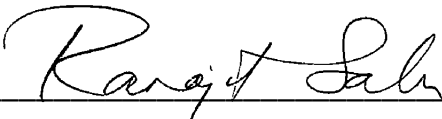


Report on Air Quality Aspects at the
Chemical Waste Management, LLC,
Model City, New York, and the
Proposed RMU-2

Prepared for Niagara County, the Town of Lewiston and
the Villages of Lewiston and Youngstown, New York

November 19, 2014



Dr. Ranajit (Ron) Sahu

Consultant

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ATTACHMENTS

- A. RESUME FOR RANAJIT SAHU

Information Required by the Federal Rules of Civil Procedure

The following is a list of the items required by the Federal Rules of Civil Procedure:

1. This report contains my opinions, conclusions and the reasons therefore;
2. I do not have any exhibits to be used in summary of, or support for, my opinions with this report other than what is provided with this report and other reports submitted in this action;
3. A statement of my qualifications is contained in Attachment A;
4. A list of publications I authored within the last ten years is shown in Attachment B;
6. A statement of my previous testimony within the preceding four years as an expert at trial or by deposition is contained in Attachment C; and
7. The documents cited in the body of this report, as well as the documents in Attachment D, lists the information I considered in forming my opinions.

The opinions expressed in the report are my own and are based on the data and facts available to me at the time of writing. Should additional relevant or pertinent information become available, I reserve the right to supplement the discussion and findings in my report.

I. BACKGROUND AND EXPERIENCE

I, Ranajit Sahu have over twenty three years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment; soils and groundwater remediation; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

I have a B.S., M.S., and Ph.D., in Mechanical Engineering, the first from the Indian Institute of Technology (Kharagpur, India) and the latter two from the California Institute of Technology (Caltech) in Pasadena, California. My research specialization was in the combustion of coal and, among other things, understanding air pollution aspects of coal combustion in power plants.

I have over twenty one years of project management experience and have successfully managed and executed numerous projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public.

I have provided consulting services to numerous private sector, public sector and public interest group clients. My major clients over the past twenty one years include various steel mills, petroleum refineries, cement companies, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, and various entities in the public sector including EPA, the states of New York, New Jersey, New Mexico, the US Dept. of Justice, California

DTSC, various municipalities, etc. I have performed projects in 48 US states, numerous local jurisdictions and internationally.

In addition to consulting, I have taught numerous courses in several Southern California universities including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management) since roughly 1992. In this time period I have also taught at Caltech, my alma mater, at USC (air pollution) and at Cal State Fullerton (transportation and air quality).

I have and continue to provide expert witness services in a number of environmental areas discussed above in both state and Federal courts as well as before administrative bodies.

Additional details regarding my background and experience can be found in my resume provided in Attachment A and in the list of publications and presentations provided in Attachment B. Attachment C provides a summary of my previous expert witness experience. Attachment D contains a list of documents considered along with those cited in the body of the report.

II. SUMMARY OF REPORT

For this proceeding, I have been asked to provide opinions and a report, based on my experience as a consultant and practitioner, that address the following items:

1. Air quality issues rising from the proposed expansion of the CWM site¹ as part of the RMU-2² project;
2. Related and relevant to the above, air quality issues associated with the current CWM site, specifically in relation to the air quality permit application submitted by CWM to the New York State Department of Environmental Conservation (hereafter “NYSDEC” or “Department”) in January 2014 and as amended and the air permit issued by the Department on October 24, 2014.³

Factually, CWM has, to date, not addressed air quality aspects and impacts that are reasonably likely as a result of its RMU-2 project – at all. In fact the cover letter accompanying the recently issued permit for the existing facility requests that a permit modification application be submitted to the Department at CWM’s earliest convenience. This, in my opinion, is improper. To the extent that CWM has avoided obtaining an air permit for the RMU-2 project on the basis that it did not, until October 24, 2014, have a current air permit (which it reasons it needs prior to addressing such impacts), it is my opinion that nothing prevents CWM from addressing, comprehensively, the air quality impacts from the RMU-2 expansion, as part of the Draft Environmental Impact Statement (DEIS) prepared for the project. That CWM has not done so is improper.

¹ Per its air permit application prepared for CWM Chemical Services by Conestoga-Rovers & Associates and submitted in January 2014 to the New York State Department of Environmental Conservation (hereafter “Permit Application”), “[T]he CWM Chemical Services, LLC (CWM), Model City Facility is located within the Erie-Niagara Region in the western section of New York State. The facility is situated on the boundary between the Towns of Lewiston and Porter in Niagara County.” I will refer to the CWM Model City Facility as the “CWM site” or “CWM” in this report.

² RMU-2 refers to a second Residuals Management Unit (RMU) to be constructed and operated at the CWM site.

³ The Air State Facility permit (9-2934-00022/00233) was issued to CWM Chemical Services LLC effective 10/24/2014 and valid for a period of 10 years.

Next, it is my opinion that the air permit application submitted by CWM in January 2014 to the Department for the current facility (i.e., pre RMU-2) is highly relevant to the RMU-2 project from an air permitting perspective for RMU-2 in at least two aspects.

First, in effect, the current permit application – via its consideration of emission sources, identification of pollutants that are emitted at the facility, the estimation of the magnitude of such emissions, and compliance mechanisms such as testing and monitoring – provides insight into how CWM considers and accounts for air quality emissions from its various operations (many of which will continue as part of the RMU-2 project). Thus, omissions and errors in identification of air emissions sources and/or pollutants as well as omissions/errors in supporting its emission calculations are directly relevant to how such technical issues can and should be handled for the RMU-2 project. Unfortunately, the recently issued permit for the existing facility does not cure any of the many flaws in CWM’s permit application.

Second, via its current permit application for the pre-RMU-2 facility, CWM sets the stage for the type of permitted facility CWM should be from an air quality perspective – i.e., whether a “major” source requiring a Federal Title V operating permit or a non-major source requiring just a state operating permit (as it suggests). Obviously, since CWM seems to believe that it will amend the air permit to be issued by the Department in order to address air quality impacts from RMU-2 via a permit amendment, it is obviously important to know what type of permit will be amended. Here again, the recently issued permit leaves much to be desired. It is still not clear whether the existing facility is a major source of hazardous air pollutants or not. In fact, the recently issued permit, at Item 2.2 states that:

“CWM Chemical Services, Inc. submitted a letter dated March 6, 2000 to the USEPA Air Compliance Branch Region 2, stating it is not a major source of hazardous air pollutants and, thus, is not subject to the National Emission Standards for Hazardous Air Pollutants from Off-Site Waste and Recovery Operations - 40 CFR 63 Subpart DD. However, the March 6, 2000 letter was not an official request for an applicability determination. As such, no later than December 31 , 2014, CWM must submit an applicability determination request to the USEPA to obtain an official

determination regarding the applicability status of this facility to 40 CFR 63 Subpart DD.”

Based on the above considerations, I provide, in this report, a critique of CWM’s current air permit application – pointing out material technical deficiencies that affect the currently issued air permit and which will also affect CWM’s assessment of air emissions from RMU-2.

III. AIR PERMITTING STATUS

III.1 Current Facility Air Permitting Status

According to the Permit Application, the CWM Model City, New York, facility began operations in 1971⁴ and has had numerous ownership changes as discussed in the Permit Application,⁵ leading up to the present.

During this time period and including the present, activities at the facility include "...Storage, treatment and disposal capabilities include an aqueous waste treatment system, which includes phase separation, oxidation/reduction, neutralization, solids precipitation and filtration, biological treatment and carbon filtration. The treated effluent is stored in a facultative (fac) pond..... Other operations include waste stabilization; secure landfilling of approved solid waste, including PCBs; solvent and fuel blending processes; RCRA and TSCA container storage and transfer; landfill leachate collection, storage and treatment.... ." ⁶

In spite of its long history and the activities above, the facility has, until October 24, 2014, not been subject to any air permit – state or Federal.⁷ As the Permit Application notes, the facility only submitted its air permit application as a result of recent changes in New York state law:

⁴ Permit Application, p.2.

⁵ Permit Application, p. 2. "The Model City Facility began operations in 1971 as Chem-Trol Pollution Services, Inc. Activities included reclamation of waste oils, distillation of spent solvents, aqueous waste treatment, and land disposal. In 1973, the stock of Chem-Trol was purchased by SCA Services, Inc. The Chem-Trol name was retained until late 1978 at which time the corporate name changed to SCA Chemical Waste Services, Inc, and in 1981, was renamed SCA Chemical Services, Inc....In October 1984, WM Acquiring Corp., owned jointly by Waste Management, Inc. (WMI), and Genstar, Inc., acquired SCA Services, Inc., of which SCA Chemical Services, Inc., was a subsidiary. Through a corporate reorganization in October 1986, SCA Chemical Services, Inc. became a wholly owned subsidiary of Chemical Waste Management, Inc. (CWM), itself majority-owned by Waste Management, Inc. In July 1988, the corporate name SCA Chemical Services, Inc. was changed to CWM Chemical Services, Inc. CWM Chemical Services, Inc., became a limited liability company in January 1998 and became CWM Chemical Services, LLC. CWM Chemical Services, LLC, is the owner and operator of the Model City Facility."

⁶ Permit Application, p. 2.

⁷ See the Department's Fact Sheet for the RMU-2 Project at Section 5. "[B]ecause CWM has not been issued an Air Permit for its existing facility to date..."

It appears that the facility was, instead, subject merely to the Minor Facility Registration requirements of 6 NYCRR Part 201-204.

“[T]he Application has been prepared as a result of the recent changes to 6 NYCRR Part 201. Table 1 of 6 NYCRR Part 201-9 presents the new 'Significant Mass Emission Rates for Persistent, Bioaccumulative and Toxic Compounds' and took effect on February 22, 2013.”⁸

III.2 RMU-2 Project Air Permitting Status

As noted earlier, no air permit application has been submitted to date for the RMU-2 Project. The Department has requested that CWM apply for such a permit modification. As the Department's Fact Sheet for the RMU-2 Project states

“According to promulgated changes to 6 NYCRR Part 201, which became effective on February 22, 2013, facilities which have non-exempt, non-trivial air emission sources are required to submit an [Air] State Facility Permit Application....in accordance with Sub-part 201-5. By letter dated March 11, 2013, NYSDEC staff informed CWM that it was required to submit an Air Permit Application for its existing Model City Facility. CWM submitted such an application on January 8, 2014, and the application is currently undergoing review by NYSDEC staff.

Because CWM has not been issued an Air Permit for its existing facility to date, CWM has indicated that a request to modify such an Air Permit to include the proposed RMU-2 landfill project cannot be submitted at this time. Therefore, it has stated in its Part 361 Siting Certificate application that this situation represents “good cause” under 6 NYCRR 361.3 for not submitting an Air Permit Modification Application for the RMU-2 project at this time. CWM further states that it will submit such a modification application subsequent to receiving an Air Permit for its existing facility.”⁹

Even with the issuance of the October 24, 2014 permit, it is not clear what the Department's position is vis-à-vis the status of the existing facility since the Department has clearly punted the issue of major source status determination to EPA and into the future, as discussed earlier.

As noted earlier, in the absence of a anyair permit application for the RMU-2 Project, I proceed to an analysis of the Permit Application submitted by CWM for the current facility, since the

⁸ Permit Application, p. 1.

⁹ New York State Department of Environmental Conservation FACT SHEET for CWM Chemical Services, LLC, Proposed Landfill Project, Model City, New York, Niagara County, May 5, 2014.

currently issued permit is based on this same flawed Permit Application. I reiterate that this Permit Application (and its review) is highly relevant to the RMU-2 project for the reasons stated previously.

IV. AIR QUALITY ISSUES RELATING TO RMU-2 AND THE CWM FACILITY

In this section, I will discuss various air quality issues associated with the RMU-2 Project, and with the CWM facility as a whole. Consideration of these issues is necessary to assess air emissions and siting issues associated with the RMU-2 Project itself. *See* Part 373-1.5(a)(2)(viii)(f) (requiring information in Part 373 applications regarding measures to “prevent releases to the atmosphere”); Part 361.7(10) (requiring a Siting board to consider “potential air quality problems,” including those resulting from “operation of the facility” and “accidental fires and explosions which may occur”); Part 617.9(b) (requiring a DEIS to provide “relevant and material facts upon which an agency’s decision is to be made”, [subsec. (1)], including “a concise description of the environmental setting of the areas to be affected, sufficient to understand the impacts of the proposed action and alternatives”, [subsec. (5)(ii)]).

This general discussion serves to highlight issues such as the potential for emissions of radiological contaminants from the facility and from the RMU-2 Project, the emissions of air toxics from the facility and from the RMU-2 Project, and the adequacy of emissions monitoring. Specific issues relating to permitting are discussed in the next section.

IV.1 Proper Air Emissions Assessment Rests on a Complete Site Characterization

The CWM facility is located on land that has a long history, discussed more extensively elsewhere,¹⁰ dating back to World War II, including the disposal of radioactive materials and wastes in the vicinity of the site.

As projects (such as RMU-2) are proposed and implemented at the site, excavation of soils (and possible contact with groundwater) are natural consequences. An assessment of air emissions from such activities (such as volatile gases including radionuclides and radon, for example or particulate matter containing radiological contaminants), of necessity, requires thorough knowledge and understanding of the previous extent of soil and groundwater contamination at the site. Yet, it appears, that there are significant gaps not only in the historical record of what,

¹⁰ See, for example, the report of Dr. Resnikoff.

when, how, and where various wastes were disposed (and how they may have migrated in soils and groundwater since initial disposal), but also in the characterization of soils and groundwater at the CWM site.

I could not find documentation on the full and thorough spatial characterization of the concentration of contaminants in soil and groundwater under the footprint of the proposed RMU-2 project. Until such an assessment is complete, the assessment of the potential sources of air emissions and associated contaminants from the RMU-2 project will, by definition, be unsupported and incomplete. Further, all subsequent assessments for air emissions pertaining to the: (i) preparation of air emissions inventories; (ii) assessment of air emissions associated with the project on surrounding areas using dispersion models; (iii) the assessment of incremental risks due to air emissions; and (iv) development of proper monitoring protocols simply cannot be completed.

Thus, the RMU-2 project should be supported by a thorough and well-documented site characterization effort for underlying soils and groundwater. To date that has not been done.

IV.2 Radiological Air Emissions Due to Excavation

The RMU-2 Project requires that several areas at the site be excavated in addition to RMU-2, which would be excavated in phases over time. Site soils and groundwater are known to contain substantial concentrations of both radiological and chemical contaminants.¹¹ Based on my review of the site history, CWM has had to address these contaminants repeatedly over the years as it has completed small project excavations and has characterized radiological contaminants as "nuggets" or small "rocks" or other discrete particles detected in the course of excavation, under

¹¹ This view is confirmed by analysis of shallow groundwater, which is in places highly contaminated with radionuclides. In an April 19, 2005 memo, Dr. Resnikoff noted: "...higher [than background] concentrations of Th-232 and Ra-226 are present in the sediments in a ditch exiting the former LOOW site onto the CWM landfill site. A DOE survey of vicinity property H' showed relatively high concentrations of Co-60, Sr-90, Cs-137, and Pu-239 in surface soils at a distance from the NFSS boundary [onto the CWM site]."

Also, there are areas that must be clean closed, like Fac Pond 8 within the RMU-2 footprint or the proposed Fac Pond 5, located over a former laboratory waste dump, where plutonium-injected animal carcasses and parts and contaminated laboratory equipment were buried. It is not clear how CWM will achieve clean closure for these areas.

the approved protocol for small project excavations, which requires scans of the excavated surface at every six-inch lift. The repeated finding of such contamination should give pause as to its appropriateness or adequacy. Past characterization, simply put, has not been systematic, covering all of the foot print of the RMU-2 Project.

Excavation of soils will unavoidably result in fugitive dust emissions. The additional questions therefore relate to the composition of the fugitive dust, particularly with regards to radiological contaminants and resultant exposures to workers and any offsite migration of dust and impacts to sensitive receptors the public such as the Lewiston-Porter combined school system with a campus one-quarter mile to the west and nearby residents.

IV.3 PCB Air Emissions Due to Excavation

PCB contamination appears to be widespread on the site, found in surface water and groundwater. RMU-1 is (and RMU-2 would be) permitted by EPA as a PCB Landfill under the federal Toxics Substances Control Act (TSCA), permitted to disposed PCB wastes with concentrations between 50 and 500 ppb. The RMU-1 permit was renewed last year, and the previous version of the permit required CWM to find and remediate the sources of PCB releases to surface water. It is not clear what CWM has done to comply.

PCBs can attach to particulate matter and, similar to radiological contaminants discussed earlier, be dispersed in the air by excavation. Thus, it is imperative that the extent, type, and nature of PCB contamination at the site be thoroughly characterized so that the resultant air emissions can be addressed.

IV.4 Air Emissions from the Facultative Ponds

CWM's lagoons (the facultative ponds or “fac” Ponds) are characterized by the company as necessary biological remediation of treated wastewater. I note that neither the Permit Application nor the recently issued permit considers these ponds to be sources of air emissions. In fact, wastewater is stored for 10-11 months in these ponds prior to discharge. And, if there are

volatile organic compounds present in the incoming waters, they will be aerated and emitted to the atmosphere. Biological treatment may also convert certain types of incoming air contaminants (such as certain hydrocarbons) to other types of air contaminants (such as greenhouse gases like methane and carbon dioxide). In addition, it is also possible for contaminants such as PCBs to be emitted via the aeration process.

The record contains no quantitative analysis of any of the air emissions from the fac ponds. Nor does it contain any support for the proposition that they cannot be sources of air emissions. Whether some of these sources are exempt from some air emissions control programs does not obviate the necessity to provide sufficient information to assess their emissions under the siting program or New York's State Environmental Quality Review Act (SEQRA).

CWM should complete a mass balance assessment for VOCs entering and leaving the fac ponds to establish the resultant loss of VOC emissions, unless it can show that the fate of the lost VOCs is via some other mechanism. In addition, it should estimate the emissions of greenhouse gases from biological activity at these ponds and the emissions of PCBs from aeration. These calculations and estimates should be part of a cumulative emissions assessment taking into account all tanks, buildings and equipment that are also potential sources of emissions.

IV.5 CWM Is A Likely Major Source of Air Emissions

As I note previously, the issue of whether the existing facility is a major source of hazardous air pollutants is still an open question, in spite of the issuance of the recent permit. The Federal Clean Air Act classifies emission sources as major or non-major based on their potential to emit specified levels of annual emissions of various pollutants. Major sources are required to obtain Title V operating permits. As I discuss in the next section, it appears likely, based on the incomplete and unsupported permit application submitted by CWM to the Department, that this CWM facility may, in fact, be a major source as opposed to a minor source of air emissions.

IV.6 Siting Board Air Assessments Cannot Be Completed

The RMU-2 proposal must be approved not only by the Department but also by the independent State Siting Board, which may apply a numerical scoring system to determine whether RMU-2 may be sited as set forth in 6 NYCRR Part 361. The scoring system¹² requires the Siting Board to assign weights of 1 to 3 to various "siting criteria," and if the sum of factors is 200 or greater, RMU-2 may not be sited.

It is my understanding that CWM has scored the RMU-2 project as follows: 2 for atmospheric stability [criteria (10)(ii)(a)]; 1 for prevailing wind direction [criteria (10)(ii)(b)]; and 2 for wind speed [criteria (10)(ii)(c)]. I note that while the score for the current facility for atmospheric stability and wind speed are 2, the score for prevailing wind direction for the existing facility is 3. First, I see no reason why the prevailing wind direction score should be lowered from 3 to 1 for RMU-2 given the presence of populations downwind of the facility and RMU-2 such as Ransomville.¹³ Second, I believe that the score under wind speed should be 3 (and not 2 like the

¹² Specifically, for air quality, the siting assessment includes the following:

“(10) Air quality.

(i) General considerations. Siting of a facility must take into account air quality problems which may result from the operation of the facility or accidental fires and explosions which may occur. The board shall consider potential air quality problems which may occur as the result of historical or estimated meteorological conditions and to what extent such respective problems and conditions will affect neighboring communities.

(ii) Specific criteria.

(a) Atmospheric stability. A site must be evaluated on the basis of the frequency of occurrence of stable atmospheric conditions which are conducive to the development of high pollution levels.

(1) Areas in which atmospheric conditions are historically "unstable" are most acceptable.

(2) Areas in which atmospheric conditions are historically "neutral" or "less stable" are less acceptable.

(3) Areas in which atmospheric conditions are historically "stable" are least acceptable.

(b) Prevailing wind direction. The population exposure to air pollution in the vicinity of a site will depend upon the frequency distribution of wind directions for the area. These may be determined from representative historical data for the area or estimated on the basis of general meteorological principles.

(1) Areas located downwind from populated areas are most acceptable.

(2) Areas located perpendicular to populated areas, relative to prevailing winds, are less acceptable.

(3) Areas located upwind from populated areas are the least acceptable.

(c) Wind speed. Concentrations of air pollutants emitted from ground level sources are inversely proportional to the wind speed. Hence, the frequency distribution of wind speeds in a site area indicates the potential for high concentrations of pollutants.

(1) Areas most likely to be associated with higher wind speeds are most acceptable.

(2) Areas in which wind speeds are predominantly moderate are less acceptable.

(3) Areas of low wind speed are least acceptable.”

¹³ On Nov. 6, 1989, CWM's first Siting Certificate was issued for SLF-12, a one million cu. yd., 22 acre capacity hazardous waste landfill. The decision accompanying certificate issuance states: "The hamlet of Ransomville, population 1400, which is located approximately 4-5 miles downwind of the site, was considered by the Board as a

current facility). I have reviewed wind roses for the area and most winds appear to be between 5-10 mph and there are significant periods when the wind is calm. Finally, while the score for atmospheric stability may be acceptable at 2, this should be supported with additional data/analyses. It is my opinion that there is not adequate documentation nor has CWM provided a proper assessment under Part 361.7(10) including air quality problems such as accidental fires and explosions.

As a result, I recommend that the siting criteria for RMU-2 be reassessed once the previous deficiencies noted in Section IV.1 above are addressed.

IV.7 Air Monitoring Does Not Include PM2.5, Radiological Contaminants or Volatile Organics

A review of the available air monitoring reports for the existing operating Model City facility indicates that the CWM facility only monitors a single pollutant, namely PM10. Since it is clear that the facility can emit numerous pollutants beyond just PM10, it is not clear why the monitoring is restricted to just this one pollutant.

Unless the facility can demonstrate that it does not or cannot emit fine particulate matter (PM2.5), various volatile organic compounds, and numerous radiological contaminants (which can, for example, bind to particulate matter of various sizes) – these should also be included in the monitoring protocol. This is not only true of any monitoring proposed for the RMU-2 project but also for the facility as a whole.

concentration of population. Therefore, a score of (3) was assigned by the Board, whereas CWM assigned a score of (1)." This conclusion was applied to siting criterion 10(B), "Prevailing Wind Direction."

V. REVIEW OF THE AIR PERMIT APPLICATION FOR THE CURRENT FACILITY

Title V of the Clean Air Act provides that major sources of regulated air pollutants may not operate without a permit issued under Title V of the Act. In addition, Part 201 of the Department's regulations require a state air facility permit for certain sources of air pollutants regulated under those regulations. As noted earlier, the CWM facility, until a few weeks ago, lacked any kind of permit despite operating numerous sources of air emissions – and despite a history of incidents such as fires, spills, and other releases of volatile compounds and particulate matter which appear to be a normal feature of operations – that result in the release of hazardous air pollutants. Unfortunately, the recently issued permit, which was based on the Permit Application, does not adequately address many air emissions issues from the existing facility.

A number of issues are presented by the failure to identify all the existing sources of potential emissions of regulated air pollutants in the RMU-2 Project application materials.

According to the Department's Fact Sheet for the proposed project, an Air State Facility Permit will be required for current operations at the CWM facility, and this permit will be then be modified if and when the RMU-2 Project proposal is approved. Such a permit has now been issued subject to significant shortcomings including: (i) the lack of determination of the major source status of the facility as discussed earlier; and (ii) improper cross-referencing of the air permit with the RCRA permit for the facility including the non-availability of several plans and procedures that were not included in the air Permit Application, and which, therefore, could not be reviewed (see Permit, Page 1, Item 4). In addition, since the recently issued permit was based on the Permit Application, it reflects all of the shortcomings of the Application itself, which will be discussed in this section.

I also note that the Fact Sheet for the RMU-2 project notes that the proposed project is also subject to SEQRA (6 NYCRR Part 617), and the impact of air emissions of the project are identified in the DEIS as potentially significant. Under these circumstances, SEQRA arguably does not allow the Department to disregard the sources of potential adverse air emissions impacts.

Thus, under SEQRA, CWM must in the first instance provide a full account of all of the facility's air emission sources in order to enable the Department and the public to evaluate the potential for adverse impacts.

In addition, the state air permit application submitted by CWM appears to show that the current facility is not a major source of air pollutants, as that term is defined by Federal regulations – and is therefore not subject to the federal Title V permitting requirements. However, not only does the recently issued permit recognize that this is not a settled issue, the permit application simply omits several sources/operations; and provides improper (or improperly supported) calculations for various pollutant emissions – which, in aggregate, underestimate the emissions from the current facility. It is likely that a proper and complete assessment of the emissions from the current facility will indicate that it is a major source of air emissions and therefore subject to Title V requirements. This would also mean that the RMU-2 project, when assessed for its air impacts, would result in the modification of a Title V permit as opposed to a modification of the state air permit. It could also mean that this recently issued state air permit is not proper for the existing facility.

V.1 Emission Sources And Activities At CWM

Emission sources and/or activities at the facility include:

- Open-air wastewater lagoons with a capacity of about 25 million gallons; currently utilized lagoons (Facultative Ponds 1&2 and Facultative Pond 3) are mechanically aerated to treat contaminants by evaporation to the atmosphere without any further controls; a proposed new Fac Pond 5 would replace Fac Pond 3, which would be displaced by the RMU-2 landfill footprint, providing comparable replacement capacity and exposed surface area from which pollutants can be emitted;
- Tanks; over 30 tanks utilized for storage of landfill leachate and/or liquid wastes that are vented to the atmosphere;

- Storage buildings for hazardous waste drums and other containers; the Drum Maintenance Building and the PCB Warehouse, for example, can be expected to generate emissions from inspections and leaks. In addition, the rate of emissions from containers is significantly affected by filling methods. Splash filling, submerged filling and bottom loading each generate predictable emission rates;

- Roll-off containers in storage; numerous roll-offs are stored at various locations around the Model City Facility, generally covered by only by tarps. Even empty roll-offs can be expected to generate emissions from residual liquids and solid wastes;

- Landfills; in addition to RMU-1 and the proposed RMU-2, a number of closed and “capped” landfills at the facility can be expected to generate air emissions. Department monitor reports indicate that at various times strong odors have been detected in the vicinity of both closed and active landfills;

- Equipment leaks; the Aqueous Waste Treatment System (AWTS) at the facility includes numerous fugitive sources of air emissions such as fittings, valves and pipes that are subject to routine leakage of emissions;

- Spills; Department monitor reports indicate that at various times hazardous waste spills occur and have occurred at the facility. Although generally in small amounts, to the extent these spills are routine events, a predictable volume of air emissions can be expected to be generated from such incidents/activities;

- Fires; intermittent but routine fires have been a normal feature of operations at the current facility and can be expected to continue at an increased rate, given the increased rate of waste receipts that will occur under the RMU-2 Project proposal, compared to current operations over the last decade. Emissions from fires include numerous volatile, and semi-volatile compounds as well as particulate matter of various sizes;

- Fugitive particulate matter (PM or dust) emissions of various sizes are generated from continual

additions and removals to clay, gravel and soil stockpiles; truck traffic associated with stockpile management; truck traffic associated with waste management; traffic associated with general facility activities; excavations to support remediation activities; and landfilling operations.

V.2 Incomplete and Unsupported Characterization of Air Emissions at CWM

CWM's characterization of emissions from several of its sources is incomplete and, in many cases, unsupported. For example:

(a) emissions from the large, open, facultative ponds are simply not quantified and are thus assumed to be zero. No supporting data are provided regarding the constituents present in the waste waters that are fed to these ponds (i) when such waters are first introduced to the ponds and (ii) when such waters are released from the ponds;

(b) emissions from fires that occur routinely at the facility are not quantified and are thus assumed to be zero. The air permit application makes no mention of fires nor does it provide any justification for how fires (and resultant emissions) would be absent in the future at the facility;

(c) emissions from spills that occur routinely at the facility are not quantified and are thus assumed to be zero. The air permit application makes no mention of spills nor does it provide any justification for how spills (and resultant emissions) would be absent in the future at the facility;

(d) emissions of volatile compounds including hazardous air pollutants from the numerous storage tanks at the facility appear to be improperly under-estimated based on the bulk liquid temperatures assumed in the calculations.

Specific issues raised by the Permit Application as follows.

(at p. 1) as noted earlier, contrary to CWM's statement that "CRA has prepared an Emission Inventory (Inventory) for CWM based on a review of all emission sources and Site operations at

the Facility...”, several emission sources or activities are missing altogether – including emissions from fires, emissions from spills, emissions from remediation activities, emissions from process buildings, equipment,, Fac Ponds, and landfills.

(at Table 1) the emission inventory omits various pollutants altogether – such as any volatile radiological compounds such as radon, and also any radiological compounds associated with fugitive dust emissions.

(at pdf p. 71) PM10 Calculations from Landfill Operations uses a moisture content value, M=14% and Silt Content value of 9.2% from EPA’s generic compilation document, AP-42. These should be site specific values instead.

(at *ibid.*) the Permit Application assumes that 90% control of PM10 will be achieved via water suppression and dust suppression but this is not supported at all. Control efficiency is a function of many variables such as the manner in which the water or suppressant is applied, the amounts involved, how the suppressants are atomized or not into fine droplets, the geometries involved, and training of the person applying the suppressant. Simply noting that a high level of efficiency such as 90% is possible with no support at all is insufficient.

(at pdf p. 82) similar to the above, the Permit Application assumes a control efficiency of 40% for PM2.5. Again, no support is provided.

(at pdf p.73/74) see similar assumptions like the above for other fugitive sources and activities.

(at pdf p. 78) the Permit Application assumes that PM control for the stabilization baghouses is 99%. No support is provided.

(at pdf p. 78) the Permit Application provides no means to document nor provides any factual support that 15% cement kiln dust (CKD) will be added for stabilization.

(at pdf p. 93) the Permit Application references a technical paper by Guo and Roache dealing with estimation of emissions, specifically limited to Indoor environments only per the Title of the paper and discussion within the paper. Yet, the Permit Application uses this paper as a basis for estimating emissions from outdoor sources such as leachate emissions from stills, for example. It is not clear why and how the Guo and Roache method is even applicable to such sources and settings.

(at pdf p. 102) a sample was apparently collected on 3/21/13 from Tank T-103 and subsequently analyzed and the results were used to estimate emissions not only for this tank but also for others.

(at pdf p. 32) It is not clear how or why only one sample, collected on one day, from just one tank can or will represent the contents of not just this tank but also those of several other tanks, as used in the Permit Application.

(at pdf p. 139) the Permit Application shows a leachate analysis for SLF 1-6 which was conducted in 1994. It is not clear how or why this is representative of the leachate being produced today, some 20 years later.

(at pdf p. 166) the Permit Application shows analysis for sampling conducted from Tank T-160 in January or early February 2012. It is not clear why this a representative sample for this tank. In addition, the Application notes that this data was used for “fac pond” evaluation, per the title. This is unclear and confusing because fac Pond emissions (see Table 1) are zero for every pollutant.

The Maximum Daily Liquid Surface Temp used in each and of the Vertical tank calculations is 53.57 F, as follows: T-102 (p. 171); T-103 (p. 176); T-105 (p. 180); T-107 (p. 184); T-108 (p. 188); T-109 (p. 194); T-110 (p. 199); T-111 (p. 204); T-130 (p. 209); T-150 (p. 213); T-158 (p. 217); T-160 (p. 221); T-100 (p. 267); T-210 (p. 271); T-220 (p. 275); T-230 (p. 279); T-1010 (p. 283); T-1020 (p. 287); T-310 (p. 291); T-320 (p. 295); T-3001 (p. 299); T-3002 (p. 303); T-3003 (p. 307); T-3011 (p. 315); T-3012 (p. 319); Frac Tank #3 (p. 323). It is not clear why the

maximum daily liquid temperature can never exceed 53.57 F in Model City, NY; no basis is provided in support of this assumption.

In contrast to the temperature used above for the Vertical tanks, the Permit Application uses a value of 68.49 F for the same parameter (Maximum Daily Liquid Surface Temp) in each of the Horizontal tank calculations is 68.49 F, as follows: T-8001 (p. 226); T-8002 (p. 230); T-8005 (p. 234); T-8006 (p. 238); T-8007 (p. 242); T-8008 (p. 246); T-8009 (p. 250); T-8010 (p. 254); T-3009 rev (p. 311). It is still not clear why: (i) the maximum daily surface temperature can never exceed 68.49 F in Model City, NY; and (ii) why it should be exactly 14.92 F greater in every Horizontal tank as opposed to every Vertical tank.

(at pdf p. 259) the only sampling data provided for groundwater tanks T-8005, T-8006, T-8007, and T-8010 was conducted on 4/22/13. It is not clear how this is representative for each tank and for all times.

(at pdf p. 375) the analytical sampling of biotower exhaust was conducted only on 3/16/13. It is not clear how or why this sample is representative for all emissions from the biotower.

Full tanks calculations are not shown (only summaries are provided instead) for the several storage tanks so the input assumptions could not be verified. See UG-1 (p. 401); Kerosene Horizontal Tank (p. 402); T-27 Fuel Oil Tank (p. 403); Firewater Pump Diesel Tank (p. 404); DF-1 Diesel Tank (p. 404); T-20 Fuel Oil Tank (p. 405); E04/E04/E05 Motor/Waste Oil Tanks (p. 406);

For the Drum Storage Building waste fuel transfer calculations, it is assumed that the liquids in the drums that can be processed in this facility are assumed to be an equal mix of gasoline and #2 fuel oil. No basis is provided for this assumption whatsoever. The resulting vapor pressure of 3.4537 psia is used in the calculation (p. 410). Actual vapor pressure could be significantly higher, leading to emission underestimation.

Collectively, based on the deficiencies noted above, therefore, the Permit Application underestimates the size of the CWM facility as to its air emissions. And, based on this, for purposes of its DEIS, its Part 361 Siting Application, and Part 373 Permit Application, CWM has therefore inadequately or improperly characterized air emissions from the current facility and the RMU-2 project.

V.3 The Permit Application Does Not Meet Part 373 Standards

The deficiencies above – i.e., the omission of sources and the improper characterization of emissions from even those sources that are identified, do not meet the minimum standards for Part 373 applications.

Under Part 373 CWM's RMU-2 Project application must include "[a] description of procedures, structures or equipment used at the facility to . . . prevent releases to the atmosphere." 6 NYCRR § 373-1.5(a)(2)(viii)(f). In addition, specific information on air emission control equipment is required for containers, tanks, and surface impoundments (wastewater ponds). 6 NYCRR §§ 373-1.5(b)(5), (c)(11), (d)(12). The information required is specified at 6 NYCRR § 373-1.5(n), which provides that the application must contain exposure information relating to “reasonably foreseeable potential releases from both normal operations and accidents,” including “the potential pathways of human exposure to hazardous wastes or constituents resulting from the releases,” and “the potential magnitude and nature of the human exposure resulting from such releases.” 6 NYCRR §§ 373-1.5(d)(10)(a) through (c).

For landfills, the application must also contain exposure information relating to “reasonably foreseeable potential releases from both normal operations and accidents at the unit, including releases associated with transportation of wastes to or from the unit,” including “the potential pathways of human exposure to hazardous wastes or constituents resulting from the releases,” and “the potential magnitude and nature of the human exposure resulting from such releases.” 6 NYCRR §§ 373-1.5(h)(10)(a) through (c). If EPA hazardous waste numbers F020, F021, F022, F023, F026 or F027 are managed in the landfill, the application must provide information

regarding “their potential to migrate through soil or to volatilize or escape into the atmosphere.” 6 NYCRR § 373-1.5(h)(11)(i).

For “miscellaneous units,” including storage and treatment buildings, the application must also provide: “[I]nformation on the potential pathways of exposure of humans or environmental receptors to hazardous waste or hazardous constituents and on the potential magnitude and nature of such exposures.” 6 NYCRR § 373-1.5(j)(3).

For process vents, “the total emissions for all affected vents at the facility” must be provided in the application. 6 NYCRR § 373-1.5(k)(2)(i). In addition, “information and data supporting estimates of vent emissions and emission reduction achieved by add-on control devices based on engineering calculations or source tests” must be included. 6 NYCRR § 373-1.5(k)(2)(ii).

Information on “vent stream characteristics and control device operation parameters” for valves, pumps, compressors, pressure relief devices, sampling connection systems, open-ended valves or lines, or flanges or other connectors, and any required control devices or systems and other equipment that may emit air pollutants is required in the application, and must include emissions controls based on “ATPI Course 415: Control of Gaseous Emissions” or equivalent engineering texts. 6 NYCRR § 373-1.5(l)(5)(iii).

Because they are elevated, roll-offs are not required to have a containment system to contain spilled or leaked waste (unless they hold F020, F021, F022, F023, F026 and F027 classified wastes), but they are not exempt from emissions controls. 6 NYCRR § 373-2.9(f)(2), (3). Such containers “must always be closed during storage, except when it is necessary to add or remove waste,” (6 NYCRR § 373-2.9(d)), so some emissions will occur upon opening and closing the container, and a smaller amount will occur when closed. An even smaller amount of emissions will occur if emission controls are installed, but there is no indication in the application materials that roll-offs have such controls.

The application materials and the DEIS do not appear to comply with the requirements of Part 373 applications as noted above.

We reiterate that CWM should provide a comprehensive inventory of all of its potential air emissions sources and activities, including routine sources as well as activities such as fires and spills that may be sporadic but are nonetheless associated with routine operations of its facility. CWM should provide all supporting data that it uses in its emissions calculations including all input data to various emissions equations and software programs used to calculate such emissions. CWM should justify why the many process and ambient variables that are inputs to the emissions calculations are representative of the facility and its location, as applicable. CWM should also justify the values it uses for emission control efficiency, to the extent it relies on such calculations and estimates, to reduce the potential emissions from various sources, such as baghouses for particulate matter.

As noted earlier, once CWM provides such an account of emission sources, it is possible that the facility will be determined to be a major source of emissions under Title V of the federal Clean Air Act, triggering additional requirements not addressed in the application materials.

Hazardous waste treatment, storage, and disposal facilities (TSDF), hazardous wastewater treatment operations exempted from air emission control requirements in 40 CFR Parts 264 or 265, and recovery operations that recycle or reprocess hazardous waste and are exempted from regulation as a TSDF in 40 CFR Parts 264 or 265 are nevertheless subject to EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) from Off-Site Waste and Recovery Operations (OSWRO), promulgated in 1996 and amended in 1999 and 2001. 61 FR 34140 (July 1, 1996) (promulgating 40 CFR Part 63, Subpart DD); 64 FR 38993 (July 20, 1999); 66 FR 1263 (January 8, 2001).

CWM operates all three types of facilities at Model City. The OSWRO rule incorporates other subparts in 40 CFR part 63 for the specific air emissions control requirements to be used for tanks, surface impoundments, containers, individual drain systems, and oil-water and organic-water separators. CWM also operates each of these potential emission sources.

The OSWRO rule requires new and existing major sources to control emissions of hazardous air pollutants (HAP) to the level reflecting application of the maximum achievable control technology. The RMU-2 Project application materials fail to provide sufficient information to determine whether NESHAP major source permitting applies to the project as proposed.

In addition, under SEQRA's general mandate to assess the potential for adverse impacts on air emissions, the DEIS should identify all emission sources, identify appropriate guidance and apply applicable emission estimation procedures to all sources of emissions, and provide a discussion and analysis of combined emissions at the facility. In addition, under the Department's hazardous waste facility regulations, the Department may require CWM to submit additional information in order to establish appropriate permit conditions. 6 NYCRR § 373-1.4(h). Accordingly, once an adequate emissions inventory is provided as discussed earlier, the Part 373 application should be supplemented with a comprehensive applicability analysis. We look forward to commenting further on this supplemental information once it is provided. However, as an initial matter we urge that it is unreasonable to believe that a facility of this kind and size would not have the potential for significant adverse emissions impacts on the surrounding community.

In addition, any inventory of potential emission sources should be evaluated for its contribution to greenhouse gas emissions, including all likely greenhouse gases that can be emitted from various operations. This includes not only methane and carbon dioxide, the better known of the many greenhouse gases but also nitrous oxide (N₂O) as well as various chloro-fluoro-carbons, as applicable.

Finally, the application for the current facility does not make any mention of the applicability of federal regulations dealing with accidental risk at the facility as provided in Section 112(r) of the Clean Air Act. These regulations require the inventory of listed substances in the applicable regulations – such as chlorine and ammonia – present in each process at the facility. If the quantities of such substances exceed specified thresholds then the regulations require various actions including the preparation of accidental risk management plans. The application should

provide a thorough discussion of the applicability of such regulations, including support for why such regulations do not apply to the facility.

ATTACHMENT A – RESUME FOR RANAJIT SAHU
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CONSULTANT, ENVIRONMENTAL AND ENERGY ISSUES

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EXPERIENCE SUMMARY

Dr. Sahu has over twenty three years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment; soils and groundwater remediation; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

He has over twenty one years of project management experience and has successfully managed and executed numerous projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public. Notably, he has successfully managed a complex soils and groundwater remediation project with a value of over \$140 million involving soils characterization, development and implementation of the remediation strategy, regulatory and public interactions and other challenges.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past twenty three years include various steel mills, petroleum refineries, cement companies, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, and various entities in the public sector including EPA, the US Dept. of Justice, California DTSC, various municipalities, etc.). Dr. Sahu has performed projects in over 44 states, numerous local jurisdictions and internationally.

Dr. Sahu's experience includes various projects in relation to industrial waste water as well as storm water pollution compliance include obtaining appropriate permits (such as point source NPDES permits) as well development of plans, assessment of remediation technologies, development of monitoring reports, and regulatory interactions.

In addition to consulting, Dr. Sahu has taught numerous courses in several Southern California universities including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management) for the past seventeen years. In this time period he has also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental areas discussed above in both state and Federal courts as well as before administrative bodies (please see Attachment D).

EXPERIENCE RECORD

- 2000-present **Independent Consultant.** Providing a variety of private sector (industrial companies, land development companies, law firms, etc.) public sector (such as the US Department of Justice) and public interest group clients with project management, air quality consulting, waste remediation and management consulting, as well as regulatory and engineering support consulting services.
- 1995-2000 Parsons ES, **Associate, Senior Project Manager and Department Manager for Air Quality/Geosciences/Hazardous Waste Groups**, Pasadena. Responsible for the management of a group of approximately 24 air quality and environmental professionals, 15 geoscience, and 10 hazardous waste professionals providing full-service consulting, project management, regulatory compliance and A/E design assistance in all areas.
- Parsons ES, **Manager for Air Source Testing Services.** Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.
- 1992-1995 Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department. Responsibilities included multimedia regulatory compliance and permitting (including hazardous and nuclear materials), air pollution engineering (emissions from stationary and mobile sources, control of criteria and air toxics, dispersion modeling, risk assessment, visibility analysis, odor analysis), supervisory functions and project management.
- 1990-1992 Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department. Responsibilities included permitting, tracking regulatory issues, technical analysis, and supervisory functions on numerous air, water, and hazardous waste projects. Responsibilities also include client and agency interfacing, project cost and schedule control, and reporting to internal and external upper management regarding project status.
- 1989-1990 Kinetics Technology International, Corp. **Development Engineer.** Involved in thermal engineering R&D and project work related to low-NO_x ceramic radiant burners, fired heater NO_x reduction, SCR design, and fired heater retrofitting.
- 1988-1989 Heat Transfer Research, Inc. **Research Engineer.** Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

- 1984-1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.
- 1984 M. S., Mechanical Engineering, Caltech, Pasadena, CA.
- 1978-1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

TEACHING EXPERIENCE

Caltech

- "Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.
- "Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.
- "Caltech Secondary and High School Saturday Program," - taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.
- "Heat Transfer," - taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.
- "Thermodynamics and Heat Transfer," Fall and Winter Terms of 1996-1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.

"Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

"Advanced Hazardous Waste Management" University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

"Environmental Risk Assessment," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1998.

"Hazardous Waste Remediation" Loyola Marymount University, Dept. of Civil Engineering. Various years since 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

"Environmental Planning and Management," 5 week program for visiting Chinese delegation, 1994.

"Environmental Planning and Management," 1 day program for visiting Russian delegation, 1995.

"Air Pollution Planning and Management," IEP, UCR, Spring 1996.

"Environmental Issues and Air Pollution," IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, since 1987.

Air and Waste Management Association, West Coast Section, since 1989.

PROFESSIONAL CERTIFICATIONS

EIT, California (# XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, since 2000.

CEM, State of Nevada (#EM-1699). Expiration 10/07/2015.

ATTACHMENT B – LIST OF PUBLICATIONS AND PRESENTATIONS

PUBLICATIONS

- "Physical Properties and Oxidation Rates of Chars from Bituminous Coals," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **67**, 275-283 (1988).
- "Char Combustion: Measurement and Analysis of Particle Temperature Histories," with R.C. Flagan, G.R. Gavalas and P.S. Northrop, *Comb. Sci. Tech.* **60**, 215-230 (1988).
- "On the Combustion of Bituminous Coal Chars," PhD Thesis, California Institute of Technology (1988).
- "Optical Pyrometry: A Powerful Tool for Coal Combustion Diagnostics," *J. Coal Quality*, **8**, 17-22 (1989).
- "Post-Ignition Transients in the Combustion of Single Char Particles," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **68**, 849-855 (1989).
- "A Model for Single Particle Combustion of Bituminous Coal Char." Proc. ASME National Heat Transfer Conference, Philadelphia, **HTD-Vol. 106**, 505-513 (1989).
- "Discrete Simulation of Cenospheric Coal-Char Combustion," with R.C. Flagan and G.R. Gavalas, *Combust. Flame*, **77**, 337-346 (1989).
- "Particle Measurements in Coal Combustion," with R.C. Flagan, in "**Combustion Measurements**" (ed. N. Chigier), Hemisphere Publishing Corp. (1991).
- "Cross Linking in Pore Structures and Its Effect on Reactivity," with G.R. Gavalas in preparation.
- "Natural Frequencies and Mode Shapes of Straight Tubes," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).
- "Optimal Tube Layouts for Kamui SL-Series Exchangers," with K. Ishihara, Proprietary Report for Kamui Company Limited, Tokyo, Japan (1990).
- "HTRI Process Heater Conceptual Design," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).
- "Asymptotic Theory of Transonic Wind Tunnel Wall Interference," with N.D. Malmuth and others, Arnold Engineering Development Center, Air Force Systems Command, USAF (1990).
- "Gas Radiation in a Fired Heater Convection Section," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1990).
- "Heat Transfer and Pressure Drop in NTIW Heat Exchangers," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1991).
- "NO_x Control and Thermal Design," Thermal Engineering Tech Briefs, (1994).

PRESENTATIONS

- "Pore Structure and Combustion Kinetics - Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).
- "Measurement of Temperature-Time Histories of Burning Single Coal Char Particles," with R.C. Flagan, presented at the American Flame Research Committee Fall International Symposium, Pittsburgh, (1988).
- "Physical Characterization of a Cenospheric Coal Char Burned at High Temperatures," with R.C. Flagan and G.R. Gavalas, presented at the Fall Meeting of the Western States Section of the Combustion Institute, Laguna Beach, California (1988).
- "Control of Nitrogen Oxide Emissions in Gas Fired Heaters - The Retrofit Experience," with G. P. Croce and R. Patel, presented at the International Conference on Environmental Control of Combustion Processes (Jointly

sponsored by the American Flame Research Committee and the Japan Flame Research Committee), Honolulu, Hawaii (1991).

"Air Toxics - Past, Present and the Future," presented at the Joint AIChE/AEE Breakfast Meeting at the AIChE 1991 Annual Meeting, Los Angeles, California, November 17-22 (1991).

"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9-10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers - Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19-24, 1994.

ATTACHMENT C – PREVIOUS EXPERT WITNESS TESTIMONY

1. Occasions where Dr. Sahu has provided Written or Oral testimony before Congress:

- (a) In July 2012, provided expert written and oral testimony to the House Subcommittee on Energy and the Environment, Committee on Science, Space, and Technology at a Hearing entitled “Hitting the Ethanol Blend Wall – Examining the Science on E15.”

2. Matters for which Dr. Sahu has have provided affidavits and expert reports include:

- (b) Affidavit for Rocky Mountain Steel Mills, Inc. located in Pueblo Colorado – dealing with the technical uncertainties associated with night-time opacity measurements in general and at this steel mini-mill.
- (c) Expert reports and depositions (2/28/2002 and 3/1/2002; 12/2/2003 and 12/3/2003; 5/24/2004) on behalf of the United States in connection with the Ohio Edison NSR Cases. *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).
- (d) Expert reports and depositions (5/23/2002 and 5/24/2002) on behalf of the United States in connection with the Illinois Power NSR Case. *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).
- (e) Expert reports and depositions (11/25/2002 and 11/26/2002) on behalf of the United States in connection with the Duke Power NSR Case. *United States, et al. v. Duke Energy Corp.*, 1:00-CV-1262 (Middle District of North Carolina).
- (f) Expert reports and depositions (10/6/2004 and 10/7/2004; 7/10/2006) on behalf of the United States in connection with the American Electric Power NSR Cases. *United States, et al. v. American Electric Power Service Corp., et al.*, C2-99-1182, C2-99-1250 (Southern District of Ohio).
- (g) Affidavit (March 2005) on behalf of the Minnesota Center for Environmental Advocacy and others in the matter of the Application of Heron Lake BioEnergy LLC to construct and operate an ethanol production facility – submitted to the Minnesota Pollution Control Agency.
- (h) Expert Report and Deposition (10/31/2005 and 11/1/2005) on behalf of the United States in connection with the East Kentucky Power Cooperative NSR Case. *United States v. East Kentucky Power Cooperative, Inc.*, 5:04-cv-00034-KSF (Eastern District of Kentucky).
- (i) Affidavits and deposition on behalf of Basic Management Inc. (BMI) Companies in connection with the BMI vs. USA remediation cost recovery Case.
- (j) Expert Report on behalf of Penn Future and others in the Cambria Coke plant permit challenge in Pennsylvania.
- (k) Expert Report on behalf of the Appalachian Center for the Economy and the Environment and others in the Western Greenbrier permit challenge in West Virginia.

- (l) Expert Report, deposition (via telephone on January 26, 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) in the Thompson River Cogeneration LLC Permit No. 3175-04 challenge.
- (m) Expert Report and deposition (2/2/07) on behalf of the Texas Clean Air Cities Coalition at the Texas State Office of Administrative Hearings (SOAH) in the matter of the permit challenges to TXU Project Apollo's eight new proposed PRB-fired PC boilers located at seven TX sites.
- (n) Expert Testimony (July 2007) on behalf of the Izaak Walton League of America and others in connection with the acquisition of power by Xcel Energy from the proposed Gascoyne Power Plant – at the State of Minnesota, Office of Administrative Hearings for the Minnesota PUC (MPUC No. E002/CN-06-1518; OAH No. 12-2500-17857-2).
- (o) Affidavit (July 2007) Comments on the Big Cajun I Draft Permit on behalf of the Sierra Club – submitted to the Louisiana DEQ.
- (p) Expert Report and Deposition (12/13/2007) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case. *Plaintiffs v. Allegheny Energy Inc., et al.*, 2:05cv0885 (Western District of Pennsylvania).
- (q) Expert Reports and Pre-filed Testimony before the Utah Air Quality Board on behalf of Sierra Club in the Sevier Power Plant permit challenge.
- (r) Expert Report and Deposition (October 2007) on behalf of MTD Products Inc., in connection with General Power Products, LLC v MTD Products Inc., 1:06 CVA 0143 (Southern District of Ohio, Western Division)
- (s) Experts Report and Deposition (June 2008) on behalf of Sierra Club and others in the matter of permit challenges (Title V: 28.0801-29 and PSD: 28.0803-PSD) for the Big Stone II unit, proposed to be located near Milbank, South Dakota.
- (t) Expert Reports, Affidavit, and Deposition (August 15, 2008) on behalf of Earthjustice in the matter of air permit challenge (CT-4631) for the Basin Electric Dry Fork station, under construction near Gillette, Wyoming before the Environmental Quality Council of the State of Wyoming.
- (u) Affidavits (May 2010/June 2010 in the Office of Administrative Hearings)/Declaration and Expert Report (November 2009 in the Office of Administrative Hearings) on behalf of NRDC and the Southern Environmental Law Center in the matter of the air permit challenge for Duke Cliffside Unit 6. Office of Administrative Hearing Matters 08 EHR 0771, 0835 and 0836 and 09 HER 3102, 3174, and 3176 (consolidated).
- (v) Declaration (August 2008), Expert Report (January 2009), and Declaration (May 2009) on behalf of Southern Alliance for Clean Energy et al., v Duke Energy Carolinas, LLC. in the matter of the air permit challenge for Duke Cliffside Unit 6. *Southern Alliance for Clean Energy et al., v. Duke Energy Carolinas, LLC*, Case No. 1:08-cv-00318-LHT-DLH (Western District of North Carolina, Asheville Division).
- (w) Declaration (August 2008) on behalf of the Sierra Club in the matter of Dominion Wise County plant MACT.

- (x) Expert Report (June 2008) on behalf of Sierra Club for the Green Energy Resource Recovery Project, MACT Analysis.
- (y) Expert Report (February 2009) on behalf of Sierra Club and the Environmental Integrity Project in the matter of the air permit challenge for NRG Limestone's proposed Unit 3 in Texas.
- (z) Expert Report (June 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*
- (aa) Expert Report (August 2009) on behalf of Sierra Club and the Southern Environmental Law Center in the matter of the air permit challenge for Santee Cooper's proposed Pee Dee plant in South Carolina).
- (bb) Statements (May 2008 and September 2009) on behalf of the Minnesota Center for Environmental Advocacy to the Minnesota Pollution Control Agency in the matter of the Minnesota Haze State Implementation Plans.
- (cc) Expert Report (August 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (dd) Expert Report and Rebuttal Report (September 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.
- (ee) Expert Report (December 2009) and Rebuttal reports (May 2010 and June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).
- (ff) Pre-filed Testimony (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (gg) Pre-filed Testimony (July 2010) and Written Rebuttal Testimony (August 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions*, No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.
- (hh) Expert Report (August 2010) and Rebuttal Expert Report (October 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Liability Phase.
- (ii) Declaration (August 2010), Reply Declaration (November 2010), Expert Report (April 2011), Supplemental and Rebuttal Expert Report (July 2011) on behalf of the United States in the matter of DTE Energy Company and Detroit Edison Company (Monroe Unit 2). *United States of America v. DTE Energy Company and Detroit Edison Company*, Civil Action No. 2:10-cv-13101-BAF-RSW (US District Court for the Eastern District of Michigan).

- (jj) Expert Report and Deposition (August 2010) as well as Affidavit (September 2010) on behalf of Kentucky Waterways Alliance, Sierra Club, and Valley Watch in the matter of challenges to the NPDES permit issued for the Trimble County power plant by the Kentucky Energy and Environment Cabinet to Louisville Gas and Electric, File No. DOW-41106-047.
- (kk) Expert Report (August 2010), Rebuttal Expert Report (September 2010), Supplemental Expert Report (September 2011), and Declaration (November 2011) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).
- (ll) Written Direct Expert Testimony (August 2010) and Affidavit (February 2012) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).
- (mm) Deposition (August 2010) on behalf of Environmental Defense, in the matter of the remanded permit challenge to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (nn) Expert Report, Supplemental/Rebuttal Expert Report, and Declarations (October 2010, November 2010, September 2012) on behalf of New Mexico Environment Department (Plaintiff-Intervenor), Grand Canyon Trust and Sierra Club (Plaintiffs) in the matter of Plaintiffs v. Public Service Company of New Mexico (PNM), Civil No. 1:02-CV-0552 BB/ATC (ACE). (US District Court for the District of New Mexico).
- (oo) Expert Report (October 2010) and Rebuttal Expert Report (November 2010) (BART Determinations for PSCo Hayden and CSU Martin Drake units) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.
- (pp) Expert Report (November 2010) (BART Determinations for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.
- (qq) Declaration (November 2010) on behalf of the Sierra Club in connection with the Martin Lake Station Units 1, 2, and 3. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Case No. 5:10-cv-00156-DF-CMC (US District Court for the Eastern District of Texas, Texarkana Division).
- (rr) Pre-Filed Testimony (January 2011) and Declaration (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).
- (ss) Declaration (February 2011) in the matter of the Draft Title V Permit for RRI Energy MidAtlantic Power Holdings LLC Shawville Generating Station (Pennsylvania), ID No. 17-00001 on behalf of the Sierra Club.
- (tt) Expert Report (March 2011), Rebuttal Expert Report (June 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (US District Court for the District of Colorado).
- (uu) Declaration (April 2011) and Expert Report (July 16, 2012) in the matter of the Lower Colorado River Authority (LCRA)'s Fayette (Sam Seymour) Power Plant on behalf of the

- Texas Campaign for the Environment. *Texas Campaign for the Environment v. Lower Colorado River Authority*, Civil Action No. 4:11-cv-00791 (US District Court for the Southern District of Texas, Houston Division).
- (vv) Declaration (June 2011) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.
- (ww) Expert Report (June 2011) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).
- (xx) Declaration (August 2011) in the matter of the Sandy Creek Energy Associates L.P. Sandy Creek Power Plant on behalf of Sierra Club and Public Citizen. *Sierra Club, Inc. and Public Citizen, Inc. v. Sandy Creek Energy Associates, L.P.*, Civil Action No. A-08-CA-648-LY (US District Court for the Western District of Texas, Austin Division).
- (yy) Expert Report (October 2011) on behalf of the Defendants in the matter of *John Quiles and Jeanette Quiles et al. v. Bradford-White Corporation, MTD Products, Inc., Kohler Co., et al.*, Case No. 3:10-cv-747 (TJM/DEP) (US District Court for the Northern District of New York).
- (zz) Declaration (February 2012) and Second Declaration (February 2012) in the matter of *Washington Environmental Council and Sierra Club Washington State Chapter v. Washington State Department of Ecology and Western States Petroleum Association*, Case No. 11-417-MJP (US District Court for the Western District of Washington).
- (aaa) Expert Report (March 2012) and Supplemental Expert Report (November 2013) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.*, Civil Action No. 4:10-cv-4969 (US District Court for the Southern District of Texas, Houston Division).
- (bbb) Declaration (March 2012) in the matter of *Center for Biological Diversity, et al. v. United States Environmental Protection Agency*, Case No. 11-1101 (consolidated with 11-1285, 11-1328 and 11-1336) (US Court of Appeals for the District of Columbia Circuit).
- (ccc) Declaration (March 2012) in the matter of *Sierra Club v. The Kansas Department of Health and Environment*, Case No. 11-105,493-AS (Holcomb power plant) (Supreme Court of the State of Kansas).
- (ddd) Declaration (March 2012) in the matter of the Las Brisas Energy Center *Environmental Defense Fund et al., v. Texas Commission on Environmental Quality*, Cause No. D-1-GN-11-001364 (District Court of Travis County, Texas, 261st Judicial District).
- (eee) Expert Report (April 2012), Supplemental and Rebuttal Expert Report (July 2012), and Supplemental Rebuttal Expert Report (August 2012) on behalf of the states of New Jersey and Connecticut in the matter of the Portland Power plant *State of New Jersey and State of Connecticut (Intervenor-Plaintiff) v. RRI Energy Mid-Atlantic Power Holdings et al.*, Civil Action No. 07-CV-5298 (JKG) (US District Court for the Eastern District of Pennsylvania).

- (fff) Declaration (April 2012) in the matter of the EPA's EGU MATS Rule, on behalf of the Environmental Integrity Project
- (ggg) Expert Report (August 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Harm Phase.
- (hhh) Declaration (September 2012) in the Matter of the Application of *Energy Answers Incinerator, Inc.* for a Certificate of Public Convenience and Necessity to Construct a 120 MW Generating Facility in Baltimore City, Maryland, before the Public Service Commission of Maryland, Case No. 9199.
- (iii) Expert Report (October 2012) on behalf of the Appellants (Robert Concilus and Leah Humes) in the matter of Robert Concilus and Leah Humes v. Commonwealth of Pennsylvania Department of Environmental Protection and Crawford Renewable Energy, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2011-167-R.
- (jjj) Expert Report (October 2012), Supplemental Expert Report (January 2013), and Affidavit (June 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.
- (kkk) Pre-filed Testimony (October 2012) on behalf of No-Sag in the matter of the North Springfield Sustainable Energy Project before the State of Vermont, Public Service Board.
- (lll) Pre-filed Testimony (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.
- (mmm) Expert Report (February 2013) on behalf of Petitioners in the matter of Credence Crematory, Cause No. 12-A-J-4538 before the Indiana Office of Environmental Adjudication.
- (nnn) Expert Report (April 2013), Rebuttal report (July 2013), and Declarations (October 2013, November 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).
- (ooo) Expert Report (May 2013) and Rebuttal Expert Report (July 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).
- (ppp) Declaration (August 2013) on behalf of A. J. Acosta Company, Inc., in the matter of A. J. Acosta Company, Inc., v. County of San Bernardino, Case No. CIVSS803651.
- (qqq) Comments (October 2013) on behalf of the Washington Environmental Council and the Sierra Club in the matter of the Washington State Oil Refinery RACT (for Greenhouse

Gases), submitted to the Washington State Department of Ecology, the Northwest Clean Air Agency, and the Puget Sound Clean Air Agency.

- (rrr) Statement (November 2013) on behalf of various Environmental Organizations in the matter of the Boswell Energy Center (BEC) Unit 4 Environmental Retrofit Project, to the Minnesota Public Utilities Commission, Docket No. E-015/M-12-920.
- (sss) Expert Report (December 2013) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).
- (ttt) Expert Testimony (December 2013) on behalf of the Sierra Club in the matter of Public Service Company of New Hampshire Merrimack Station Scrubber Project and Cost Recovery, Docket No. DE 11-250, to the State of New Hampshire Public Utilities Commission.
- (uuu) Expert Report (January 2014) on behalf of Baja, Inc., in *Baja, Inc., v. Automotive Testing and Development Services, Inc. et. al*, Civil Action No. 8:13-CV-02057-GRA (District of South Carolina, Anderson/Greenwood Division).
- (vvv) Declaration (March 2014) on behalf of the Center for International Environmental Law, Chesapeake Climate Action Network, Friends of the Earth, Pacific Environment, and the Sierra Club (Plaintiffs) in the matter of *Plaintiffs v. the Export-Import Bank (Ex-Im Bank) of the United States*, Civil Action No. 13-1820 RC (United States District Court for the District of Columbia).
- (www) Direct Prefiled Testimony (June 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17319 (Michigan Public Service Commission).
- (xxx) Expert Report (June 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).
- (yyy) Declaration (July 2014) on behalf of Public Health Intervenors in the matter of *EME Homer City Generation v. US EPA* (Case No. 11-1302 and consolidated cases) relating to the lifting of the stay entered by the Court on December 30, 2011 (US Court of Appeals for the District of Columbia).

3. Occasions where Dr. Sahu has provided oral testimony in depositions, at trial or in similar proceedings include the following:

- (zzz) Deposition on behalf of Rocky Mountain Steel Mills, Inc. located in Pueblo, Colorado – dealing with the manufacture of steel in mini-mills including methods of air pollution control and BACT in steel mini-mills and opacity issues at this steel mini-mill.
- (aaaa) Trial Testimony (February 2002) on behalf of Rocky Mountain Steel Mills, Inc. in Denver District Court.

- (bbbb) Trial Testimony (February 2003) on behalf of the United States in the Ohio Edison NSR Cases, *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).
- (cccc) Trial Testimony (June 2003) on behalf of the United States in the Illinois Power NSR Case, *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).
- (dddd) Deposition (10/20/2005) on behalf of the United States in connection with the Cinergy NSR Case. *United States, et al. v. Cinergy Corp., et al.*, IP 99-1693-C-M/S (Southern District of Indiana).
- (eeee) Oral Testimony (August 2006) on behalf of the Appalachian Center for the Economy and the Environment re. the Western Greenbrier plant, WV before the West Virginia ????
- (ffff) Oral Testimony (May 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women's Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) re. the Thompson River Cogeneration plant before the Montana Board of Environmental Review.
- (gggg) Oral Testimony (October 2007) on behalf of the Sierra Club re. the Sevier Power Plant before the Utah Air Quality Board.
- (hhhh) Oral Testimony (August 2008) on behalf of the Sierra Club and Clean Water re. Big Stone Unit II before the South Dakota Board of Minerals and the Environment.
- (iiii) Oral Testimony (February 2009) on behalf of the Sierra Club and the Southern Environmental Law Center re. Santee Cooper Pee Dee units before the South Carolina Board of Health and Environmental Control.
- (jjjj) Oral Testimony (February 2009) on behalf of the Sierra Club and the Environmental Integrity Project re. NRG Limestone Unit 3 before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.
- (kkkk) Deposition (July 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*
- (llll) Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Coletto Creek coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (mmmm) Deposition (October 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (nnnn) Deposition (October 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.
- (oooo) Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Tenaska coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH). (April 2010).
- (pppp) Oral Testimony (November 2009) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

- (qqqq) Deposition (December 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (rrrr) Oral Testimony (February 2010) on behalf of the Environmental Defense Fund re. the White Stallion Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.
- (ssss) Deposition (June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).
- (tttt) Trial Testimony (September 2010) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, State of Maryland, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case in US District Court in the Western District of Pennsylvania. *Plaintiffs v. Allegheny Energy Inc., et al.*, 2:05cv0885 (Western District of Pennsylvania).
- (uuuu) Oral Direct and Rebuttal Testimony (September 2010) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).
- (vvvv) Oral Testimony (September 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions*, No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.
- (wwww) Oral Testimony (October 2010) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.
- (xxxx) Oral Testimony (November 2010) regarding BART for PSCo Hayden, CSU Martin Drake units before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.
- (yyyy) Oral Testimony (December 2010) regarding BART for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.
- (zzzz) Deposition (December 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).
- (aaaaa) Deposition (February 2011 and January 2012) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).
- (bbbbb) Oral Testimony (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).

- (ccccc) Deposition (August 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (US District Court for the District of Colorado).
- (dddd) Deposition (July 2011) and Oral Testimony at Hearing (February 2012) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.
- (eeee) Oral Testimony at Hearing (March 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).
- (ffff) Oral Testimony at Hearing (April 2012) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).
- (ggggg) Oral Testimony at Hearing (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.
- (hhhhh) Deposition (March 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.
- (iiii) Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).
- (jjjj) Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).
- (kkkkk) Deposition (February 2014) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).
- (llll) Trial Testimony (February 2014) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.*, Civil Action No. 4:10-cv-4969 (US District Court for the Southern District of Texas, Houston Division).
- (mmmmm) Trial Testimony (February 2014) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).

(nnnnn) Deposition (June 2014) and Trial (August 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).

ATTACHMENT D – DOCUMENTS CONSIDERED

All of the documents relied by me in the preparation of this report are noted in appropriate locations in the text of the report and/or footnotes.