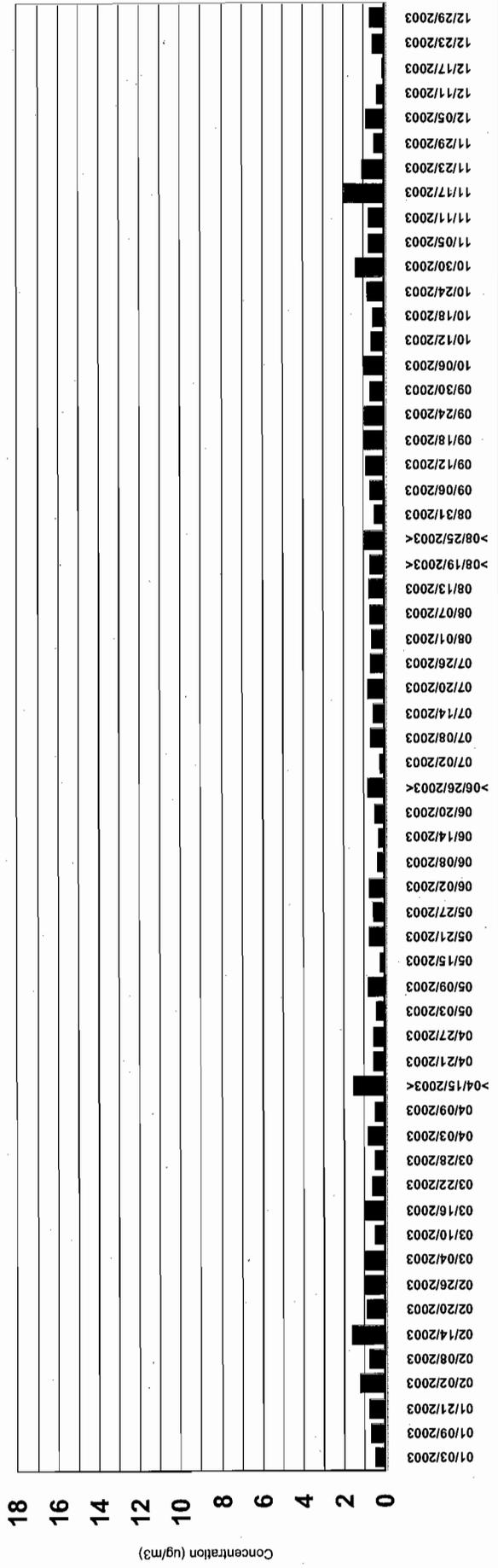
Chattanooga, TN - Sulfate 2003



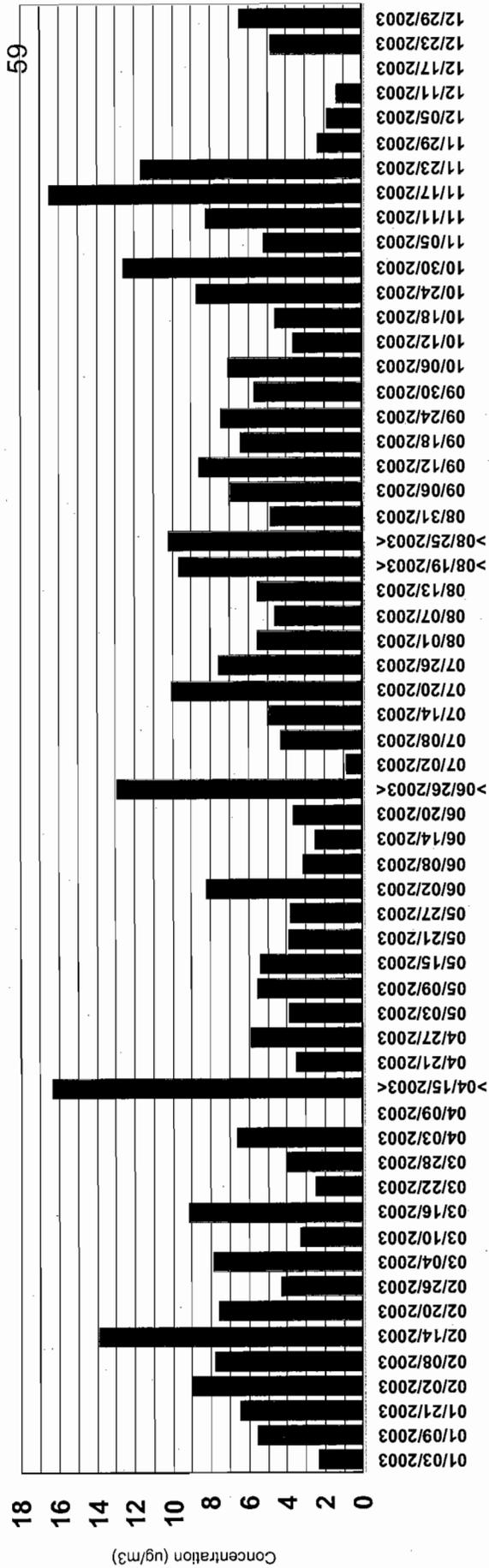
Chattanooga, TN - Organic Carbon Mass - 2003



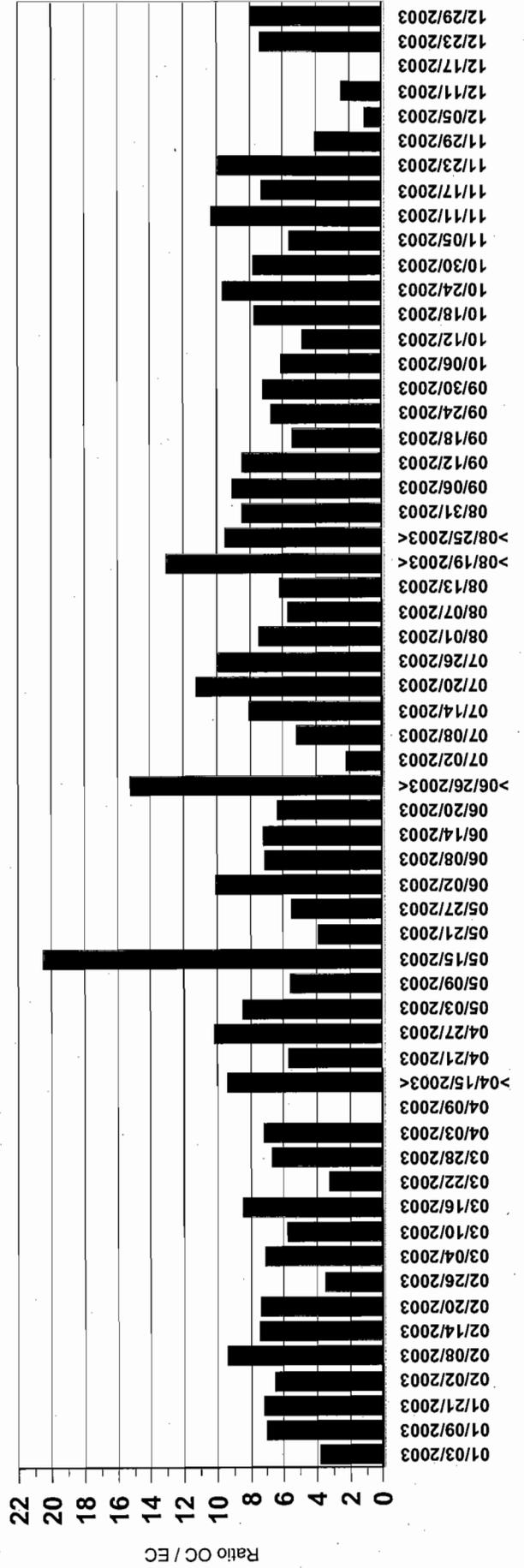
Chattanooga, TN - Elemental Carbon 2003



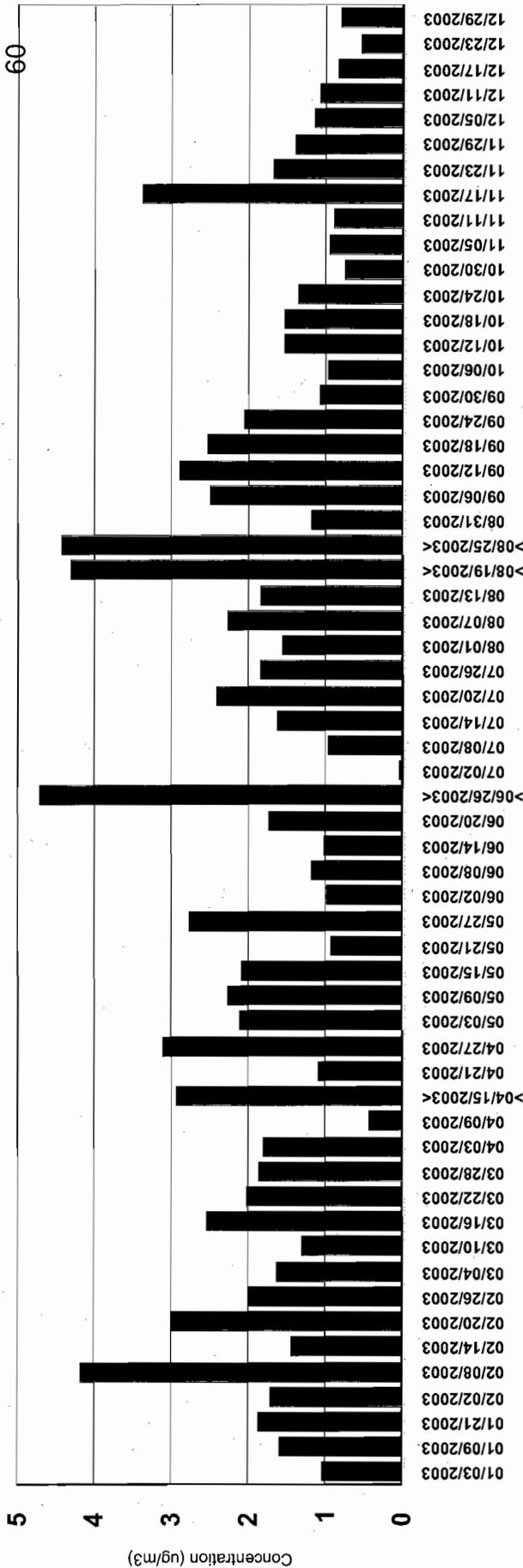
Chattanooga, TN - Total Carbon 2003



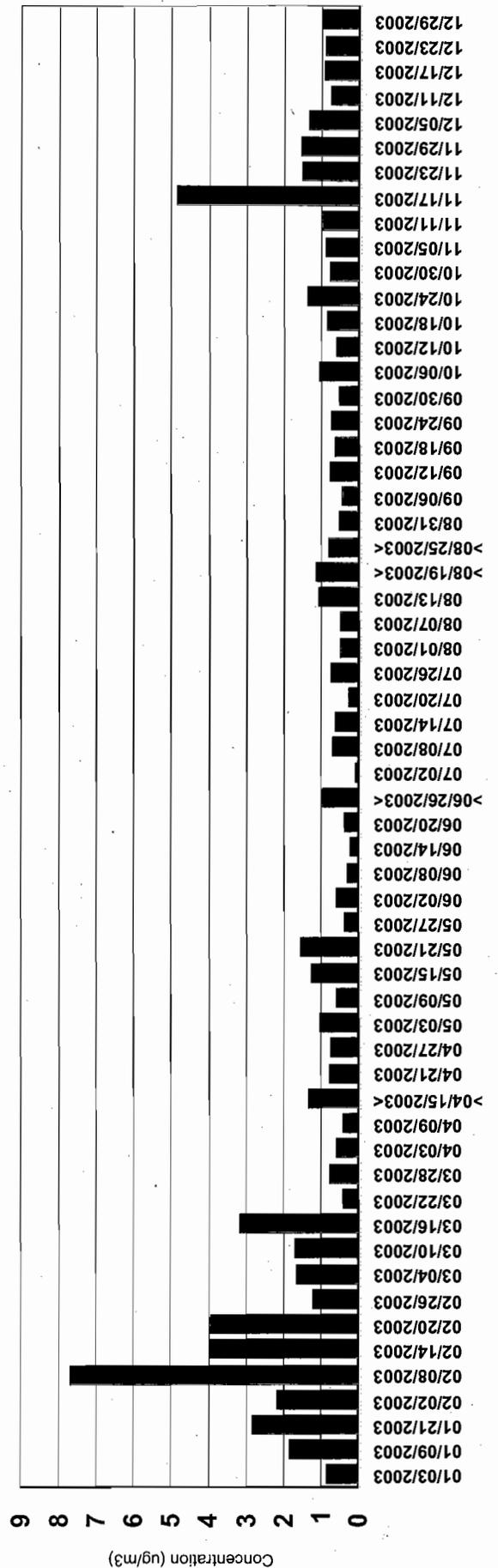
Chattanooga, TN - OC / EC Ratio 2003



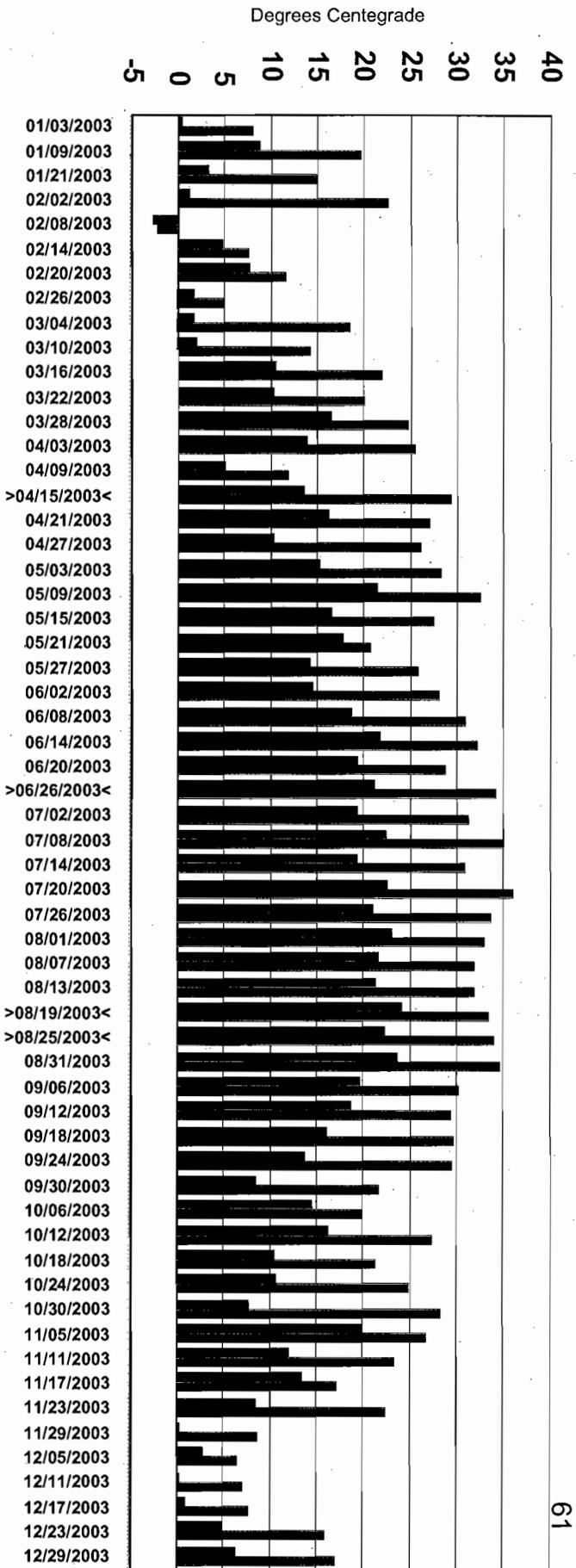
Ammonium



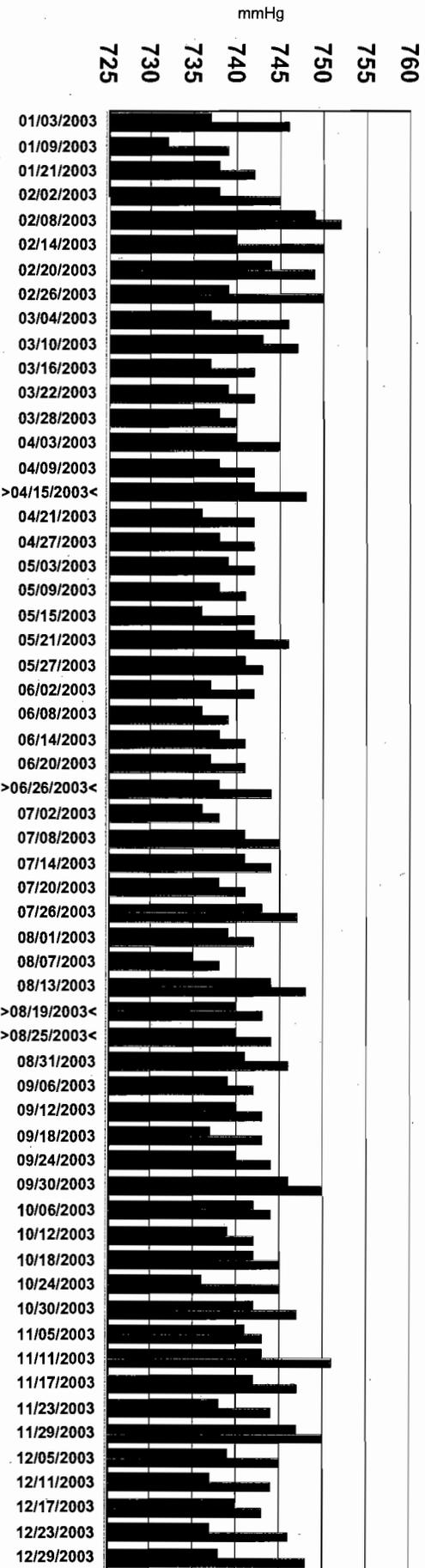
Chattanooga, TN - Nitrate 2003



Chattanooga, TN - Min / Max Ambient Temperature



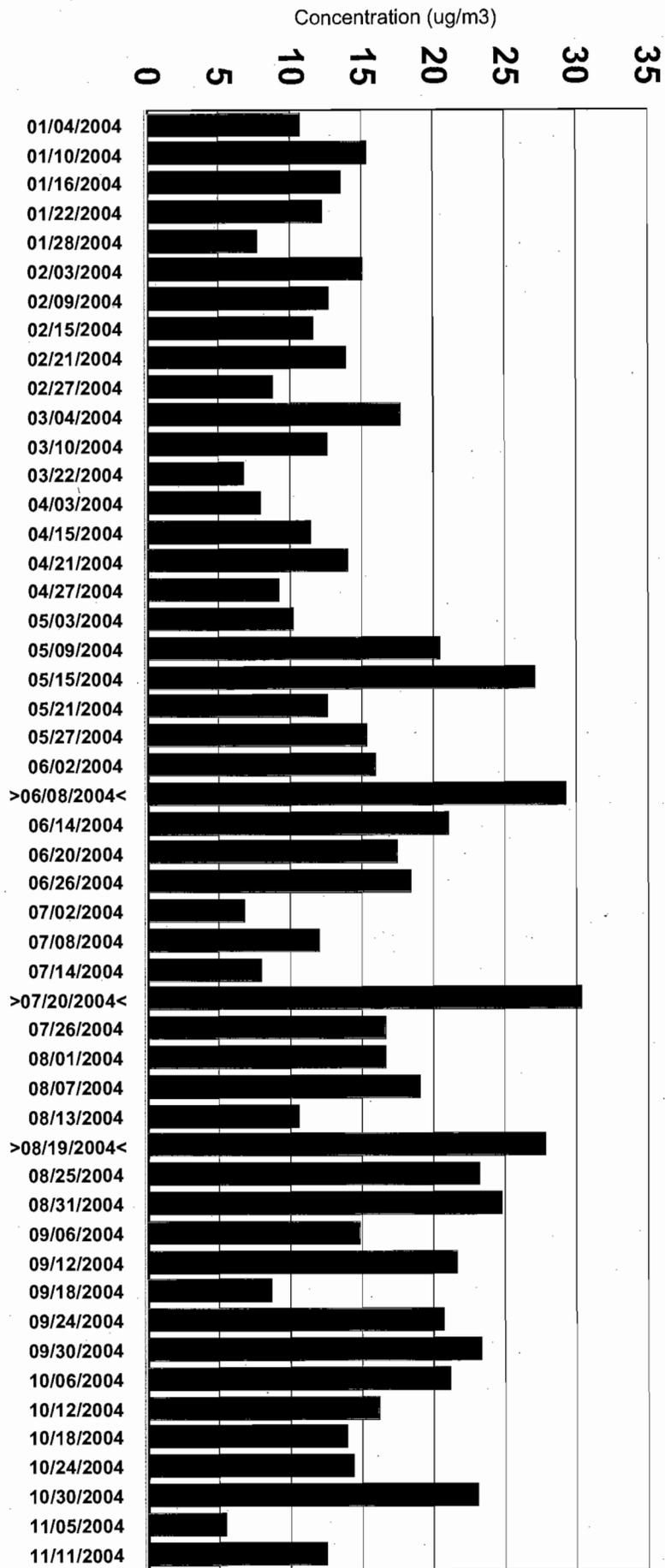
Chattanooga, TN - Min / Max Barometric Pressure

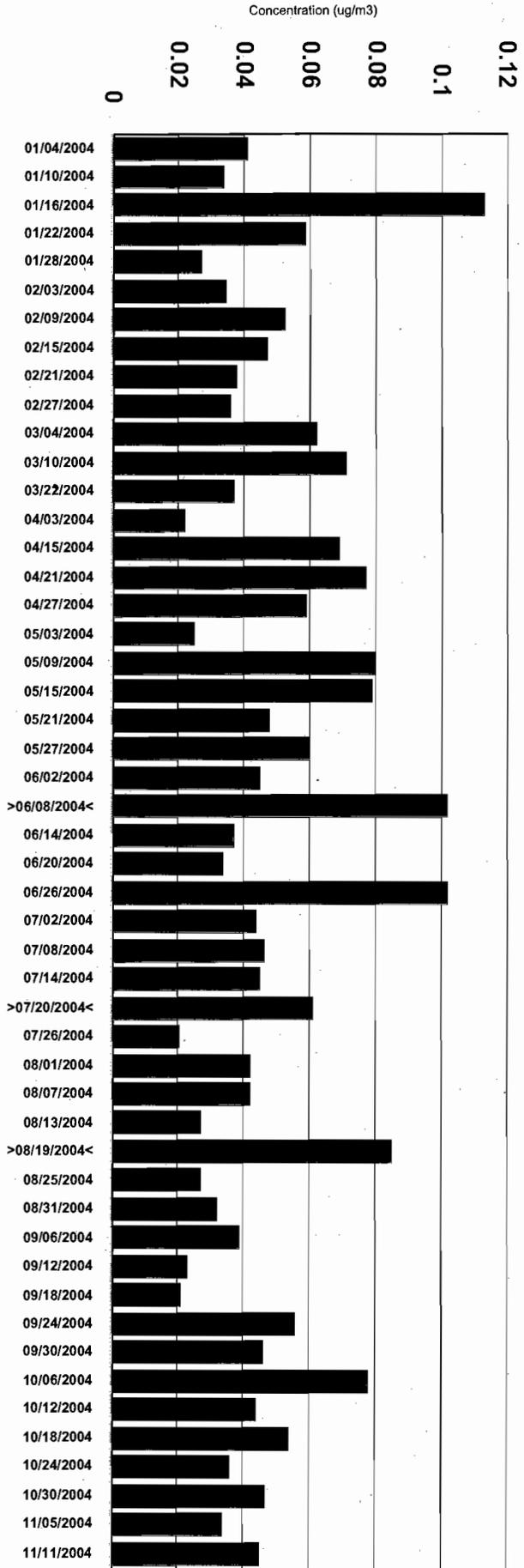


Chattanooga PM_{2.5} Chemical Composition Data for 2004

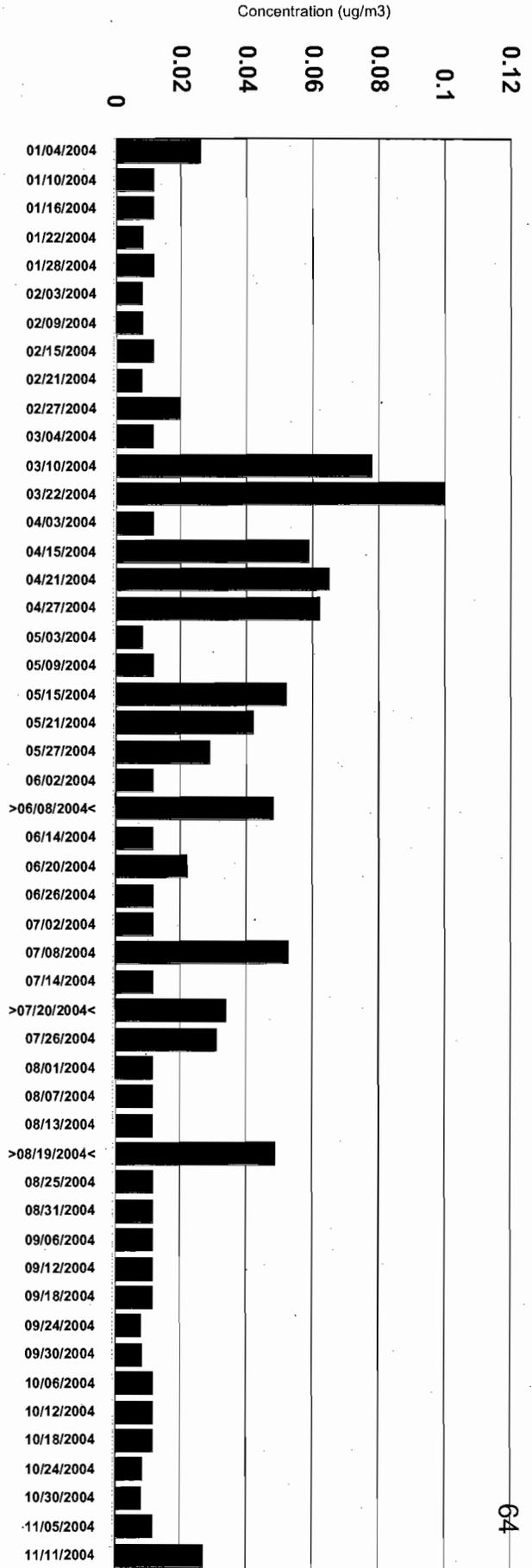
Chattanooga, TN - 2004

PM2.5 Speciation Mass

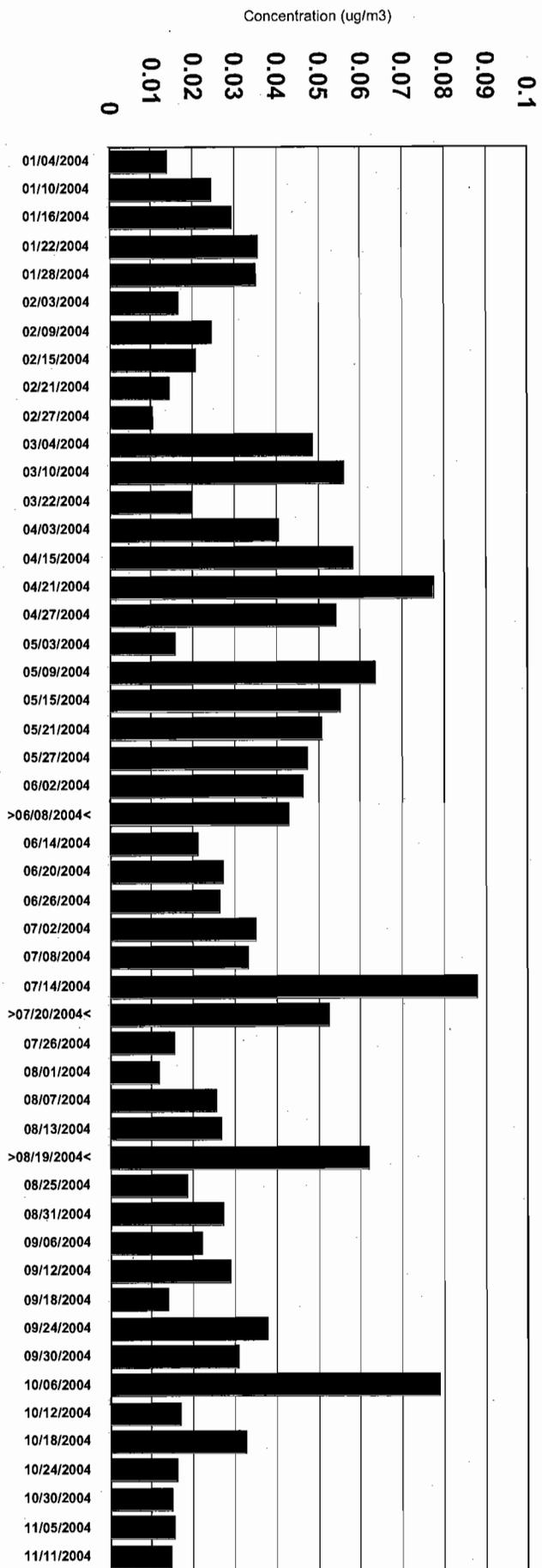




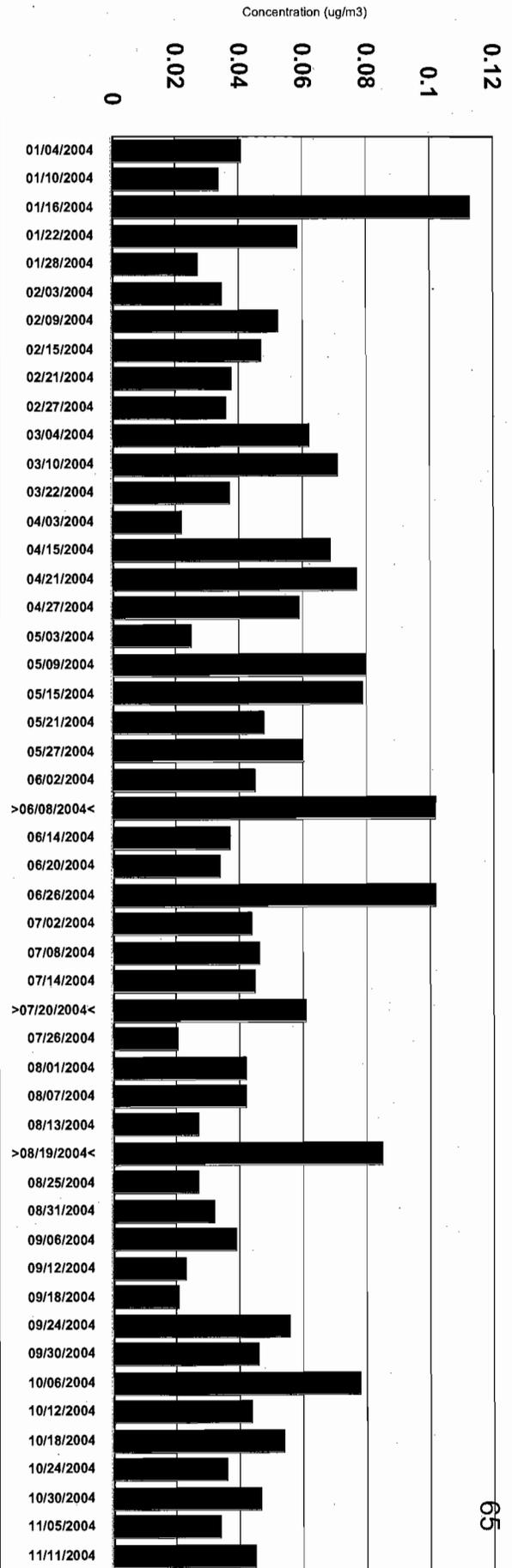
Chattanooga, TN - Potassium 2004



Chattanooga, TN - Aluminum 2004

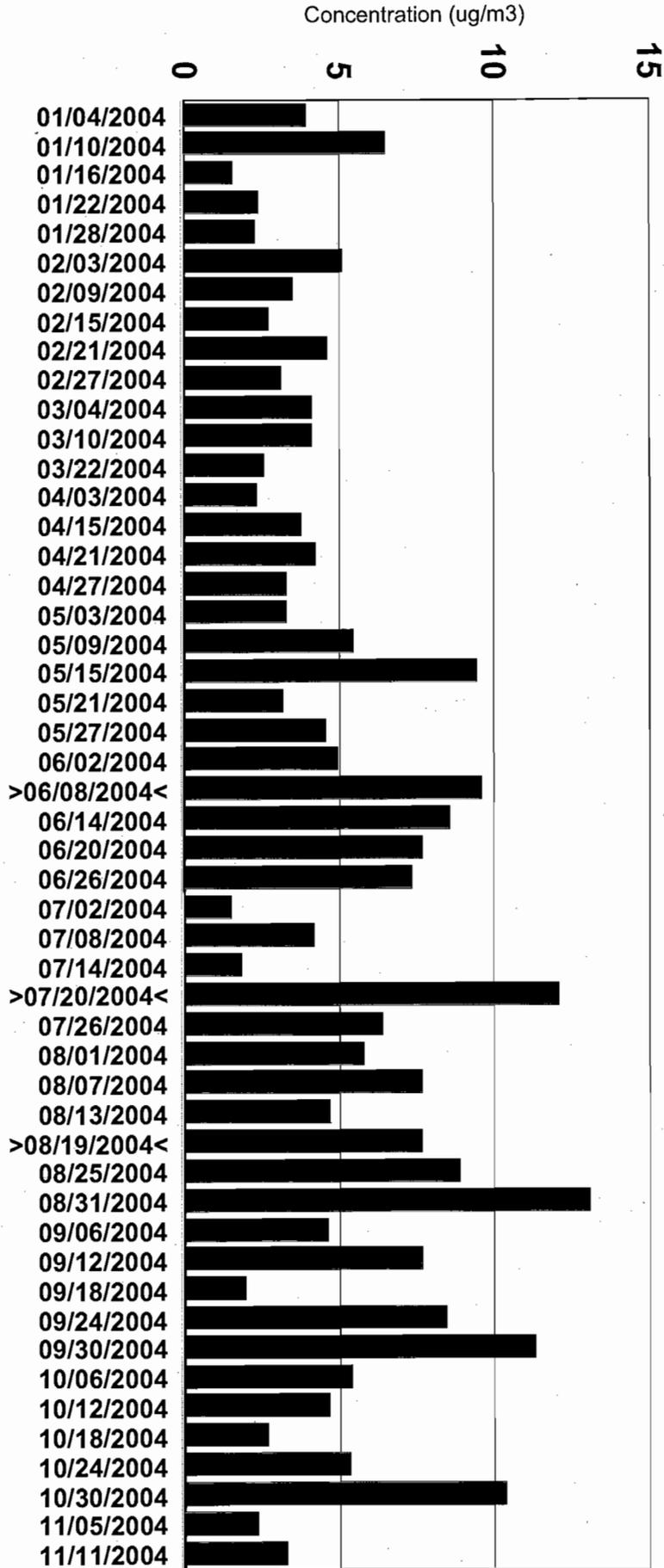


Chattanooga, TN - Calcium 2004

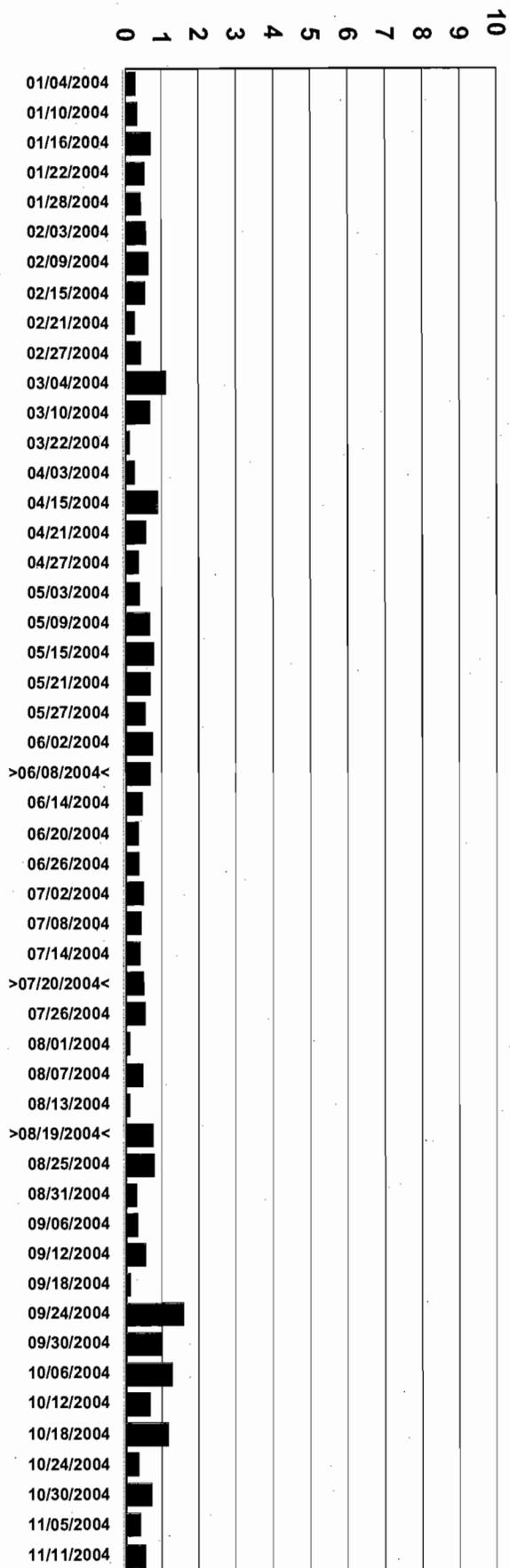


Chattanooga, TN - Potassium 2004

Chattanooga, TN - Sulfate 2004

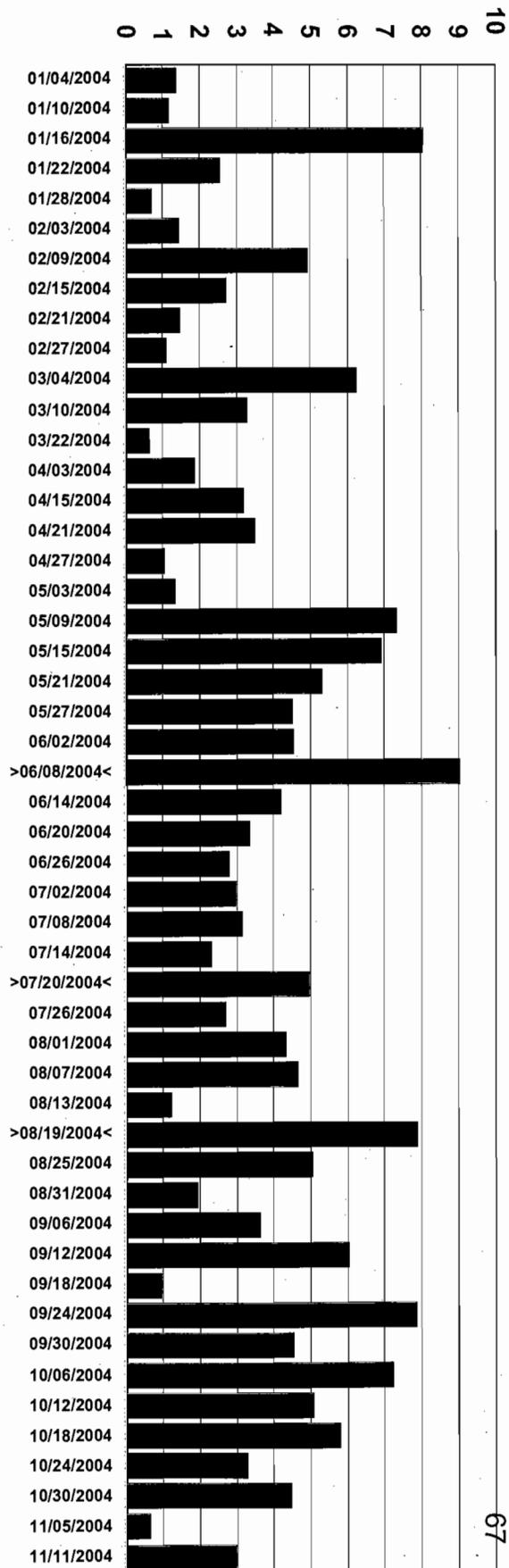


Concentration (ug/m3)

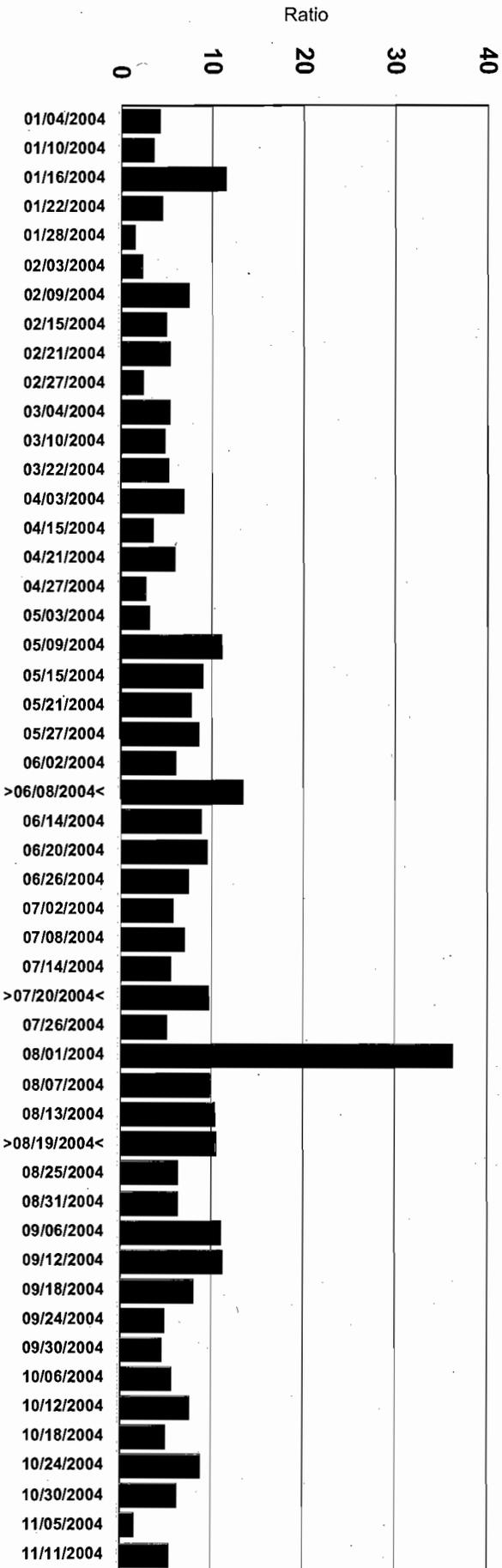


Chattanooga, TN - Elemental Carbon

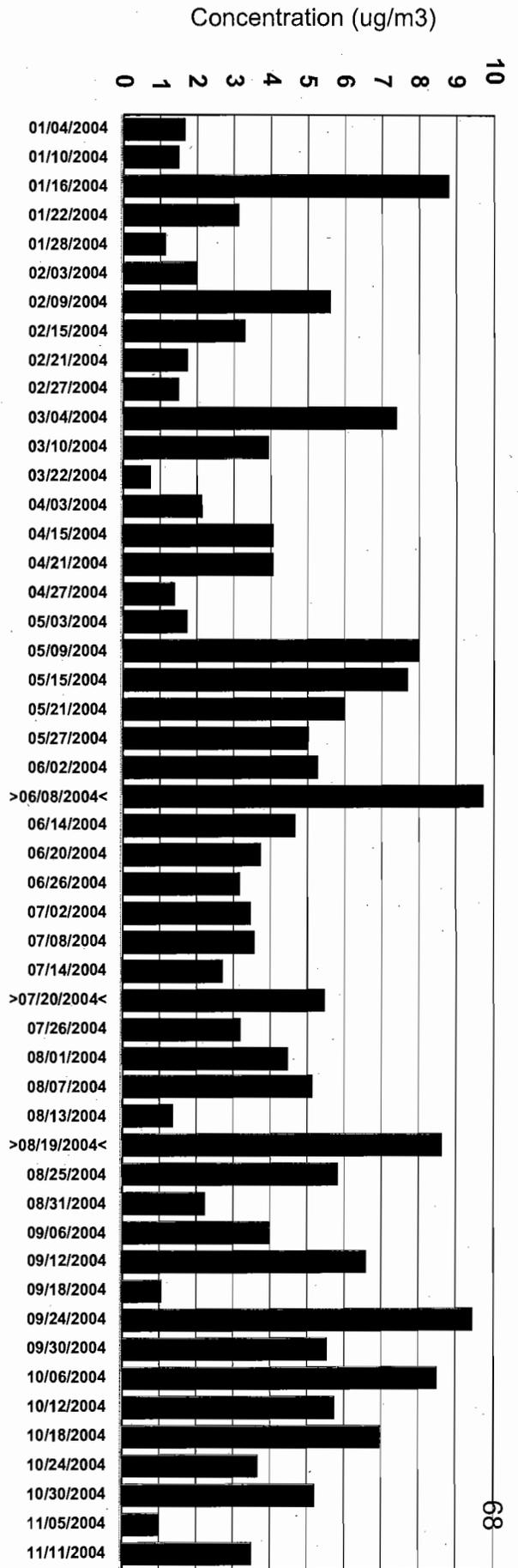
Concentration (ug/m3)



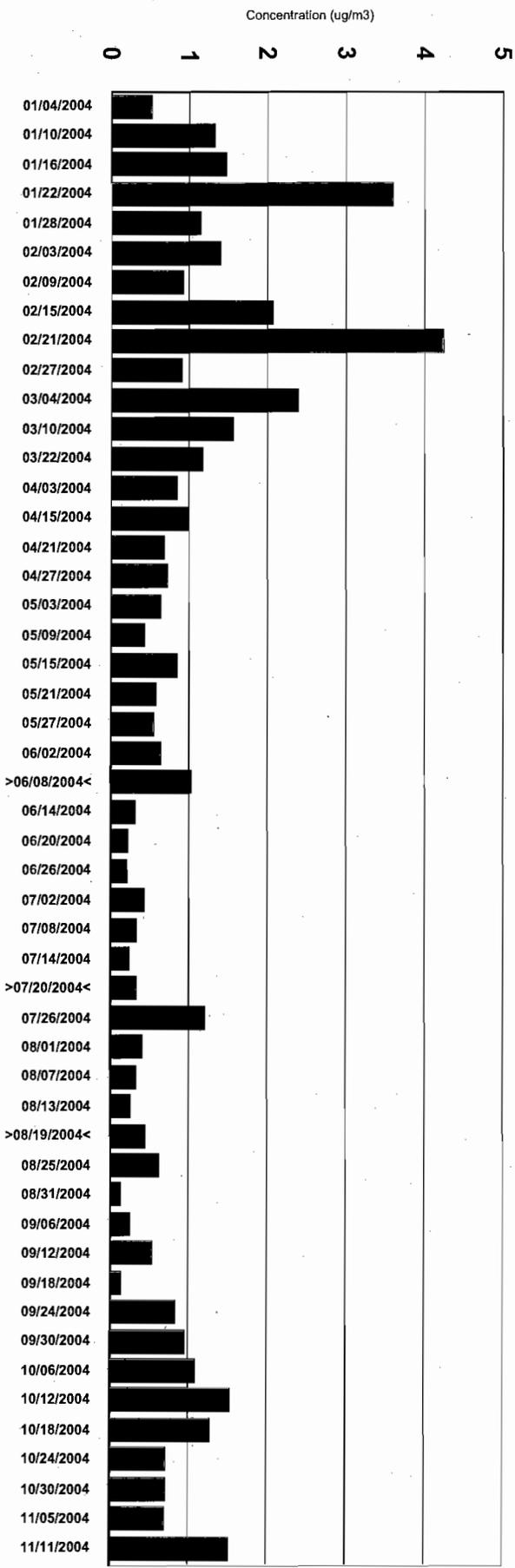
Chattanooga, TN - Organic Carbon Mass



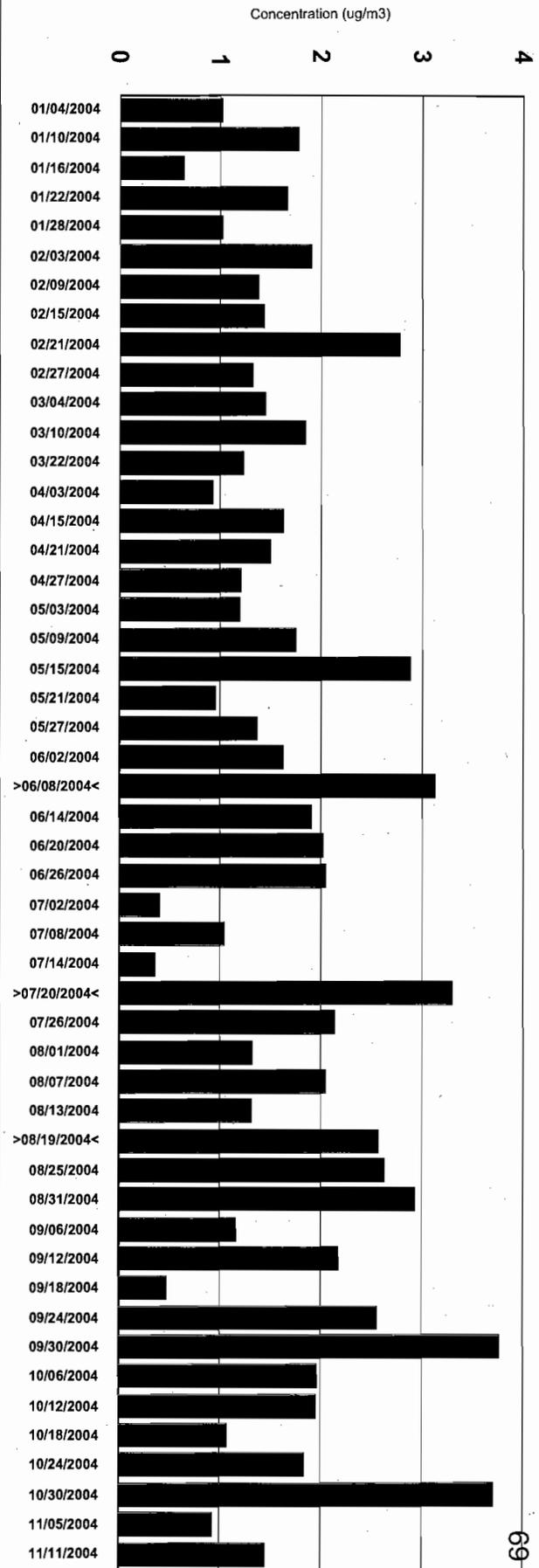
Chattanooga, TN OC / EC Ratio 2004



Chattanooga, TN - Total Carbon 2004



Chattanooga, TN - Nitrates 2004



Chattanooga, TN - Ammonium 2004

Chattanooga, TN - Min & Max Ambient Temp

