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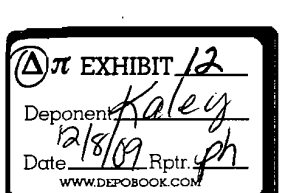
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Deponent Kaley
Date 12/8/09 Rptr. ph
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
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4APT-APB

MEMORANDUM

DATE: April 29, 2005

SUBJECT: Preliminary Assessment of the Potential Contributions of PCB Air Emissions from the Solutia (formerly Monsanto) Facility in Anniston, Alabama, to Measured PCB Soil Concentrations Near the Facility

FROM: Rick Gillam, Acting Chief
Air Quality Modeling and Transportation Section

Stan Krivo, Environmental Scientist
Air Quality Modeling and Transportation Section

TO: Mike Stephenson
Office of Environmental Accountability

The purpose of this memorandum is to transmit our preliminary assessment of the potential contributions of polychlorinated bi-phenyl (PCB) air emissions from the Solutia facility in Anniston, Alabama, to the measured PCB soil concentrations near the facility. A summary of our assessment is attached. It is important to note that this assessment is based on a very limited amount of data and information regarding the historical air emissions of PCBs from the Solutia facility. The conclusions that are presented are based on the limited amount of available information and therefore potentially have a high level of uncertainty associated with them.

Our preliminary assessment indicates that we expect a large portion of the PCB air emissions from the facility would have been deposited near the facility (e.g., within a few kilometers) primarily because the emissions are believed to have been released from sources near ground level at near-ambient temperatures. Assuming the 2003-2004 wind direction measurements are representative of the long term operation of the facility, continually released PCBs would have been dispersed in every direction. Additionally, our limited literature search of studies on atmospheric transport of PCBs indicates that there is a potential for some portion of the emitted PCBs to be transported large distances from the facility. A more detailed discussion of these conclusions is contained in the attached documentation.

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Per your request, copies of our resumes are also attached. If you have any questions regarding the information contained in this memorandum, feel free to contact us.

Attachments

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ATTACHMENT A

Preliminary Assessment of the Potential Contributions of PCB Air Emissions from the Solutia (formerly Monsanto) Facility in Anniston, Alabama, to Measured PCB Soil Concentrations Near the Facility

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PCB Contamination - Anniston, AL
Observations and Thoughts

Objective - To analyze and provide an assessment of the potential air pathway contribution to the observed PCB contamination of the soils around the Solutia (formerly Monsanto) plant in Anniston, AL.

Basic Information and Assumptions

- PCB contamination of concern is from past operations; operations over the last 43 years (i.e., 1929-71)
- From a picture of the plant during operation, a prepared litigation document, and from discussions with Jon Beihoffer with EPA's National Enforcement Investigations Center (NEIC) in Denver, Colorado, it appears that the PCB air emissions from the plant were from fugitive type sources. The PCB emissions were released from roof vents and building openings and other such structures. The releases were without buoyant and momentum plume rise and had release elevations of from the surface to 100 feet (30 meters).
- Plant PCB emissions were from tank vents, scrubbers, tank and vacuum jets, drumming operations, still charging, earth treatment, surface evaporation, leaks and spills, and tank car and truck loadings.
- The 2002 Monitoring Plan indicated a meteorological station and 5-6 PCB monitors were to be placed about the Solutia plant. The meteorological station will be in continuous operation while the PCB monitors will be in operation for two 24-hour period each month.
- The meteorological data from the site specific monitoring have been processed into a wind rose (i.e., graphic presentation of the frequency distribution of wind direction by wind speed) for the period of April 2003 to March of 2004 (see the attached figure). [It is assumed that these data are representative of the meteorological conditions during the 40-year period of concern.]
- PCB emissions contained the full range of congeners from heavy to lighter molecular weights. [It is assumed that the PCB emission rates are constant throughout the day and throughout the year - no variation of emissions during the day nor by month. It is also assumed that PCB emissions will be in both particulate and gaseous forms.]
- Monsanto's daily estimated PCB emissions of 12.76 lbs yields about 60,000 lbs over the 43 year period of interest given an Aroclors production of approximately 680 million lbs over this period.
- The 12/29/70 Wright memorandum provided as background information gives some indication of the magnitude of the emissions for a number of measured fugitive sources. The warehouse drumming area, Aroclor still room, and Montar hood were the larger

emission sources, from 1.5 to 23 times the magnitude of the other measured emission sources.

- No Monsanto plant plot plan was available so the locations of the PCB emission sources are not available.

Observations

1. The attached 2003-2004 meteorological wind rose shows generally similar frequency of winds from the W through N to E (frequency of about 5 to 7 % for each sector). The WSW (8%) and ESE (7.5%) through SE (11%) are the more predominate annual directions. Winds from the SSE through S to WSW wind sectors occur less frequently (from between 4 to 7% of the time).
2. A cursory review of selected monitoring results and comparison with predominate wind directions during each monitoring period does not reveal any definitive relationships. This is not unexpected as the sources of PCB emissions from the plant have been eliminated and the monitors are measuring the ambient levels of PCBs from re-suspended and/or evaporated previously deposited PCBs. The following are our initial observations from this cursory review [Note: A more detailed review can be performed if needed.]:
   - Higher concentrations appear to occur at most monitors when there are higher ambient wind speeds. [Note: Higher winds would tend to produce greater re-suspension and evaporation of deposited PCBs.]
   - The higher concentrations tend to occur at the stations NW(#7), N(#4), and NE(#6) from the plant. This tendency appears not to have a relationship with concurrent ambient wind directions.
3. Because the PCB air emissions are generally fugitive and at near ground elevations, the annual transport of emissions should mirror the meteorological wind rose.
4. Given the near ground release of PCBs, the larger particles will be deposited close to the plant (expected within 1km) with a large portion of the remaining smaller particles and gaseous PCBs expected to be deposited within a few km from the plant.
5. Lighter PCB that are subject to volatilization at ambient temperatures and smaller particles that can be re-suspended are expected to have undergone a redistribution process.
6. Surface disturbances such as industrial and residential construction, traffic movement, road construction, etc., will both physically redistribute the contaminated soils as well as re-suspend and re-volatilize the PCBs for re-distribution by the wind.

Summary of Information Derived from a Limited Literature Search on Atmospheric Transport of PCBs

The following information on the atmospheric transport of PCBs is contained in an internal EPA-Review Draft of a document titled: "EPA Persistent, Bioaccumlative Toxics (PBT) Monitoring Strategy," dated December 19, 2003, in Appendix A, Section A.4 called "Conceptual Model for PCBs in the Environment." While this document indicates that it is an internal review draft and

that it should not be cited or quoted, it provides a good summary of important factors for understanding the atmospheric transport of PCBs.

- Atmospheric transport is a key mechanism for the global dispersion of PCBs.
- Lower-chlorinated congeners tend to be in the gas phase and therefore dominate in the atmosphere while heavier congeners adsorb to particulates.
- During transport, atmospheric PCBs can be deposited to soil and water via wet deposition (rain or snow), dry deposition (settling of particles with PCBs adsorbed), or gas absorption.
- PCBs can also volatilize in the gas form into the atmosphere from soil and water or resuspend in the air on particulate matter.
- It is estimated that the atmosphere is a net recipient of PCBs from these reservoirs.
- The atmospheric half-lives of PCB congeners range from weeks to years.
- Biphenyls with 0-1 chlorine atoms remain in the atmosphere and degrade first, those with 1-4 chlorines migrate toward polar latitudes in a series of volatilization/deposition cycles, those with 4-8 chlorines remain in mid-latitudes, and those with 8-9 chlorines stay close to the source of contamination.
- Some PCB congeners travel far in the atmosphere through a series of volatilization-transport-deposition cycles, typically ending up at higher, colder latitudes on a global scale. For example, studies cited in the *3rd Great Waters Report to Congress* found PCBs in fish from a remote U.S. lake and in the blubber of whales from Alaska's north coast, indicating long-range transport and atmospheric deposition of PCBs.

Additionally, a number of papers have been published in the scientific literature which summarize studies on atmospheric transport of PCBs. The following is a brief summary of the important findings from three papers that were found during a limited search of the available literature. These studies provide valuable information related to the evaluation of the potential for atmospheric transport of PCBs from the Solutia facility in Anniston.

1. Gouin, T., et. al., "Evidence for the 'grasshopper' effect and fractionation during long-range atmospheric transport of organic contaminants," *Environmental Pollution* 128 (2004) 139-148.
   - There is indisputable evidence that long-range atmospheric transport of organic contaminants (including PCBs) occurs on a global scale, but there are uncertainties about how this long-range transport occurs.
   - This paper describes the "grasshopper effect," which can be described as a series of deposition and then re-volatilization events which cause the pollutant to "hop" from one place to another.
   - Recent studies have shown evidence of the "hopping" of PCBs.

2. Eisenreich, S., "Polychlorinated Biphenyl Emissions to Urban Atmospheres: Enhanced Concentrations, Atmospheric Dynamics and Controlling Processes," Proceedings from an

International Joint Commission Workshop held in Milwaukee, Wisconsin on November 8-9, 2000.

- Urban areas can be significant sources of air emissions of PCBs to the atmosphere.
- PCB concentrations in urban atmospheres range from 100-300 pg/m^3 in the winter to 5000-16000 pg/m^3 on hot summer days.
- The "footprint" of elevated gaseous PCB concentrations down gradient of urban source areas may be on the order of 5-60 km, although much larger "footprints" are expected under sustained winds blowing from urban-industrial regions across wide expanses of water.

3. Bright, D., et. al., "Evidence for short-range transport of polychlorinated biphenyls in the Canadian Arctic using congener signatures of PCBs in soils," *The Science of the Total Environment* 160/161 (1995) 251-263.
   - Sampling indicates that elevated levels of PCBs have been found up to 10 km from sources in the Canadian Arctic (radar stations with known use of PCBs).
   - Congener-specific analysis has been done to show that these elevated levels are likely associated with short-range transport from the radar stations versus long-range transport from sources located hundreds to thousands of km away.
   - Congener-specific analysis at other remote sampling locations indicates that a long-range transport mechanism does exist with the more volatile congeners present in much higher proportions than were seen in the short-range transport samples.

Conclusions

1. Without more explicit and applicable emissions and meteorological information that would allow air quality transport and dispersion estimates representative of the 43 year period of concern, the most definitive statements concerning the possible contribution of the air pathway PCB emission to the currently observed PCB soil concentrations are:
   - PCBs were emitted from the Monsanto plant from a number of fugitive sources.
   - The fugitive PCB emissions were release from near-ground level elevations (range from ground to 100 feet) at near-ambient temperatures.
   - The PCB release characteristics suggest that largest ambient air concentrations of PCB would occur near the plant (e.g., within a few km).
   - A large portion of the PCB emissions would also likely be deposited very near the plant (e.g.,within a few km).
   - The distribution of the 43-year plant PCB emissions near the plant should mirror the wind frequency distributions for this same 43-year period. Based on the current one-year, site-specific meteorological measurements, larger amounts of emitted PCB will be distributed in direction sectors of ENE, WNW, and NW from the plant. The northern sector (i.e., sectors NNW, N, NNE, and NE) from the plant should have received smaller amounts of plant emissions (see attached wind rose plot).

2. Manmade and natural soil disturbances as well as natural re-volatilization and redistribution of deposited PCB emissions may make it difficult to relate the current PCB soil sampling measurements to past air pathway transport and dispersion processes.

3. It is possible that air emissions of PCBs from the Solutia facility have been transported large distances from the facility via continual deposition and re-volatilization processes. These atmospheric transport processes has been termed the "grasshopper effect" and have been reported in a number of scientific studies.

4. While it is likely that the largest impacts from the Solutia PCB air emissions would have occurred near the facility (e.g., within a few km), much smaller impacts may have occurred at longer distances from the facility (e.g., up to 100's-1000's of km from the facility).

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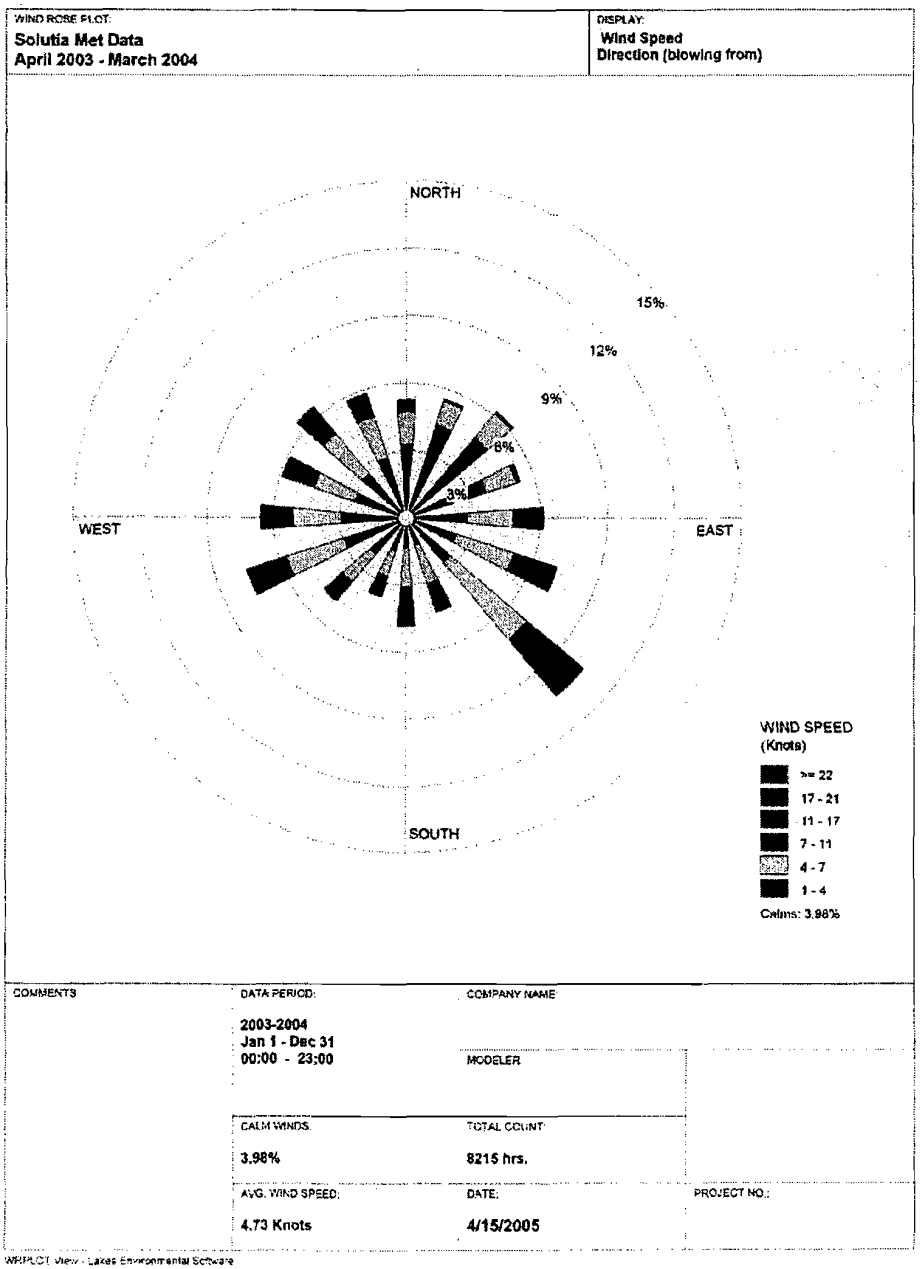

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ATTACHMENT B

RESUMES

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RESUME

Stanley J. Krivo
1348 Cambridge Court
Atlanta, Georgia 30319
(404) 266-8980

OBJECTIVE/EXPERTISE

Professional position in air resources and environmental studies. Experienced in meteorology/air quality assessments, dispersion modeling, regulatory permitting and compliance, environmental audit and assessments, expert testimony, and project management.

EDUCATION

M.S. Atmospheric Science, State University of New York
B.S. Physics, State University of New York
Graduate course in atmospheric turbulence.
Company courses in computer programming and technical writing.
Management courses towards Certificate in Management Development - Olgelthorpe University.

EXPERIENCE

June 1997 to Present — U.S. Environmental Protection Agency, Region 4, Atlanta, Georgia

Environmental Scientist - Technical specialist on air quality dispersion and transport modeling and meteorology associated with the implementation of Prevention of Significant Deterioration (PSD)/New Source Review (NSR), Hazardous Air Pollutant, and Superfund programs. As a regional technical authority, directs and performs detailed reviews of modeling guidelines and protocols related to air quality portions of PSD/NSR permits. Ensures compliance and consistency with regional and national policy. Maintains cooperative liaison with the region's state/local agency modelers and meteorologist and provides training and guidance. Serves on national/regional workgroups, committees and tasks forces to develop guidance, policies and procedures dealing with modeling and/or meteorological issues. Maintains cognizant of new modeling concepts and models with the responsible of transferring these to the regional programs. Provides expert consultation on air quality modeling and meteorological related topics.

March 1995 to June 1997 — ERM-Southeast, Inc., Kennesaw, Georgia

Senior Project Manager - Senior member of air quality group performing air permitting and related studies for industrial clients in the southeast. In addition to technical and management project assignments, responsibilities have included training and supervision of junior level staff, marketing, and proposal preparation. Project technical assignments have included development of both Title V and synthetic minor operating permits, dispersion modeling for ambient impact assessments for criteria and toxic pollutants, RACT assessments, and others related industrial air quality issues. Representative project experience includes:

- Performed dispersion modeling analysis for NAAQS, PSD, and toxic impact assessments to demonstrate compliance with federal and state ambient guideline values.

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- Preparation of Title V permit applications for the two Hercules Inc. chemical plants in Georgia. This effort was part of a corporate-wide Title V support for Hercules. All required elements of Title V permitting were included in the project scope - air emission source identification and emission estimates, regulatory review, compliance evaluation and demonstration, development of future operating scenarios, enhanced monitoring evaluation, preparation of application, and other related support activities.

-Managed the preparation of a conditional major permit application for a clay processing facility in South Carolina. Major issues for this project were the development of representative emission estimates and permit conditions to ensure emission levels that qualified for a conditional major permit while not limiting facility operations below that considered acceptable for all operational scenarios.

- Performed historical prevention of significant deterioration (PSD) applicability study for carpet manufacturing facility in Georgia.

- Technical reviewer and consultant for a hazardous pollutant compliance demonstration project in Georgia. Dispersion modeling used to assess current ambient impacts and to determine acceptable compliance scenarios for the facility.

- Provided consultation and assisted in the preparation of Title IV (Acid Rain) emission monitoring plan for a power generation facility in north Georgia.

- Managed the development of Title V and synthetic minor permit applications for petroleum distribution centers in Alabama, Georgia, and South Carolina. Dispersion modeling performed for ambient impact compliance assessments for South Carolina facilities.

- Provided instruction on the 1990 Clean Air Act Amendments and Section 112(r) Accidental Release Prevention Program as part of environmental training seminars.

March 1972 to March 1995 — Dames & Moore, Atlanta, Georgia

Associate/Senior Meteorologist - Project and marketing responsibility for a wide range of environmental consulting services to industrial and utility clients. Responsibilities included technical supervision of Atlanta Air Services Group and management of technical computer services for the office. Representative project experience includes:

- Development of Prevention of Significant Deterioration (PSD) application and supporting air quality studies (e.g., dispersion modeling, BACT analysis, GEP stack height analysis, etc.) for an electric peaking facility in Georgia.

- Title V permit application development for three wet corn-milling plants. This three plant corporate-wide Title V support project required permitting in three different states. All required elements of Title V permitting were included in the project scope: e.g., emission identification and estimates, regulatory review, compliance evaluation and demonstration, development of future operating scenarios, enhanced monitoring evaluation, preparation of application, and other related support activities.

- Management of a comprehensive siting study and subsequent environmental permitting project for a two unit, 900 megawatt coal-fired power generating facility. Project included consideration of economic, environmental, and engineering issues in a four state region.

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- State air permit and Prevention of Significant Deterioration permit development for oil-fired boiler expansion at a corn processing facility in Alabama. Extensive plant modeling performed to establish proper stack design to meet engineering and air quality guidelines. Provided follow-up permit support analysis.

- Performed a number of air quality siting studies in Georgia and North Carolina for the location of simple-cycle and combined-cycle natural gas-fired combustion turbines for independent power generators. Studies included all air quality permitting issues and initial air quality impact modeling assessments.

- Review and evaluation of PM_{10} air quality compliance problem for a facility located in a PM_{10} non-attainment area. Air quality assessment included a review of plant emissions and state agency modeling, performance of new air quality modeling, and impact assessment based on the development of more accurate plant configuration and compliance scenarios.

- Prepared air quality assessment and provided air permit support for a successful coal-fired boiler expansion at a corn processing facility in an SO_2 non-attainment area in Indiana. Investigation included emission offset analysis and extensive dispersion modeling.

- Performed meteorological and transport/dispersion assessments for a number of nuclear facilities in support of, and inclusion in, Safety Analysis Reports, Environmental Reports, emergency planning studies, and other specific studies for these facilities.

- Prepared air emissions/risk assessment, and meteorological and air quality analysis for a U.S. Environmental Protection Agency third party environmental impact statement associated with a coal-fired cogeneration facility in Florida.

- Provided operational meteorological monitoring support and consulting services for nuclear power plants owned by Southern California Edison Company and Florida Power and Light Company. Performed these activities for three other nuclear power generating plants. Activities have included tower erection, instrument calibrations, data reduction and analysis, and dispersion and transport evaluations for radiological assessments.

- Meteorological/air quality investigations and subsequent preparation of final safety analysis and environmental reports for nuclear power generating facilities in Arkansas, California, and South Carolina. Investigations included meteorological data acquisition, processing and dispersion/transport analysis for the assessment of impacts of releases to the population. Analysis also included estimates of extreme and severe meteorological phenomena for engineering and safety design considerations.

- Performed air quality and environmental compliance audits for property acquisition transactions. Plants included a secondary metal recovery facility located in South Carolina and a farm equipment manufacturer in Kansas. Project tasks included site inspection of facilities, file review (both plant and state agency), agency discussions, and developed recommendations for improved compliance program.

- Managed the preparation of a third party environmental impact statement for the U.S. Environmental Protection Agency as well as a state environmental impact statement document for a 1400-megawatt coal-fired power generating station in Arkansas. Effort included management of the comprehensive multi-discipline environmental assessments, preparation of all air and water

permit activities, and support testimony at public hearings before the Arkansas Public Service Commission.

- Development of the uniform toxic chemical release analyses and reports required of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 for a golf cart and utility vehicle manufacturer in Georgia.

- Performed study to estimate extreme hurricane winds for two nuclear power plants in Florida. The project included the determination of absolute theoretical maximum hurricanes, probable maximum hurricanes, and extreme hurricane winds for various return periods at the two sites.

- Provided environmental site review, fatal flaw analysis, and support studies for an independent power producer's response to a power solicitation. Project included up to 1,200 megawatts of natural gas-fired peaking power.

- Performed full audit of the meteorological monitoring, data processing, and dispersion/transport systems for nuclear facility in Florida. Evaluation included all regulatory and plant requirements concerning the towers, equipment/shelters, sensors, communication, recorders, data processing, analysis, and administrative issues.

- Expert meteorological consultation and testimony for a number of civil proceedings in Georgia.

- Developed numerous computer dispersion, transport, data processing and analysis models with various applications and responsible for the firm wide documentation and certification and support of meteorological/air quality computer programs. Routine data processing and analysis computer software packages were developed for specific application to nuclear power plant operations at Arkansas Power & Light Company and Florida Power & Light Company.

June 1971 to March 1972 — Northrop Service, Incorporated, Huntsville, Alabama

Unit Chief - Terrestrial Environmental Unit - Performed studies on the dynamics of the mesoscale wave motion and turbulence in the lowest 18 kilometers of the atmosphere; analyzed the aerodynamics characteristics of balloon wind sensors.

June 1967 to June 1971 — Lockheed Missiles & Space Company, Huntsville, Alabama

Research Engineer - Conducted research on wind observations through the earth's boundary layer in support NASA's Saturn Program; developed new techniques of data processing to improve capability of balloon wind observation systems.

PROFESSIONAL AFFILIATION

American Meteorological Society
Air & Waste Management Association
American Nuclear Society Standards Committee - Member of the Standards Committee Working Group ANS-2.5 "Guidelines for Determining Meteorological Information Appropriate for a Reactor Site".
Board of Private Sector Meteorology - American Meteorological Society (Chairman)
Nuclear Utility Meteorological Data Users Group - Member of Steering Committee

PROFESSIONAL REGISTRATION

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Certified Consulting Meteorologist by the American Meteorological Society (Number 267; 1980). Qualified Environmental Professional by Air & Waste Management Association (Number 11940144; 1994)

PUBLICATIONS

Papers presented to national conferences on aerospace meteorology, meetings of the Air & Waste Management Association (formerly Air Pollution Control Association), American Society for Quality Control, and Nuclear Utility Meteorological Data Users Group. Author and co-author of papers published as company and NASA documents as well as in the Journal of Applied Meteorology.

REFERENCES

Provided upon request.

* * *

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Fax Number: (404) 562-9019
e-Mail Address: gillam.rick@epa.gov

WORK EXPERIENCE

10/2000-Current *U.S. Environmental Protection Agency Region 4* *Atlanta, Georgia*

- Title: Environmental Engineer Salary: $79,000/yr (GS-13, step 6) Hours/Week: 40
- Duties and Accomplishments: My current position is an Environmental Engineer/Air Modeler in the EPA Region 4 Air, Pesticides and Toxics Management Division (APTMD), Air Planning Branch, Air Quality Modeling and Transportation Section. My **specific duties** include: serving as a technical authority in atmospheric transport and deposition modeling; performing air dispersion and deposition modeling for air quality and human health impact analyses; performing reviews and input on projects involving air modeling; and supporting clients, including state and local agencies, other EPA divisions and other branches with APTMD. My **accomplishments** have included: completing a complex air quality modeling study for the only sulfur dioxide non-attainment area in EPA Region 4; helping prepare and present a training course for state and local regulators on EPA's new AERMOD model; performing an air modeling study in Chattanooga, Tennessee; preparing atmospheric deposition analyses to support the EPA Region 4 Water Division's total maximum daily load (TMDL) analyses for mercury pollution in numerous Georgia water bodies; participating in cross-program workgroups relating to mercury, PCBs and other persistent, bioaccumulative toxics (PBTs).
- I am currently serving as the Acting Chief of the Air Quality Modeling and Transportation Section for a period of ninety (90) days ,which is scheduled to end on May 28, 2005.

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08/1991-09/2000 *U.S. Environmental Protection Agency Region 4* *Atlanta, Georgia*

- Title: Environmental Engineer Salary: $66,000/yr (GS-13, step 4) Hours/Week: 40

Duties and Accomplishments: This position was an Environmental Engineer, Combustion Specialist, in the EPA Region 4, Waste Management Division, RCRA Programs Branch, North Section. My primary duties in this position included issuance and modification of hazardous waste combustion permits and overview of authorized State Agency hazardous waste programs. **Specific duties** included: conducting technical reviews of hazardous waste combustion permit applications with emphasis on air pollution control systems, stack emissions testing requirements, air dispersion modeling, and risk assessments; participating in the development of hazardous waste regulations, policy, and guidance; representing the Agency at public meetings and hearings; providing technical assistance to State agencies and permit applicants; and conducting field audits of air emissions stack sampling during combustion unit trial burns and performance tests. My **accomplishments** included: serving as the **Team Leader** of the Combustion Team in 1996; successfully managing one of the largest and most technically complex commercial hazardous waste incineration facilities in EPA Region 4; participation in the Hazardous Waste Combustion Workgroup, including development of policy, guidance and regulations; participation in the RCRA Organic Air Emissions Workgroup to address organic air emissions from non-combustion hazardous waste units, including development of regulations and guidance; and participation on the EPA Region 4 Air Modeling Team, which includes involvement with various air emissions modeling projects.

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EDUCATION

Ohio University — *B.S. in Mechanical Engineering*
Athens, Ohio — 1991

Athens High School — *Diploma*
The Plains, Ohio — 1987

OTHER QUALIFICATIONS

- Job-related training courses: EarthTech – *CALPUFF Training Course*, 2003; EPA – *Environmental Impact Assessment*, 2002; Lakes Environmental – *AERMOD/ISC Training*, 2002; EPA - *Introduction to ArcView* , 2000; The Air Group, Dallas - *Combustion Risk Assessment, Implementing EPA Human Health Risk Assessment Methodology*, 1999; EPA - *Environmental Justice 101*, 1999; EPA - *Risk Assessment for Air Toxics Workshop*, 1998; APTI Course SI:410 *Introduction to Dispersion Modeling*, 1996; Trinity Consultants *Fundamentals of Dispersion Modeling*, 1996; EPA - *Risk and Decision Making*, 1994; EPA *Contract Administration Training*, 1992, 1997, 2001

- Job-related skills: excellent written and oral communication skills; excellent organizational and time management skills; demonstrated leadership ability; proficient at using many computer software packages including spreadsheets, data base programs, word processors, air modeling programs, and geographical information systems (GIS). Ability to quickly learn new computer skills; experience using air dispersion models including: ISCST3, AERMOD, and CALPUFF; familiar with Models-3/CMAQ, REMSAD, UAM, and many other models.

- Job-related certificates: Engineer in Training (EIT) – 1991

- Job-related honors, awards, and accomplishments: EPA Silver Metal for Mercury TMDL project (2002); EPA Bronze Metal for work on a complex enforcement case in the RCRA program (2001); Received EPA Performance Awards every year from 1992-2004; received Outstanding ratings on past performance evaluations; received numerous awards and honors while attending Ohio University (1987-1991); Team Leader of the Region 4 Combustion Team in 1996.

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4APT-APB

MEMORANDUM

DATE: November 18, 2005

SUBJECT: Addendum to Memo Dated April 29, 2005, Titled: "Preliminary Assessment of the Potential Contributions of PCB Air Emissions from the Solutia (formerly Monsanto) Facility in Anniston, Alabama, to Measured PCB Soil Concentrations Near the Facility"

FROM: Rick Gillam, Environmental Engineer
Air Quality Modeling and Transportation Section

TO: Mike Stephenson
Office of Environmental Accountability

The purpose of this memorandum is to transmit and addendum to our previous analysis, dated April 29, 2005, which contained a preliminary assessment of the potential contributions of polychlorinated bi-phenyl (PCB) air emissions from the Solutia facility in Anniston, Alabama, to the measured PCB soil concentrations near the facility. The addendum is attached. This addendum was prepared at your request to evaluate newly available information related to the potential for atmospheric dispersion of Aroclor 1268/1269, which was manufactured at the Solutia facility.

As was the case with the previous analysis, it is important to note that this assessment is based on a limited amount of data and information regarding the historical air emissions of PCBs from the Solutia facility. The conclusions that are presented are based on the limited amount of available information and therefore potentially have a high level of uncertainty associated with them.

If you have any questions regarding the information contained in this memorandum, feel free to contact me.

Attachment

WATER_PCB-SD0000046780

DO NOT RELEASE - FOIA EXEMPT - ATTORNEY CLIENT PRIVILEGED COMMUNICATION - ATTORNEY WORK PRODUCT - DELIBERATIVE PROCESS – PREPARED IN ANTICIPATION OF LITIGATION

ATTACHMENT

Addendum to Memo Dated April 29, 2005, Titled:
"Preliminary Assessment of the Potential Contributions of PCB Air Emissions from the Solutia (formerly Monsanto) Facility in Anniston, Alabama, to Measured PCB Soil Concentrations Near the Facility"

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Purpose

To evaluate information and documentation related to the potential for atmospheric dispersion of Aroclor 1268/1269 from the historical manufacturing processes at the Solutia facility in Anniston, Alabama.

Documentation Reviewed

- June 5, 2001, Section 6(e) PCB Investigation Report for the Solutia Facility in Anniston, Alabama
  - Indicates that PCB residues were found in the form of flakes on both the inside and outside of the "MCC Warehouse."
  - The facility sources suspect that the PCB residues were from the past PCB manufacturing processes, which included operation of a PCB flaker machine and solidifying of liquid PCBs in the building.
  - PCB flakes were found in seams of the sidewalls and concrete floor outside the building.
  - The facility sources "suspect the PCB flakes to have been airborne at the time of the PCB processing through the vents and stacks and suspect heavier particles of the PCBs to have settled on the roof top and washed off by rain into gutters over a period of time and solidified at the seam of the sidewalls and concrete floor near the storm-water trenches."

- June 1935 document titled: "Diphenyl and Chlorinated Diphenyl Derivatives," which describes historical manufacturing processes at the Solutia facility.
  - Describes the operation of a "flaking wheel" in the Aroclor 1269 manufacturing process which was used to "produce a product of satisfactory physical characteristics," which were referred to as "the desired fineness of one half micron."
  - Describes additional equipment associated with the flaker wheel – "The flaker is enclosed by a hood which is connected to a Raymond dust collector equipped with stainless steel cyclones." "A Siroooo exhaust fan is used to clear the still room of fumes liberated at the end of a distillation."
  - As the result of some operators developing a severe type of dermatitis, "adequate ventilation facilities were installed."

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- March 11, 1966 Monsanto Finished Product Specification Sheet which provides a description of the Aroclor 1268 product.
  - Describes the appearance and color of the product as a "white to off-white powder" with a specific gravity @25°C ranging from 1.804 - 1.811.
  - Provides the specification for screen tests as "0.1% Max. retained on a No. 16 mesh" (opening size of 1 millimeter) and "10% Max. retained on a No. 20 mesh" (opening size of 850 micrometers or microns).

Potential for Atmospheric Dispersion of Aroclor 1268/1269

- Based on the information contained in the documents cited and summarized above, Aroclor 1268/1269 was potentially released to the atmosphere during the manufacturing process. Evidence of this is that an exhaust fan was used to clear fumes from the manufacturing room. Also, evidence of PCB residues have been found outside the building where the "product flaking" was performed. The product would likely have been released through vents in the building.

- PCBs are semivolatile organic compounds. In the atmosphere, they exist in both the vapor and particulate phase (W. J. Lee et al, 1996). The distribution of PCBs between gas and particle phases is dependent on temperature, air humidity, property of the adsorption surface, adsorption surface availability, molecular weight and vapor pressure of the PCBs (S-J Chen et al, 1996).

- Based on the naming conventions for Aroclors, 1268/1269 contain 68 weight % and 69 weight % chlorine, respectively. Aroclors consist of a mixture of a number of different PCB isomers and congeners, which are typically classified by "homologue." Aroclor 1268/1269 consists of the more highly chlorinated homologues (i.e., octa-CB, nano-CB).

- In general, the more highly chlorinated homologues have more PCB mass fraction in the particle phase. (W. J. Lee et al, 1996). Also, the product specification sheet for Aroclor 1268 indicates that it exists in a solid form as a "white to off-white powder." Therefore, it is likely that most of the Aroclor 1268 that was emitted to the atmosphere from the manufacturing process would have been in particulate form.

- Based on the descriptions of the Aroclor 1268/1269 product presented above, the particles that were emitted would have varied from fine to coarse sizes. The sizes could have varied

from 0.5 micrometers to greater than 850 micrometers. No site-specific information on the quantity of product in the different size ranges is available.

- Airborne particles are removed from the atmosphere by wet and dry deposition processes. Organic compounds partition between gas and particle phases, and particulate deposition depends largely on the particle sizes available for adsorption. **Dry deposition of organic materials (e.g., dioxins, dibenzopfurans, polycyclic aromatics, PCBs) is often dominated by the coarse (larger) size fraction**, even though mass loading in this size fraction may be small relative to the fine (smaller size) particulate matter (PM) fraction. In contrast, wet deposition is often dominated by the much larger material associated with fine particles. (U.S. EPA, 2004).

- A study of dry deposition of PCBs in an urban area conducted in Taiwan indicated that, in general, dry deposition velocities increased as the level of chlorination increased. The mean dry deposition velocities of the highly chlorinated homologues were greater than that of the less chlorinated homologues. **The highly-chlorinated homologues (octa-CBs) consisted of larger particles, the majority being larger than 25 micrometers.** The study also found that more than 94% of the total particle mass and more than 87.5% of the total PCB dry deposition flux are contributed by particle diameters larger than 10 micrometers. (W. J. Lee et al, 1996).

- The atmospheric lifetimes of particles vary with size. Fine particles in the 0.1 to 1.0 micrometer range are kept suspended by normal air motions and have very low deposition rates to surfaces. They can be transported thousands of kilometers and remain in the atmosphere for a number of days until they are removed primarily by cloud processes. **Coarse particles (greater than 2.5 micrometers) can settle rapidly from the atmosphere (within hours) and normally travel only short distances.** (U.S. EPA, 2004).

- After Aroclor 1268/1269 particles have been deposited to soils, surface water or vegetation, it is possible that some fraction of the deposited PCBs could undergo re-volatilization and be dispersed further in the vicinity of the facility. This "grasshopper effect" could occur by resuspension of dust or soil particles contaminated with the PCBs. (T. Gouin et al, 2004)

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Conclusions

Since Aroclor 1268/1269 consist mainly of higher-chlorinated PCB homologues, which generally exist in particle form and are associated with the larger (coarse) particle sizes, much of Aroclor 1268/1269 emitted from the manufacturing process at the Solutia facility would likely have been deposited near the facility (e.g., within a few kilometers). Since some fraction of particles emitted could have been in the smaller (fine) size category, it is possible that small amounts of the product could have been transported large distances, from hundreds to thousands of kilometers from the facility. Based on the wind rose presented in the April 29, 2005, memo, larger amounts of Aroclor 1268/1269 would likely have been distributed to the North-West, West-North-West, and East-North-East of the facility, but the winds blow from all directions at some point during the year. Therefore, Aroclor 1268/1269 could have been transported in all directions from the facility.

References

1. Chen, S.-J., et al., "Concentration, Phase Distribution, and Size Distribution of Atmospheric Polychlorinated Biphenyls Measured in Southern Taiwan," *Environment International* 22, No. 4 (1996) 411-423.

2. Gouin, T., et al., "Evidence for the 'grasshopper' effect and fractionation during long-range atmospheric transport of organic contaminants," *Environmental Pollution* 128 (2004) 139-148.

3. Lee, W. J. et al., "Monitoring and Modeling of PCB Dry Deposition in Urban Area," *Journal of Hazardous Materials* 49 (1996) 57-88.

4. U.S. Environmental Protection Agency (EPA), "Air Quality Criteria for Particulate Matter, Volume I of II," EPA/600/P-99/002aF, October 2004.