

CITY OF PHILADELPHIA

DEPARTMENT OF PUBLIC HEALTH

AIR POLLUTION CONTROL BOARD

The virtual meeting of the Air Pollution Control Board was held Thursday, January 27, 2022.

Eddie R. Battle, Chairman, presided:

ATTENDING:

MEMBERS: Eddie Battle, Chair of the APCB
Dr. Arthur Frank Member, APCB
Dr. Carol Ann Gross-Davis, Member, APCB
Thomas Edwards, Member, APCB
Terry Soule, Member, APCB
Cheryl Bettigole, Health Commissioner
Dr. Kassahun Sellassie, Director, Air Management Services (AMS)

STAFF: Hallie Weiss, Program Manager, AMS Laboratory
Edward Wiener, Source Registration Chief, AMS
Thomas Barsley, Fac, Comp & Comp Chief, AMS
Henry Kim, Program Services Chief, AMS
Maisha Wheeler, Administrative Scientist, AMS Laboratory
Jiazheng (Jason) Li, Environmental Engineering Supervisor, AMS
Richard Annunziato, Asbestos Manager, AMS
Vanessa Accime, Analytical Chemist Supervisor, AMS Laboratory

Paresh Meta

Abdessalem Cherifi, Electronic Technician, AMS Laboratory

Morgan Robinson, Analytical Chemist, AMS Laboratory

Aadarsh Shah, Environmental Engineer, AMS Laboratory

Dennis Yeun, City Solicitor, Environmental Law

India McGhee, City Solicitor, Environmental Law

James Garrow, Communications, Health Commissioners Office

Eliza Alford, City Council

Tung Vu, Engineering Specialist, AMS Laboratory

Matina Granieri, Office of Sustainability

John Ewurum, Environmental Engineer, AMS

Sarah Carroll, Graduate Engineer, AMS

GUESTS:

Emma Cheuse, Earth Justice

Ben Hartung

Craig Johnson, Interpret Green

John Krueger, PADEP

John Lee, Clean Air Council

Charles McPhedran, Earth Justice

Richard Pepino, UPenn

Peter Winslow

Adrian Wood, UPenn

Aggarwal Bhagwan

Peter Barnard

Chandriani Kinnari

Michael Nines

Nagash Mendik

Joe Minott

Mica Root

Jerome Shabazz

Ben Slay

Nick Spiva

Jeanne Van Orman

Alina Vo

Bonnie Vu

Chairman Battle: Announcement; instructions

Members introduction:

Carol Ann Gross-Davis

Department of Protection Agency at Regency Office and I am an EPA liaison for the Board.

Dr. Arthur Frank

I am a Professor of Environmental Occupational Health at Drexel University School of Public Health and also a professor of medicine doing occupational environmental medicine.

Commissioner Cheryl Bettigole

Health Commissioner. I am also a family doctor.

Mr. Soule

I am a board member and a retired engineer.

Mr. Battle: So obviously we do not have a quorum; is that the case, Kass?

Director Sellassie:

I think two people are not there. I don't know about Dr. Bill miller.

I haven't seen him and Joe Minott.

I think last time they mentioned we will take it from seven, I believe.

So, if there are four, that will be fine.

Mr. Battle: Well, Okay. So can we take a vote on the minutes; this is what I am asking?

Director Sellassie: Yes

Mr. Battle: Alright, Number two on your agenda is actually the minutes of October 21, 2021.
Are there any additions or corrections to the minutes?

Dr. Frank: Motion to accept

Mr. Battle: is there a second?

MR. Soule: I Second

Mr. Battle: All those in favor of approving the minutes, say AYE!

AYE!

Mr. Battle: Those opposed..

No Response:

Charirman Battle: Motion carries.

We're on number three, Program Updates
Kass you have the floor.

Director Sellassie:

Greet the Chairman, Board members and Guests.

Introduction: My name is Kass Sellassie; Air Management Director.

I would like to report to the board about AMS progress since we last met on October 21, 2021.

Summary

- Air Quality**
- NAAQS**
- State Implementation Plan (SIP)**
- EPA Updates**
- PA DEP Updates**
- City Updates**
- AMS Updates**
- Laboratory**
- Outreach**
- Regulatory Services Activities**

Number one and number two were done by the Chairman. And number three its usually thirty minutes but we have three very intelligent presenters; three professors for cumulative risk assessment, so we

will focus on that one. I hope there will be a lot of questions so I leave most of the minutes or hours to that.

Presentation on Risk Assessment and Cumulative by Dr. Anneclaire De Roos. She will go first. Then Dr. Carol Ann Gross-Davis. The third one will be Dr. Arthur Frank.

I will include some of what AMS is doing during my presentation and the next meeting will be April 28, 2022, at the same time which will be on Thursday.

So the summary is air Quality, NAAQS. First we go for the air quality in Philadelphia then the federal state and local and AMS updates.

Air Quality

AIR QUALITY

- From Oct. 1, 2021, to Dec. 31, 2021, there were 46 good days (50%), 46 moderate days (50%), and **0** unhealthy day (0%).
- From Jan. 1, 2021 to Dec. 31, 2021, there were 222 good days (61%), 132 moderate days (36%), and **11** unhealthy days (3%).
- Current 2020 4th 8-hr O₃ concentration is **72 ppb** at NEA with a 2020 design value of **71 ppb**

As you see the quarterly from December 31st, there is zero unhealthy days. That is our concern. For the whole year, this is unusual. I think the problem is some fire from Canada and west USA, California.

That is an increase to PM2.5, that is why it was high last year. It was eleven unhealthy days. The design volume for the ozone, as everybody knows we are attainable for Ozone. This is 2015 we are using. It is still not finalized but we used the 2015 which is 70 parts per billion. We are 72 are ok with the 2008 but not the 2015. We are almost close. We will see it next year. We have a lot of reaction including mobile sources.

NAAQS

NAAQS

•**October 8, 2021:** EPA published in the *Federal Register* (86 Fed. Reg. 56,263) a notice announcing that the draft document titled, “Policy Assessment for Reconsideration of the National Ambient Air Quality Standards for **Particulate Matter**.”

•**October 29, 2021:** The EPA filed a motion in the U.S. Court of Appeals to hold in abeyance until December 23, [2023](#) litigation in which petitioners challenge the agency’s December 21, [2020](#) decision titled, “Review of the **Ozone** National Ambient Air Quality Standards”, in which the EPA retained the existing (2015) ozone NAAQS without revision

October 8, 2021, there was a discussion about particulate matter to be reduced from twelve annually to ten micrograms per minute. So, we don’t know yet; still in discussion. The other one is ozone, there is a lot of the community wants instead of seventy to go down to sixty-five maybe. Still in discussion. So 2023 they might have some discussion.

EPA UPDATES

- **December 13, 2021:** The EPA announced the availability of \$20 million in competitive grants under the **American Rescue Plan (ARP)** for community air pollution monitoring.
- **December 22, 2021:** The EPA Administrator signed a notice adding **1-bromopropane (1-BP)** to the Clean Act Act’s list of hazardous air pollutants.
- **December 30, 2021:** The EPA published in the *Federal Register* (86 FR 74434) a revision to the greenhouse gas emissions standards under the Clean Air Act section 202(a) for **light-duty vehicles for 2023 and later model years to make the standards more stringent.**

The state implementation plan.

November 1st; EPA approved our RACT SIP for 2008. Its is approved now so we move to the 2015; but waiting for the ADP RACT III which is very stringent and we wait for them.. Once it is evolved and finalized, we will use that one. So, it will not take that much time because in 2008, when we did it, we did include the 2015. So maybe a little bit has changed and more stringent.

December 15th, EPA number two. You approved the last time number two fuel oil for 2,500 parts per million of sulfur to 15, one – five, parts per million sulfur. Now it is registered in the federal registration so that is good. The next one we will send is a “Heavy Fuel Oil” you approved last meeting. Maybe soon it will be on the federal registration.

EPA announced availability of the American Rescue Plan. That is a good plan that helps the Philadelphia

community. There are two. The first one is fifty million. We applied a non-competitive one. EPA mentioned we might get some amount close to three hundred fifty thousand. This is a competitive one; its twenty million. We are in the process of application to fulfill the requirements of the application. We are working and Councilwoman Johnson is going to help us by writing so support letters or something. I hope as a community member she can help with this one because it helps the community. We will install toxic monitors in heavy or overburdened communities.

Of course, we will discuss with the community once we get the money, what we buy and where we locate.

December 22nd; EPA added on to the Clean Air Act list which is around 187 bromopropane added the list. This is another toxin. It will be 188.

December 30, 2021. EPA published in the Federal light -duty vehicles for 2023 which is for greenhouse gas. They want is a safe fuel efficiency. Maybe they put like thirty-five miles per gallon or something. The most important one; they say this even as the city is starting sustainability start is zero emission. That means electric cars, maybe. That is what the Federal and the city if Philadelphia is working with now.

PA EPA UPDATES

- **November 16, 2021:** At the Pennsylvania Environmental Quality Board (EQB) meeting, the Board adopted the Final-Form Rulemaking of Control of VOCs from Gasoline Dispensing Facilities (**Stage I and Stage II**).
- **December 9, 2021:** At the Pennsylvania Air Quality Technical Advisory Committee (AQTAC) meeting, DEP presented Draft Final-Form Rulemaking of Control of VOC Emissions from **Oil and Natural Gas Sources**.

Stage one and stage two, which is gas station. Most of the vehicles have on board refueling. They are for recovery, so maybe stage one is not necessary. There are around three hundred and two gas stations in Philadelphia. AMS use EPS standard 6c; which is for gas station just to work on the cleaning and some kinds of stuff.

Still, we have three types; gas station permits.

The Pennsylvania Air Quality Technical Advisory, They have a new rule for that one.

City Updates

- **November 18, 2021:** The Philadelphia City Council adopted a resolution (No. 210935), calling on the Pennsylvania General Assembly to adopt House Bills 2034 and 2043, House Resolution 151, Senate Resolution 201, and Senate Bill 189 and thanking Governor Tom Wolf, Representative Donna Bullock, Representative Malcolm Kenyatta, Representative Chris Rabb, and Senator Vincent Hughes for their commitment to addressing **Environmental Justice** in the Commonwealth of Pennsylvania. .

This is a big issue in environmental justice. Philadelphia City Council adopted a resolution, number 219035. We are discussing with Council and the group Dr. Bettigole is also in and we are working on that one. That is a big issue now in Philadelphia.

We have a draft policy environmental justice, but we are waiting for PADP. The draft is done by law and AMS.

OTHER UPDATES

- **October 26, 2021:** Fifteen states (including Pennsylvania) urged the Biden Administration to limit NOx emissions from heavy-duty trucks. **The NOx standards are based on California's Heavy-Duty Omnibus Regulation to protect historically disadvantaged communities that for far too long have suffered the concentrated impacts of heavy-duty truck pollution.**
- **November 2, 2021:** Researchers find consumption by the world's richest countries responsible for **half of all global premature deaths from exposure to PM2.5.**

Fifteen states including Pennsylvania; the NOX standard are based on the California's Heavy-Duty regulation which is the one I always mention... I the board remembers, four or five years ago I started this mobile source which contributes a lot of emission to the atmosphere at fifty percent compared to other sources. So, we need to reduce that one and that is the only way we can contain the ozone standard.

Still we have a group that Dr. Bettigole is there, EPA is there, PADP is there, Law is there from the office. AMS still working so they gave us some approval to work on. We will include the executive order 107 we put in the Reg 9 we already have control of the emission from mobile sources. We will work on that one.

In the future the EPA and this kind of additional mobile source will be brought to your attention for approval. We will see in the future we will have a lot of stuff to do.

Research

What the research found is our developed country, which the richest countries contribute half of all global premature deaths from exposure to PM2.5. So, the need to reduce PM2.5 by a lot to help other countries too.

AMS LABORATORY- CHEMISTRY

- **PAQS:** The PAQS session is in progress. Laboratory operations for weighing and conducting **Black Carbon** measurements are ongoing. We purchased an **Ion Chromatography system to analyze Ogawa pads used in the Harvard impactors.**
- **Village Green Monitor:** The Village Green monitors continue to collect continuous **meteorological, ozone and particulate data at 6th and Arch Streets** across from the Constitution Center.

AMS Laboratory Chemistry PAQs

I think for a year we are measuring and now another thirteen monitors. We added to overburdened communities or maybe double in some places. We will add maybe another six. We distribute throughout the EJ community and with more concern on aging communities. That helps a lot, and we will continue measuring that.

We have it in fifty locations in Philadelphia. That's the major one, the Village Green monitor. It was EPA and now it belongs to AMS. We measure metrological ozone and data which is at 6th and Arch. Which is a real-time monitor so people, tourists can check the air pollution concentration in that area including metrological data.

AMS Laboratory chemistry

We are still working for Washington, DC measuring some NATTS. We are taking "Fuel Oil" samples; we not only promoted regulation. We have samples from industries from facilities and measure for content. That is I think we have the new instrument for coating and painting analysis. We continue to paint and coat samples in the industry. We are measuring all those.

OUTREACH

- **AMS discussed with GAMP and UPENN how to proceeds the CSAT monitoring at South Philadelphia and Eastwick community. AMS subsidize \$35,000 for the CSAT project to GAMP school.**

Community Scale Air Toxic Plan, we got last year. It is almost around five thousand. We already installed everything around the refinery area. Because of COVID everything was delayed. We expected it like a month or two ago the standard in training, so the company still keeps telling us they don't have the manpower. We are still in cooperation with the GAMP school, which is in Eastwick, the most overburdened community.

We provide them with \$35,000, AMS and UPenn, Dr Pepino and others give us and the teachers in science class. We go out and do our outreach in the communities. We also plan to have three school district teachers in the summertime. That is our plan.

REGULATORY SERVICES ACTIVITIES

•From Jan 1st, 2021 to Dec 31st, 2021:

- AMS issued 1052 permits (865 air and 187 asbestos)
- AMS serviced 427 citizen complaints (267 Air, 57 Asbestos, 103 Noise)
- AMS also performed 3854 inspections (2225 air, 1629 asbestos)
- AMS observed 19 vehicles at 15 locations, issued 6 citations for violations of the City's anti-idling rules.
- AMS issued 465 new NOVs, (C&E 398, Asbestos 67)
- Resolved 406 NOVs (C&E 357, Asbestos 49).
- AMS collected \$ 507,531 (C&E \$462,731, Asbestos \$44,800) in Fines and Penalties

From January 1st to December 31st, AMS issued one thousand fifty-two permits in a year. That is a lot. That is a lot because we found new sources. We found seen thousand now. We found around thirty-five hundred new sources from communicating with L&I and others. We started issuing those permits. It is good to reduce emission because we have to control and inspect and generated revenue to the city too.

AMS serviced four-hundred and twenty citizen complaints. Recent Asbestos complaints in schools.

AMS performed three thousand eight hundred and fifty-four inspections. Even during COVID time. Everyone was still working. Observed nineteen vehicles at fifteen locations and issued citations for idling. Still working with Clean Air Council.

Question: Mr. Soule

Kass, on the seven thousand sources that were not permitted, how does that affect the emissions inventory database.

Answer: Director Sellassie

So what we did is we contact PA License and Inspections, and they have all the data sources they. Once we got to seven thousand; we go after capacity.

Question: Mr. Soule

Isn't going to demonstrate a major increase in emissions inventory?

Answer: Director Sellassie

These sources are already there. So the only thing that we didn't do is we didn't go after them. Those emissions are even more when we permit. So, we reduce the emission because we ask for maintenance. We control limitation for use of fuel.

Question; Mr. Soule

What would they go forward with there control but historically they haven't been taught of the emissions inventory to begin with . The original database for emissions the wouldn't have included. Am I right?

Answer: Director Sellassie

yeah because emission inventory we do for title five major sources. We don't do it for small sources any emission inventory.

Mr. Soule

Okay, so you're saying of the seven thousand, none of them were major sources?

Director Sellassie:

No, No. They are smaller. Like I said, boiler like hotels. Most of them are in hotels and some small like building like residential. They are very small, most of them. But the one, it is like twenty-five hundred we ask for permits. I don't think that will give that much emission to the city.

Mr. Soule

Okay.

Chairman Battle

Okay. Members any more questions for Kass?

No Response

Chairman Battle:

Okay Kass, Great work.

Director Sellassie:

Can I finish this one part?

Chairman Battle: Yes. Please. Go ahead.

Director Sellassie

Cumulative Risk. This is what I want to put here as part of what AMS is doing or will do in the future. The three Professors will explain.

Cumulative Risk

- **Definition: The combination of risks posed by aggregate exposure to multiple agents or stressors in which aggregate exposure is exposure by all routes and pathways and from all sources of each given agent or stressor.**
- **Cumulative Risk will be done in the context of regulatory requirements such as issuance of permits for stationary emission sources**

Cumulative Risk

- The **combination of risks:** ($I_{inh} + I_{ing} + I_{der}$)
- Posed by aggregate exposure to multiple **agents/Stressors:**
 - (**Chemicals**, Biological, physical, Radiological)
- Exposure by all **routes:** (**Inhalation**, Ingestion, Dermal)
- **Pathways:** (**Air**, Soil, Water, wastes, and Food)
- All sources of each given agent/Stressor
- Environmental, community, and residential issues: (Environmental justice)
- Indoor Toxics? (radon, mold, Formaldehyde, pesticides)
- Genetics, age, sex, race, existing medical condition

Cumulative Risk: Based on the definition, it is a combination of risks

Those risks that re inhalation which is for the air, ingestion. This is when I say daily intake or daily average intake NI. These are the routes we are doing.

AMS is doing only the first one. Inhalation form the air. The rest we don't do but we have been working with the city and groups that are, so we have been working with the water department and others.

The definition posed by aggregate exposure to multiple agents and stressors. Chemicals; biological like Hepatitis A or whatever, physical like noise, radiological like radon.

Exposure by all routes. We are only looking for inhalation. Ingestion, dermal; we are not.

Pathways: we are only doing the air part. The rest maybe water department and others. All sources of each given agents and stressors.

Environmental, community, and residential issues. We are dealing with this one, which is Environmental Justice and indoor toxics.

Radiological as radon, mold, formaldehyde, pesticide. We don't deal with this one. EPA doesn't have any standards on this one.

We are also looking for genetics, age sex race and existing medical conditions. If we do most of it, we need toxicology, epidemiology, risk assessment management, that we can do. I have experts on Risk Assessment and Health Policy and exposure science.

That is what AMS is doing.

Cumulative Risk

- Who are involving in the CR?
 - Toxicology
 - Epidemiology
 - **Risk Assessment/Management**
 - Health Policy
 - Exposure Science

Director Sellassie: Any Questions?

No questions. I'll give it to Chairman Eddie Battle.

Mr. Battle

Kass Great Work.

Director Sellassie: Thank you

Chairman Battle: Did I hear correctly that you are working with City Council?

Director Sellassie;

Yes. Council woman Jackson, she is involved a lot. She is working hard, and others are also involved and many from the mayor's office too.

Chairman Battle. Great. I love that. I like it when we are visible to the city.

Chairman Battle: Let us move on to number four on your agenda

Presentation: Dr. Anneclaire J. De Roos
Risk Assessment of Aggregate and Cumulative Exposures
Dornsife School of Public Health, Drexel University

Dr. Frank suggested that I come speak because I am an expert on this topic, which I must say I am not actually an expert on cumulative risk assessment, but I have had a class on risk assessment at Drexel for about seven years now, so I do know a lot about risk assessment in general.

I am in the same department as Dr. Frank, Environmental Occupational Health, and Carol Ann as well.

When we talk risk, what we are talking about is a probability that a specific event will occur and that event in an environmental health risk assessment is an adverse health risk outcome.

What is “Risk”?

In simple terms:

- The probability that a specific event will occur

Risk is expressed as a fraction, without units (range 0-1):

e.g., “1” (100% certain that the event will occur)

e.g., “0.000001” (or 10^{-6}) (probability is 1 in a million that the event will occur)

This is a particularly important number because it is a benchmark that is used by some of the agencies that do risk assessment with one in a million as being seen as a tolerable risk that we are willing to tolerate for the general public since it's impossible to regulate any chemical to zero risk; unless we stop using it entirely.

The Purpose of Risk Assessment

- To identify and evaluate the likelihood of adverse (or beneficial) outcomes of defined scenarios

What can happen?

How likely is it to happen?

- Is usually conducted to inform decision-making

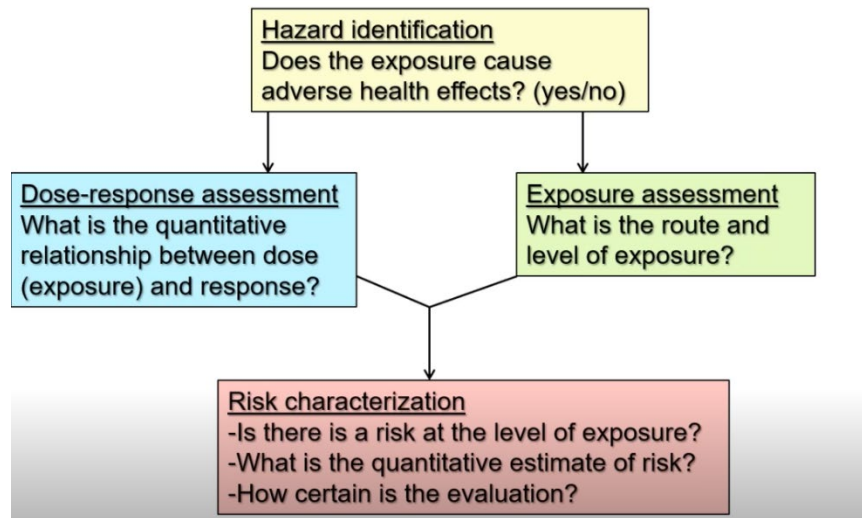
Are we certain enough about the data to inform decision-making?

Purpose of Risk assessment is to identify and evaluate the likelihood of these adverse or beneficial outcomes of defined scenarios. We are using the knowledge to predict what the outcomes might be under those exposure scenarios. So, what can happen, what is likely to happen.

Risk assessment is usually conducted to inform decision making often or regulatory purposes and you know that we are certain enough about the data to inform the decision making because there are always uncertainties in risk assessment.

There are four basic steps that were laid out by the National Academy of Sciences in 1983 when they reviewed the risk assessment process.

The NAS “Red Book” (1983) Named 4 Basic Steps of Risk Assessment



Hazard Identification: What do we know about the chemical or its hazard?
Does it pose health effects, yes or no?

Dose response and assessment and exposure assessment:

Once you have an idea from hazard Identification that there is enough evidence that there are Adverse health outcomes, you move to doing dose response assessment.

What kind of a slope do we expect to see that links exposure to the outcome of interest.

The more doses you have the more risk you have.

Exposure assessment:

Evaluation a specific scenario of exposure assessment assessing what level of exposure

Do you expect the population that you are evaluation to have?

Dose response assessment and exposure assessment together:

You know the level, estimated the level of exposure. We know the dose response relationship to be able to look at that curve and see at this level of exposure this the amount of risk we expect.

Risk Characterization:

Putting it together is the risk characterization step which answer eth questions is there a risk at ta certain level of exposure? What is the quantitative estimate of risk? How certain is the evaluation?

Human Exposure

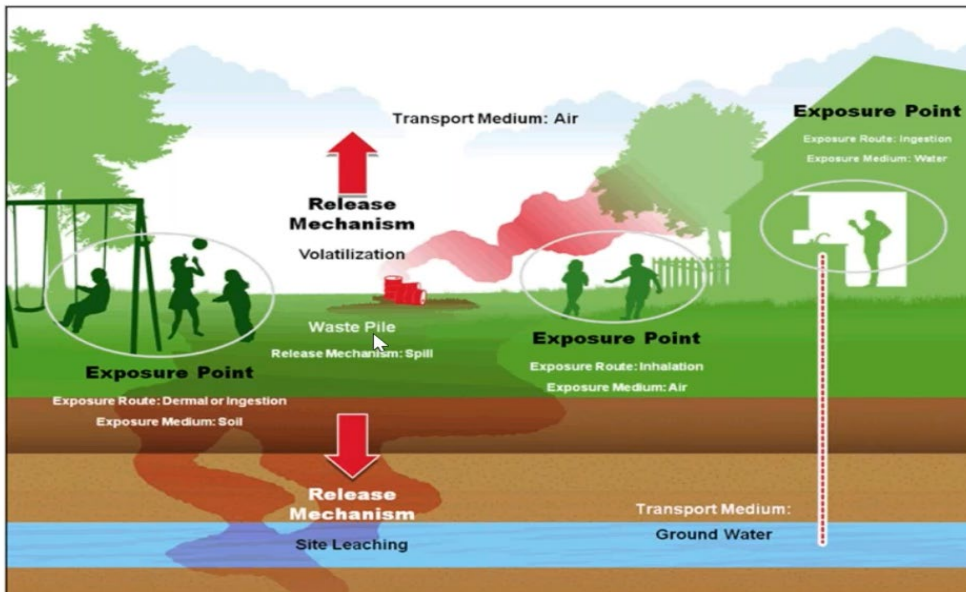
‘Exposure’ is often used synonymously with dose, agent, stressor

‘Exposure’ can refer to a stressor, but also to a process



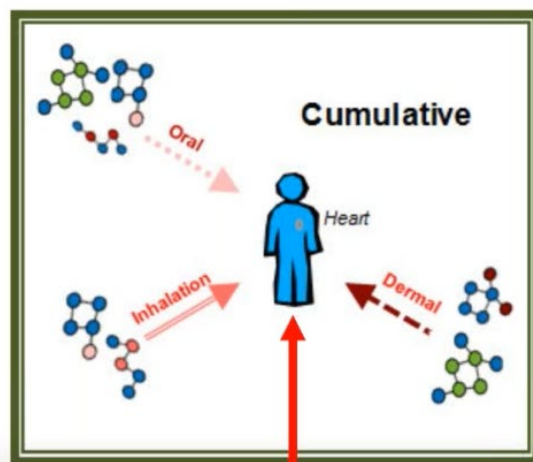
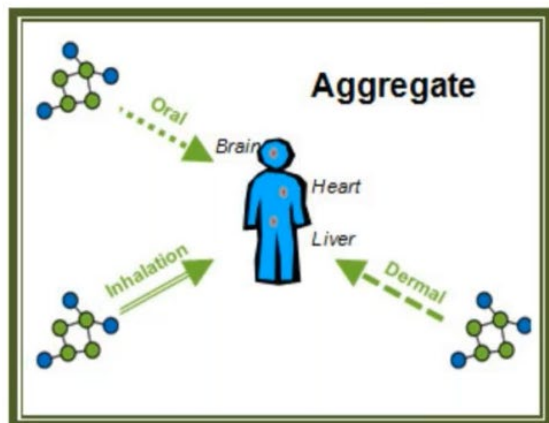
Human exposure occurs by different routes. Inhalation, ingestion, dermal depending on the Medium that the chemical is in and the type of setting that they are exposed in.

Exposure Can Occur from Different Sources, through Different Media, and by Different Exposure Routes



Depiction by the EPA, it shows that exposures from different sources through different sources through different media and different exposure routes. So here we have a waste pile in the middle creating emissions to the air soil and water as well. Being exposed through inhalation, ingesting and dermal absorption.

Aggregate vs. Cumulative Exposure

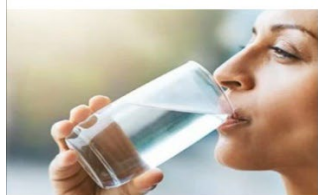


Communitive exposure through different Stressors.

Psychosocial stressors like poverty, physical exposures like radon and biological stressors like infectious diseases or even someone biological make up with things like obesity or prior disease conditions.

Aggregate exposure:

Looking at the same chemical for different exposure routes.



Risk Assessment for Aggregate Exposure

Risks can be added across different exposure routes for the same health endpoint if the chemical mode-of action is the same across exposure routes

$$\text{Aggregate Risk} = \text{Risk}_{\text{inhalation}} + \text{Risk}_{\text{ingestion}} + \text{Risk}_{\text{dermal}}$$



Risk Assessment for Cumulative Exposures

Different stressors, often from different media & exposure routes, and of different types

Additive? Risk 1 + Risk 2 + etc.

Synergistic? Risk 1 x Risk 2

Potential joint action of multiple stressors on a single health endpoint, or possibly multiple endpoints

In this type of scenario this is approached as this what we call cumulative risk assessment. Try to figure out outside of this problem, we can just add the risks for these different stressors

This might be multiplicative meaning that the two together cause greater risks than you would expect by each of them individually added together.

Cumulative Risk Assessment

1. Assuming Toxicological Independence

Assumes toxicity modes of action are different & biologically independent

Treat risks as additive

- Sum risks across chemicals (as for cancer)
- Sum hazard quotients (for threshold effect) $HQ + HQ = HI$

EPA's National Air Toxics Assessment has taken this approach

If you have a few different chemicals or maybe two or three and if you can assume toxicological independence of those chemicals, meaning that the modes of toxicity of those chemicals are different and biologically independent.

Within the body they will go through their own mode of action and potentially cause disease. Individually or even just one of them.

It would be treated as additive and if there was a cancer outcome, you would just simply add the risk across the chemicals.

Cumulative Risk Assessment

2. Assuming Toxicological Similarity

Assumes toxicity mode of action is the same/similar between different chemicals

Treat doses or risks as additive

- Sum risks across chemicals (as for cancer)
- Sum hazard quotients (for threshold effect) $HQ + HQ = HI$

Has usually been applied for similar groups of compounds

- Multiple organophosphate insecticides
- Multiple dioxobenzofurans

Assuming that the toxicological similarity or that the toxic mode of action is the same or similar across different chemicals, this scenario you can actually consider the exposure or the risks as additive.

Cumulative Risk Assessment

3. Stressor Interactions and Unknowns

Simple assumptions don't apply

- Joint or cumulative toxicity can depend on total dose, relative exposure levels, duration, timing, and co-exposures
- Toxicity & interaction data for multiple exposures is usually impossible to obtain

Feasible approaches to characterizing risks:

- Semi-quantitative description of risk or screening-level risk ranking, utilizing available data on 1 or 2 major stressors
- Qualitative descriptions of risk, including description of exposed population, multiple stressors, and vulnerabilities

“Health Impact Assessments” have taken these approaches to describe population-based risks from multiple exposures to chemical, physical, biological, and psychosocial (e.g., neighborhood) stressors

A more common scenario is that you have either stressor interactions, interactions between exposures, or else you simply don't know what the relationship between these exposures and how the express toxicity happens.

Information on interaction for multiple exposures simultaneously is usually impossible to obtain. There are a couple of approaches of characterizing risks that are being done in this type of scenario. Getting information or deriving information on semi quantitative descriptions of risks or screening level risk rankings.

Using any available data even if it is only on or two of the major stressors, you can at least quantify for some of the stressors and even directionally specify what the direction of an effect would be or other stressors how they might interact in order to rank risks or even rank different neighborhoods.



Conclusions

The relevance of cumulative risk assessment approaches is clear

Methods are not well-developed and not widely applied

Even so, semi-quantitative approaches can be useful *now*, for risk ranking that can lead to public health interventions

The relevance of cumulative risk assessment approaches is clear. For decades regulatory agencies and scientists have been talking about it really doesn't make sense to look at one chemical at a time because people don't live that way. But the methods or cumulative risk assessments are not well developed, and they are not widely applied even now.

Chairman Battle: Any Questions?

Mr. Minot: How do you turn that into regulation?

Dr. De Roos: I am not a regulator; I'll allow others to speak to that.

Dr. Frank: I am not sure there is an official response. I was going to throw out right now that the regulatory setting is particularly difficult one. To include these things because regulations are being considered or being put into place. Arguments sometimes legitimately can be made that look there are all of these other factors, you know.

Dr. Gross Davis

We don't regulate communities specifically. I think that again gives us another layer of complexity of whatever would be trying to set those official regulations.

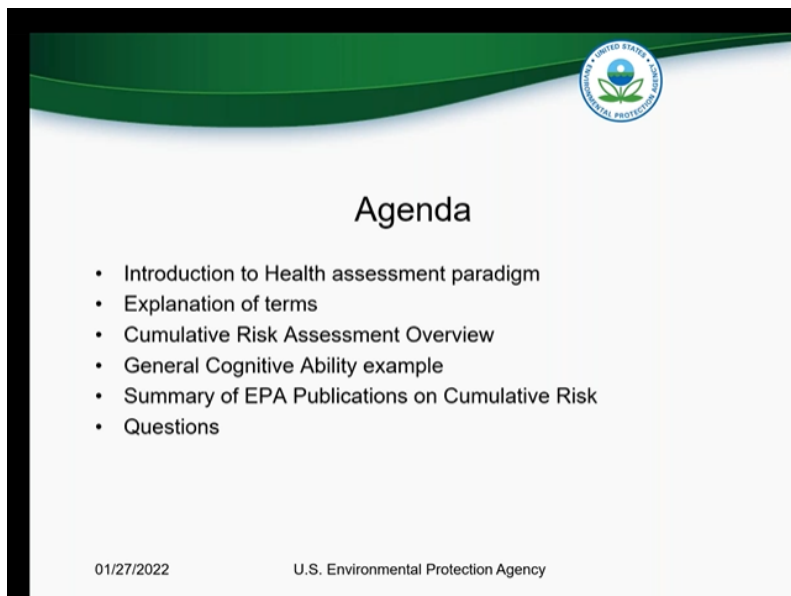
Mr. Soule

I think that the environmental justice initiative is another way. Maybe not directly but indirectly that could address some of this.

Chairman Battle: Let's move on to the next Presenter Dr. Carol Ann Gross Davis

I am going to kind of do an introduction to the health assessment paradigm
Specifically looking at "Cumulative Risk Assessments.

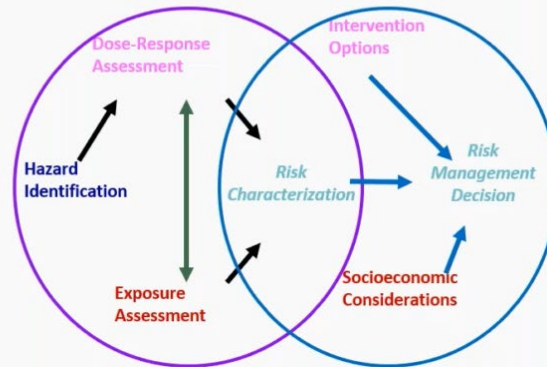
Update on some of the time line of some of the documents that EPA has on cumulative risk.



We have that risk characterization in the middle, and we have the hazard identification dose response and exposure assessment.



Human Health Risk Assessment: Research and Decision Contexts

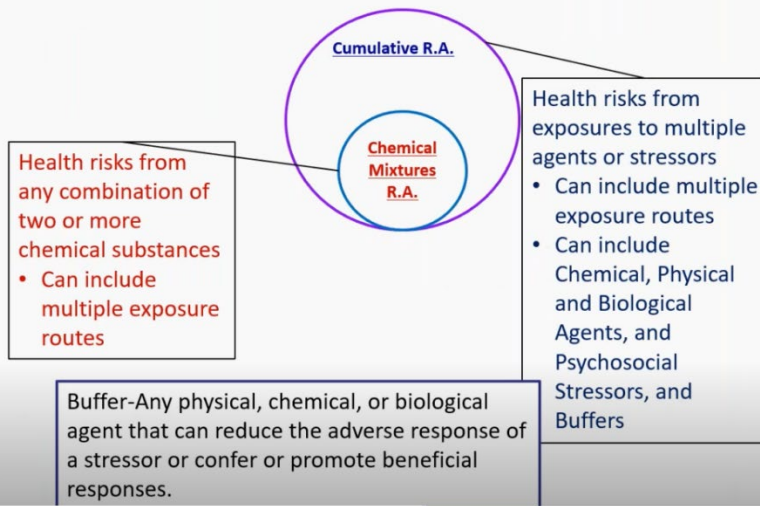


Explanation of Terms

- **Chemical mixtures** – “any combination of two or more chemical substances regardless of source or of spatial or temporal proximity”
 - Range from combinations of a few compounds to highly complex mixtures consisting of hundreds of compounds, some of which may not be identified chemically
 - US EPA (1986) Chemical Mixtures Risk Assessment Guidelines
- **Cumulative risk** – “Combined risks from aggregate exposures to multiple agents or stressors”; cumulative risk assessment “an analysis, characterization, and possible quantification of combined risks to health or environment from multiple agents or stressors”
 - US EPA (2003) Framework for Cumulative Risk Assessment (CRA)
- **Cumulative impacts** – All individual impacts occurring over time and space, including those of the foreseeable future (not addressed in this presentation)



Cumulative, Aggregate, and Chemical Mixtures Risk Assessments



Why does EPA care about Health risks from exposures to multiple agents or stressors ?

- Public health officials and ecological risk managers recognize that chemical-focused and source-focused assessments might not comprehensively address risks experienced by populations.
 - Considering multiple chemical, physical, and biological agents, and psychosocial stressors.
- Many health outcomes of concern, such as cancer and heart disease, are multifactorial.
- Questions about how occupational factors, environmental factors, personal behaviors, genetics, epigenetics as well as life history cumulatively influence health outcomes in populations.



Why considering nonchemicals is important

– Synergistic effects for chemical and nonchemical stressors

– Noise and Solvents

- » Johnson, A. C., and Morata, T. C. (2010). Occupational Exposure to Chemicals and Hearing Impairment. (The Nordic Expert Group), pp. 177. University of Gothenburg, Gothenburg, Sweden. Available at: <http://hdl.handle.net/2077/23240>. Lead and Chronic Stress

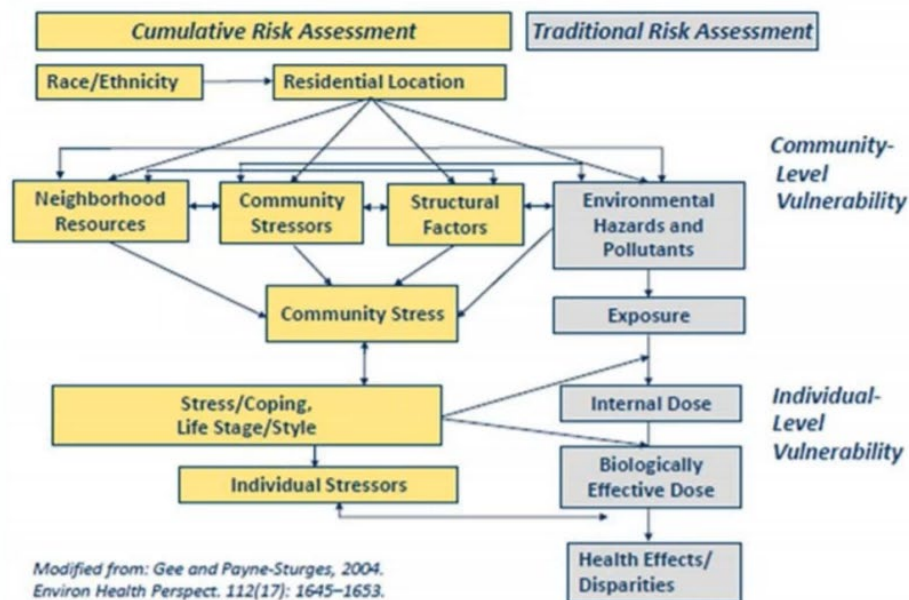
– Differential **Susceptibility** by nonchemicals

- Chronic psychosocial stress – *susceptible population*
 - » Clougherty, Jane E., et al. "Synergistic effects of traffic-related air pollution and exposure to violence on urban asthma etiology." *Environmental health perspectives* (2007): 1140-1146
- Diet – *resilient population*
 - Romieu, Isabelle, et al. "Omega-3 fatty acid prevents heart rate variability reductions associated with particulate matter." *American journal of respiratory and critical care medicine* 172.12 (2005): 1534-1540.

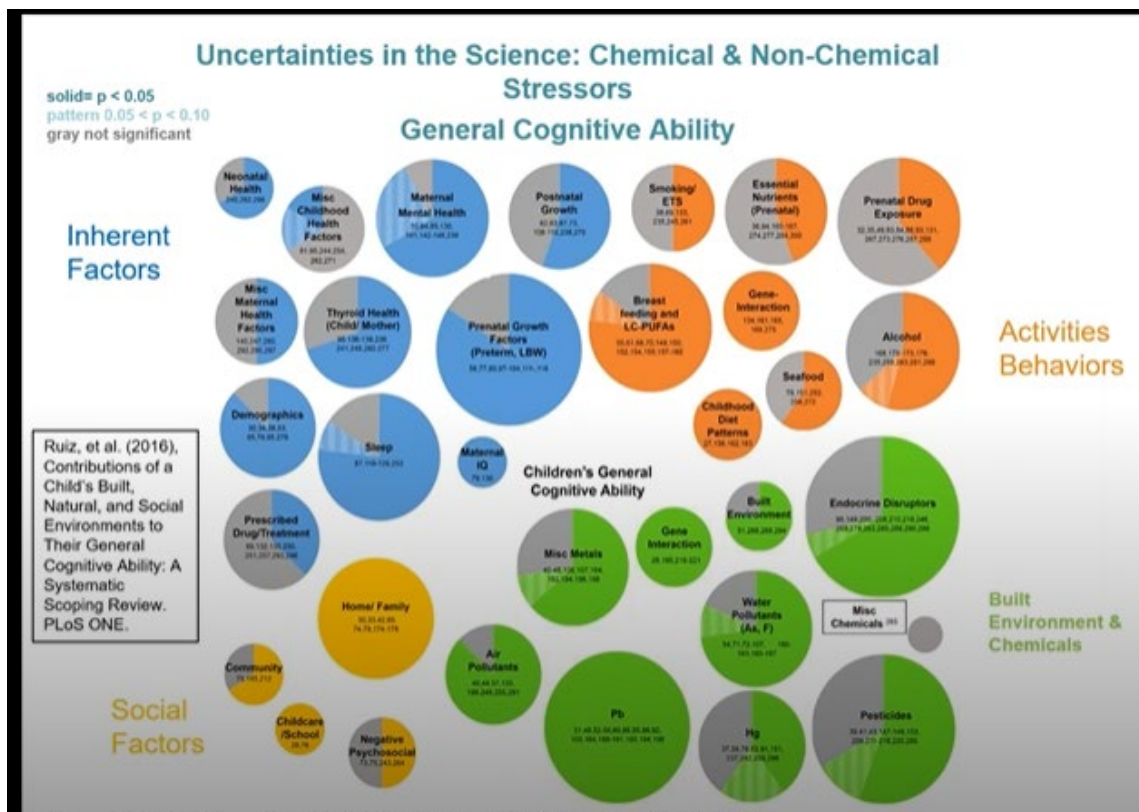
– Differential **Vulnerability** by nonchemicals

- Socioeconomic status - *Environmental Justice (EJ) population*
- Nelson JW, Scammell MK, Hatch EE, Webster TF. 2012. Social disparities in exposures to bisphenol a and polyfluoroalkyl chemicals: A cross-sectional study within nhanes 2003-2006. *Environmental Health* 11:1-15.

Cumulative Assessment – Chemical and Non-Chemical Stressors



Conceptual map of the interaction between traditional risk assessment, focused on biological dose and adverse outcome pathways emphasized by the Chemical Safety for Sustainability research program, and community-scale contributors to cumulative risk assessment needed to address environmental health disparities.



So, the studies themselves actually found a relationship between cognitive general ability and the thing it was studying

We think about in the blue realms we have inherent factors like thyroid, prenatal growth factors and demographic.

When we think about pattern in a pie chart that means it was between 0.05 and 0.1. not statistically significant but perhaps you know there were issues with the studies, and it just needs to be looked at some more. We have the gray of those pie charts that really said that you know that's the percentage of the studies that did not find a relationship.

Think about inherent factors again in blue like sleep and demographics you see in the social factors again children general cognitive ability. We see that the home, family had a really big and strong relationship with general cognitive ability in children.

We look at built environment we see things like endocrine disruptors. We have uncertainty.

Three quarters of that are seeing a relationship with NVC Lead, which makes sense, right that in built environment that lead is on hundred percent, basically.

Studies have show that there is an impact, right to general cognitive ability. When you kind of look up in the behavior in the orange quadrant, we see things like smoking, ETS. You see the split down the middle.

We don't have a solid answer on all of these things that would be called could be thought about when we are thinking about the health outcomes and really about what are those interactions synergistic interactions or additive interactions when doing a cumulative risk assessment

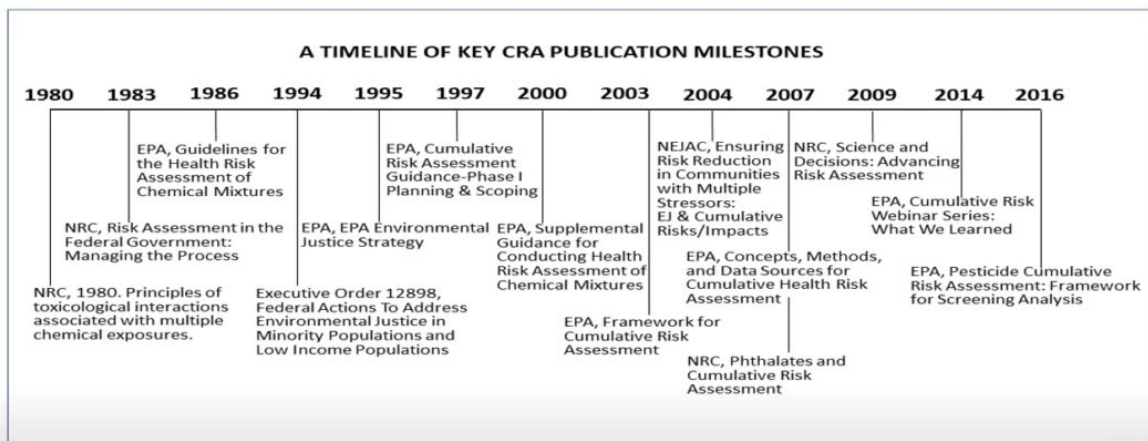


Issues to be Addressed if using Chemical Mixtures RA, CRA, or CIA

- Agreement on the relationship between stressor(s) and health impacts
 - Lack of research/data
 - Reconciling of academic research literature and studies
 - Community involvement and agreement
- Data uncertainties and compounded uncertainties when multiple data are combined into single assessment
- Working among state/federal regulations that are single media based.



Summary of EPA Publications on Cumulative Risk



So here is a good example of the difference visually that you can see this conceptual map of the interactions between traditional and chemical risk assessment that is really fueled by EPA statutes.

When we think about the community scale and contributions that a cumulative risk assessment can offer both at the community level to identify vulnerability like neighborhood resources and community stressors. Conditions of environmental justice and tools that offers us now to combine with again good regulation is an opportunity that we can continue to think about better ways to think about all those exposures so that we can be focused on improving health outcomes and to just kind of sticking to our regulatory framework.

Chairman Battle: Questions

Mr. Pepita: How do you feel about the population first and what the stressors might be as a secondary objective:

Dr. Gross Davis

I think we are moving in that way to help us create studies because again we have to collect that data. After you look at that population to see you know what re the similarities what they have going on because it could be other health outcomes that because it might be smaller population, you might not see on the scale that you're looking at, but it might be important for prevention in that community.

Chairman Battle: Any other comments, questions.

Chairman Battle: Dr Frank, Arthur; your up next.

Dr. Frank:

I am going to make sort of a couple of generic statements and then get into some of the specifics from a medical perspective.

What we see all of the country from government leadership from the courts that this is not necessarily the situation right now. This whole issue of cumulative risk assessment and cumulative impact which really go together is a real-world problem and its especially so in a regulatory setting that our colleague mentioned

I have been involved with Environmental Justice Advisory Board Pennsylvania Department of protection since 2004 and I can assure you we have tried to address this issue of cumulative impact or the regulatory role because when things are under regulatory paradigm you know it is usually one company wanting to do one thing.

From a medical perspective its also a difficult issue if it was easy the EPA wouldn't have been looking at this since 1980 with out solving it.

What do you use for a measurement? Is it a birth date, infant mortality, cancer risk, heart disease, longevity o the population which we know can vary greatly or something like Asthma?

WE know that the outdoor air contributes to asthma, and we also know that indoor air pollution is responsible for at least fifty percent of not more of asthma issues in children.

We do not have any community level data. Thais why I'm just delighted that the city is thinking of doing this.

When you are thinking about cumulative risk, you are trying to set a regulation.

We can address things like poverty levels and other health effects. We can unfortunately not combine that with some of the health outcomes that are important because those are usually kept at the county level.

Regulations don't deal with it at that level. They deal with-it citywide, countywide, or usually statewide. If this was a simple problem, it would be adjusted already.

Maye we can look to these other models like California in trying to decide maybe the regulations are if we are dealing with a high cancer risk in a neighborhood, we shouldn't be putting another set of cancer risk materials out there.

For all the boards and commissions and stuff I have been on the fact that the Air Pollution Control Board actually gets to vote and help sent regulations is important to me.

Chairman Battle:

Questions?

MR. Walker: Can you give me an update on sort of where AMS stands in terms of whether to include cumulative impacts in the risk assessment.

Director Sellassie:

We didn't change anything now for the risk assessment.

Dr. Bettigole; Is there any way we can include the vulnerability index as a factor?

Chairman Battle: Yes, that is a good Idea we should have a discussion on that at the next meeting.

Director Sellassie: Okay.

Dr. Gross Davis

Doesn't it need to go to the public comment anyway.

Director Sellassie: Yes, it does.

Mr. Walker: What are the obstacles; what would prevent AMS and the board from doing those?

Director Sellassie: What we do is we have a hazard index that we add each pollutant for non-cancer and add the hazard quotient for HQ. We add all those pollutants or toxics, and we add up so that is the one we said less than one which is HI not HQ

So we add the HQ to one, HQ to Benzine HQ to cyandied or where it is. So that's what we do. The same with the risk. We add up all the risk then we make it like then in a million. That is the combined one we do in the regulation.

MR. Walker: Just for one pollutant thought, right: You not doing multiple pollutants?

Director Sellassie: NO, W do multiple. One single one in a million and the combined one is ten in a million. That's what regulation says. We add up all those pollutants.

Mr. Walker: You're saying you are adding up the pollutants that would affect the same target organ for the hazards?

Director Sellassie: That's management. I think its management. We will discuss about that one after we found we identified the toxics, and we have to see the target organ

Chairman Battle: We are on number five of the agenda. Next meeting of the Board will be Thursday, April 28, 2022, of course from 2:00 to 4:00. Is there a motion to Adjourn?

Dr. Frank: So moved.

Dr. Gross Davis

If there would be a way to keep the Board updated?. I am just curious on kind of how the Environmental Justice and Council group is moving.

Chairman Battle

Motion to adjourn?

Mr. Soule: Second

Chairman Battle: Okay. All those in favor say Aye.

Opposed:

No Response.

Chairman Battle.. See you next time..