No Burn Broome Position Paper on the Lithium-Ion Battery Recycling-Incineration facility proposed for Endicott

This position paper was prepared by the Science Team at No Burn Broome. With such little time this represents work-in-progress and we reserve the right to update this position paper as new science and information comes in. Updated version as of April 26, 2020.

We have organized our concerns into 5 categories:

A. Lack of Sufficient Time for Public Participation.
B. Environmental and Human Health Risks.
C. Basic Plant Functioning.
D. Endicott-specific Location Concerns.
E. An alternative technology that might be better.
F. Notes on nanoparticles.

Summary

1. This lithium-ion battery recycling plant owned by Sungeel MCC Americas LLC ("Sungeel") is being rushed through with little information being given to the Endicott community (or residents of Broome County who might also be impacted). The dangers have been hidden. Lithium-ion batteries present a well-known fire and explosion risk, yet no formal accident analysis has been performed.

2. The mayor's description that this is simply a "recycling plant" as if it was separating bottles and cans, disguises the fact that it includes two potentially dangerous processes: a rotary kiln operating at 600 degrees centigrade and burner which burns the gases emitted from the kiln, producing many dangerous products including dioxins and nanoparticles.

3. For those familiar with incinerators these steps are almost identical to a dual chamber incinerator a fact confirmed by a US EPA Region 2 spokesperson who described the facility as a Commercial and Industrial Solid Waste Incinerator unit.

4. The plant has the potential to emit many toxic substances including dioxins, furans, hydrogen fluoride, toxic metals and many other toxic substances and nanoparticles. Like other incinerators the dangers posed will depend on how well the plant is operated but even so nanoparticles – because they are so small - may evade most air pollution control devices and are not regulated or monitored by the NYS Department of Environmental Conservation (DEC)

5. The DEC has already given approval to this plant based upon totally inadequate monitoring data provided by the company itself. These included just a single measurement of dioxins made on one day. Experts in the field know that dioxin emissions can vary by over a factor of 1000 on a single day, especially during start-up, shut-down and upset conditions (there will be one start-up and shut-down each day). Taking the company's single measurement at face value was a reckless and inexplicable act by the DEC in our view.

6. Current zoning for the location of this plant does not permit a recycling facility or any incinerating plant. The mayor is trying to get around this zoning restriction by offering a definition of "recycling" which includes the vague term "processing." We hope the village board members will deny any zoning change that would allow the operation of this facility in Endicott. The first opportunity they will have to do this will be at the public hearing to be held via Zoom on May 4 at 7 pm. All citizens of Endicott and Broome County are invited to zoom (or phone) into this meeting. See the Calendar at No Burn Broome for details how to call in. We need residents to say, **"We do not want re-zoning of this site. We do not want any incineration in Endicott or Broome County"** -and then give your own reasons why (you can choose from the material below)

A. Lack of Sufficient Time for Public Participation (given Covid-19):

1. **Misleading promotion.** The mayor has described this facility as **a "recycling plant**." But she has *not* made it clear to the public that the process involves two potentially dangerous steps:

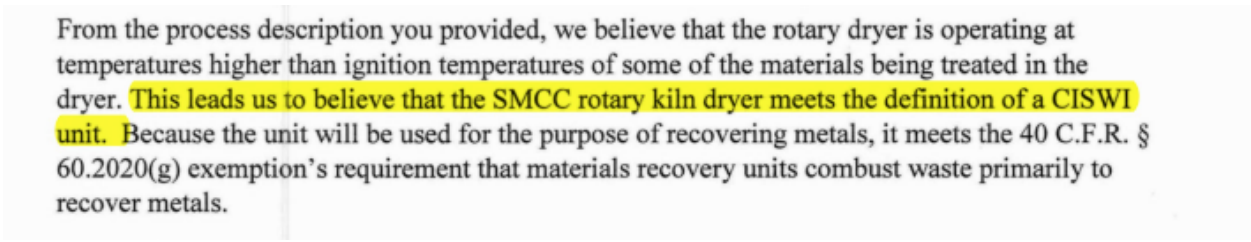
    a) the dismantled batteries are subjected to high temperature treatment in a rotary kiln which vaporizes some of the contents of the batteries (e.g. plastic casing and other non-metallic components, including a fluorinated polymer, PVDF).

    b) an afterburner, which burns the gases which leave the kiln.

    While it is true that the purpose of this facility is to recover metals like lithium, cobalt and nickel and not simply to dispose of waste, for those familiar with incineration technology this facility is almost identical to a **dual chamber incinerator**, in which the materials are heated in the first chamber (which in the Sungeel facility is akin to the rotary kiln) and the emitted gases are burned in the second chamber (which in the Sungeel facility is akin to the "afterburner").

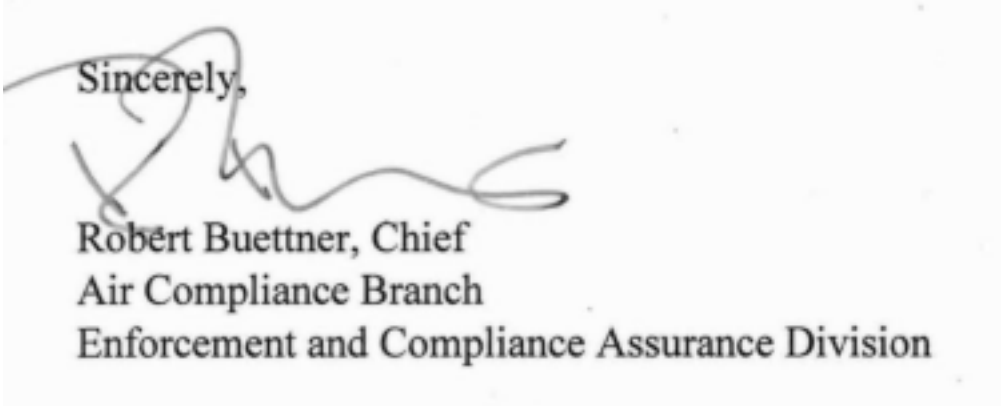
    Like any other incinerator the rest of the equipment attempts to capture some of the heat released in a boiler, and some of the toxic emissions, with air pollution equipment. The dangers posed will depend on how well the air pollution works (12 hours a day), how well it is maintained and how well the facility is monitored.

    Our view that this is technically an incinerator was confirmed in letter to the owner of the Sungeel company (Danish Mir) by the chief of the Air Compliance Branch, Enforcement and Compliance Division of Region 2 of the US EPA, Robert Buettner, in a letter dated, July 16, 2019, where he writes that:



From the process description you provided, we believe that the rotary dryer is operating at temperatures higher than ignition temperatures of some of the materials being treated in the dryer. This leads us to believe that the SMCC rotary kiln dryer meets the definition of a CISWI unit. Because the unit will be used for the purpose of recovering metals, it meets the 40 C.F.R. § 60.2020(g) exemption's requirement that materials recovery units combust waste primarily to recover metals.

CISWI stands for Commercial and Industrial Solid Waste Incineration unit.



Sincerely,

Robert Buettner, Chief
Air Compliance Branch
Enforcement and Compliance Assurance Division

This letter was retrieved by William Huston of Endicott who has accumulated a huge data base on the history of this project. See the letter

1. **Most people in Broome County do not know much about this project.** Many people in the area either have not heard about this project or have been persuaded by the mayor that this is just a "recycling plant" with no harmful emissions and no potential for a serious fire or accident.

2. **An Unhealthy Rush.** This whole project is being rushed through by the state, the mayor and the DEC at an unhealthy speed and during a worldwide Pandemic!

3. **Put this project on hold.** In our view this whole project should be put on hold until the state lockdown is over - or at least until formal public hearings can be held in which every aspect of this operation can be examined by residents and independent experts.

4. **This current rush is not fair to the community.**

5. **The Endicott Planning Board says not enough information.** Our concerns above were underlined when the Endicott Planning Board voted 5 – 0 neither to approve or deny the wording of the Mayor's resolution (defining recycling): "due to a lack of information."

B. Environmental and Human Health Risks.

1) **There has been no accident analysis performed for this plan.** Lithium-ion batteries are a well-known fire and explosion hazard. No accident analysis has been performed to assess the impact of trucking accidents on route to the plant or a fire in the battery storage area, which is adjacent to a NYSEG substation.

2) **The mayor has claimed on a local radio program that the only thing that will come out of the stack is water vapor!** With all its faults, even the DEC air permit (see 5 below). for the facility makes it clear that more than water vapor will come out. No environmental scientist would believe that all the emissions from this facility will be harmless, but you don't have to be an expert to know this is very unlikely. **Based upon an aerial photograph obtained via google map the Korean facility run by Sungeel's parent company has a 500-foot stack (see photo below).** Why would you need a 500-foot stack if there were no harmful emissions?

Korean Facility:
35.954453°, 126.538481°
143-15, Gunsansandan-ro, Gunsan, Jeollabuk-do, 54002, Korea

I estimate the small stacks to be ~200'ft, and the larger stacks to be ~500'ft.

Photo and stack height estimate by William Huston of Endicott

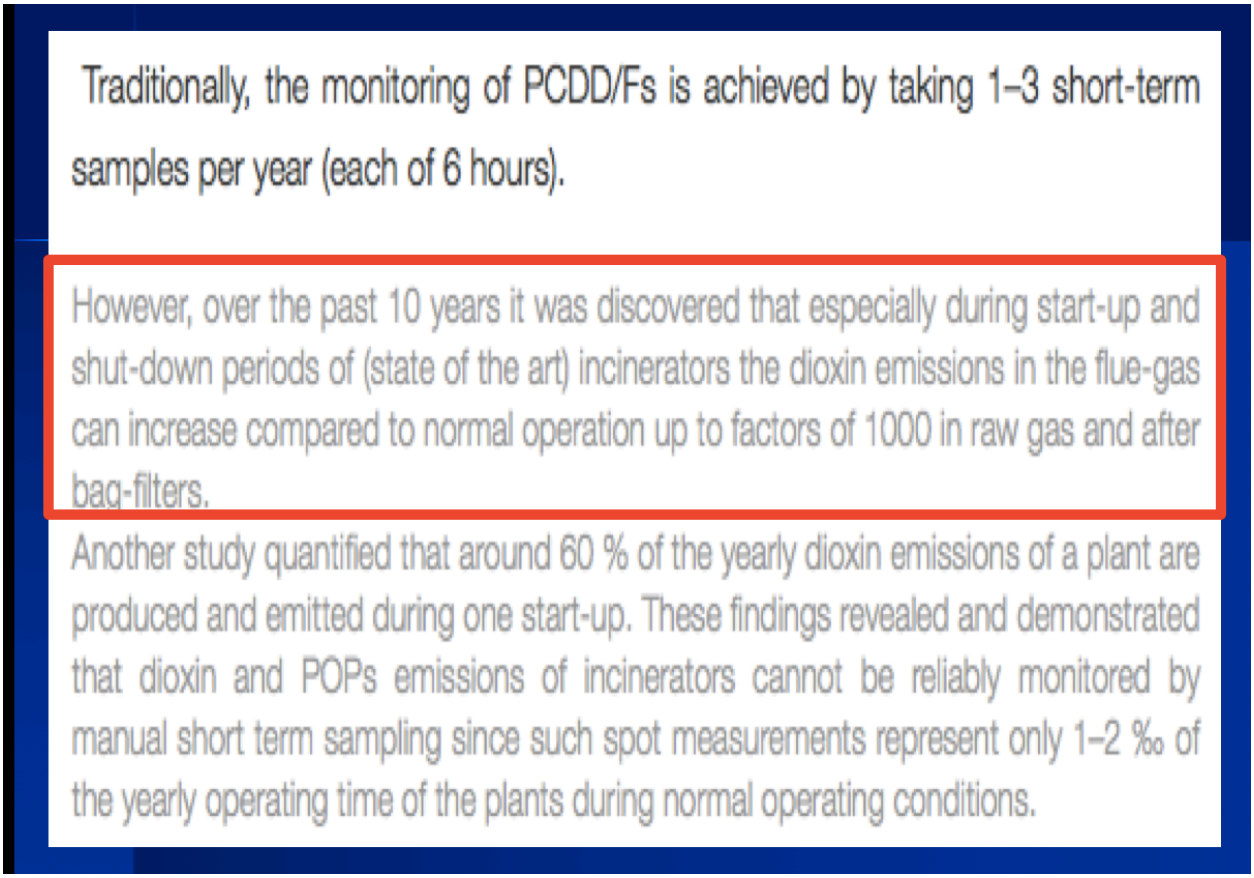
3) **In the Endicott project the stack height is only 111 feet** which is inadequate to lift the pollution above the homes of many people living in the community. Why 500 feet in South Korea but only 111 feet in Endicott?

4) **There are many risks.** These include toxic air emissions and the possibility of fires, explosions and truck accidents. We are concerned for the health of ourselves, our

children, our grandchildren, our pets and our gardens as well as the lowering of our property values.

5) **The DEC has given an air permit for the project** even though the scientific basis for the **emission claims** from the company's plant in South Korea **were grossly inadequate**. For example,

   a) **They are relying on Sungeel for an estimate of dioxin emissions based on a single measurement made on a single day.** Experts in the field know that **dioxin measurements from incinerators can vary by a factor of 1000 within a single day** – **especially during start up and shut down**. This plant will operate for 12 hours a day and thus there will be at least **one start-up and one shut-down each day!** The DEC should have insisted on a range of emissions based on an extended which included start-up, shut-down and upset conditions. This is what a company specializing in monitoring dioxin monitoring has stated:



This statement is taken from the website of the AMESA company which offers 4-week continuous sampling of dioxin (PCDD/PCDF) emissions from incinerators.

   b) **The danger of pyrolyzing (heating in absence of air and not burning) PVDF**. One of the substances used as a binder in Lithium-ion batteries is a polymer called Poly

Vinylidine Di Fluoride (PVDF or simply PVF). This contains almost 60% fluorine by weight and when it is heated to high temperatures (as in the kiln) it breaks down to produce hydrogen fluoride (very toxic) and many fluorinated organic molecules – some extremely toxic at low levels. These may include polyfluorinated octyls (PFOs, PFOAs) over which there is currently huge regulatory concern. Yet the company offers no analysis of these potential emissions and refers to them vaguely as "fluoride compounds" and the DEC didn't question this!

c) **Nanoparticles**. Neither the company nor the DEC discuss the whole issue of nanoparticles. The emitted gases from this operation will include **nanoparticles** (particles which are less than one micron in diameter) which are very difficult to capture and are so tiny that they can pass through the lung membrane and once in the blood are circulated to - and can enter - every tissue in the body. These particles will often contain toxic metals and dioxins. Recent studies have shown a strong relationship with the number of these particles in the air and the incidence of brain cancer **(see the notes on Nanoparticles in F).** Unfortunately, modern incinerators are NOT regulated or monitored for nanoparticles but that does not mean that they will not pose dangers to local residents. Again, this cutting-edge issue was not discussed by the DEC. Their attitude appears to be if a threat is not regulated it does not exist!

6) **More data and protection for the community is needed.** If this project goes forward camouflaged as a "recycling plant," at the very least there should be:

a) An organized site visit to the plant in South Korea to examine the situation in the local area as well as obtaining a more comprehensive monitoring data (see b) below). The data provided to the DEC by the company - especially for dioxins - was grossly inadequate (see 5).
b) A full environmental impact statement, including an accident analysis and a human health risk assessment using more scientifically obtained data on the range of emissions of pollutants including dioxins and furans (chlorinated, brominated and fluoridated); a whole range of fluorinated substances; HF and toxic metals. Many of these substances are cancer-causing and/or endocrine disrupting.
c) There also needs to be an assessment of the threat to the local community of an increase in exposure to **nanoparticles** (**see F),** known to be produced in any high temperature treatment of materials and the burning of waste but not regulated or monitored by the DEC. They can be monitored in the ambient air and we need baseline data for Endicott.
d) A strict monitoring program for dioxins (and related compounds); toxic metals, hydrogen fluoride and formaldehyde. This would include the commercially available **4-week continuous sampling** for dioxins and related compounds which would capture emissions during start-up, shut-down and upset conditions (a discussed above 5).

7) Is there a "dumpstack" on this facility?

A "dumpstack" or "thermal relief valve" is intended to operate if a blockage occurs in the air pollution devices downstream of the heater and burner to avoid a pressure build up and possible explosion. However, in granting the permit the DEC answered a question posed by Dr. Paul Connett (a resident of Binghamton), that there was no dumpstack on the facility. Why not? How do they intend to deal with a pressure build-up in the event of a downstream blockage or failure?

C. Basic Plant Functioning

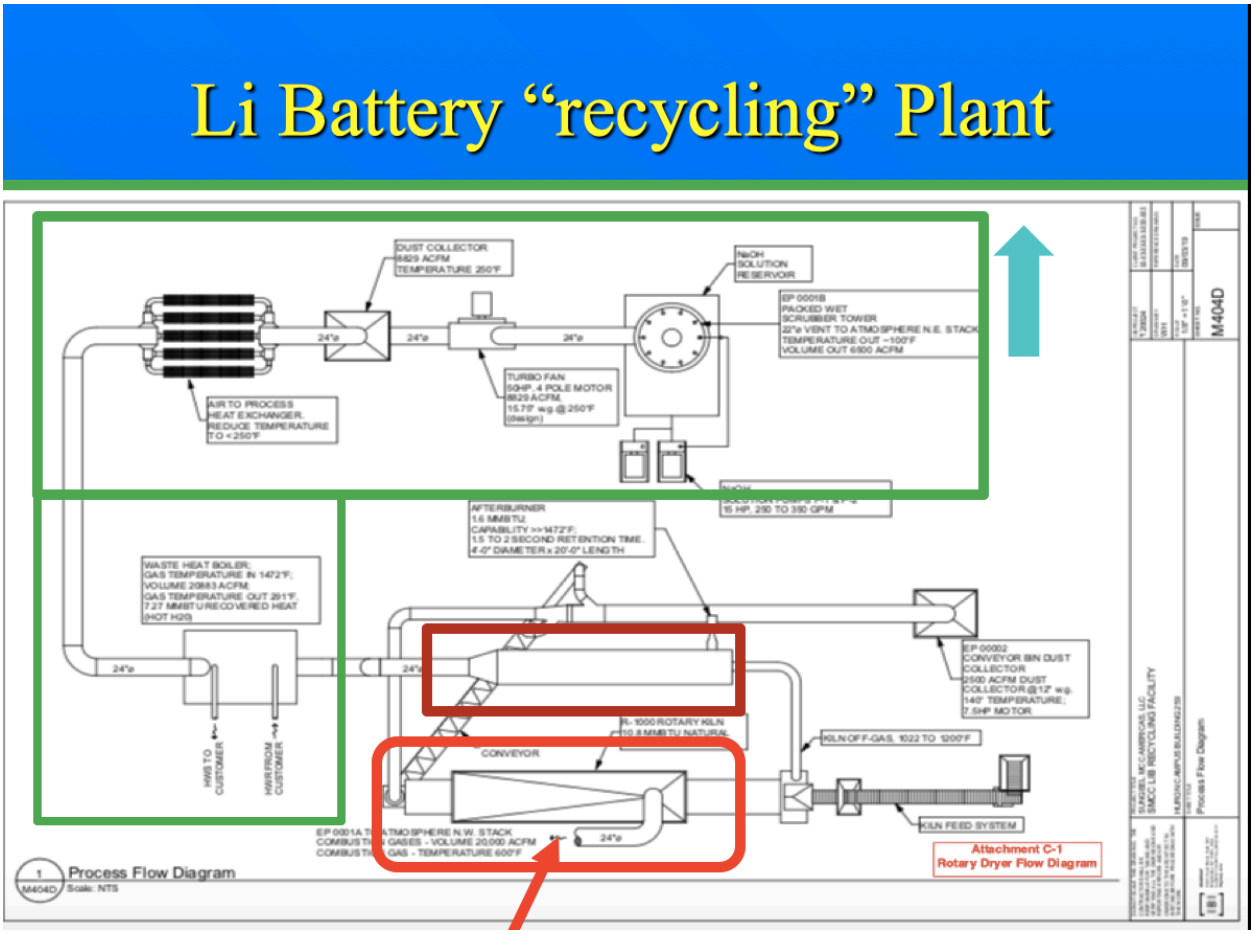
1) **This project** will operate 12 hours a day and handle approximately 24 tons of Lithium-ion batteries each day. It will be owned and operated by Sungeel MCC Americas, LLC and will be located on the Huron campus of the old IBM facility.

Photo courtesy of William Huston of Endicott

2) **An explanation of the operations** of the plant (see figure below).

a) The batteries are received and discharged to reduce fire hazard.
b) The batteries are stored.
c) The batteries are dismantled

d) The dismantled batteries are fed into the rotary kiln for high temperature thermal treatment (red box in the figure below). Here the plastic cases and other materials are vaporized.
e) The gases and particles released in the thermal treatment are burned in an after burner (purple box in figure below)
f) The flue gases from the burner are passed through a waste heat boiler for some energy recovery.
g) A heat exchanger (this is used to lower the temperature of gases to reduce dioxin formation and to avoid burning out the baghouses
h) A dust collector (a baghouse)
i) A wet scrubber (steps f-I are contained within the green box in the figure below)
j) The residual gases and particles are then vented via a 111-foot chimney to the atmosphere in Endicott and beyond.



D. Endicott-specific Location Concerns:

1) **The location.** This proposed facility is in the heart of neighborhoods, ball fields, Union Endicott Schools, a grocery store, pharmacy, restaurants and Churches. All will be impacted by any toxic emissions from the chimneys that leave the plant.

The building highlighted in yellow is the recycling-incineration facility; the building highlighted in red is the storage/discharge area.

2) **Little benefit to Endicott.** The facility is receiving a $1.75 million grant from the Empire State Financing Corporation but this project offers little if any financial benefit to the majority of citizens of Endicott. The facility will pay no local taxes and provide only a few jobs (probably dangerous and low-paying). The benefits will go to a few investors and this South Korean company. **Most of the profit will probably leave the country.**

3) **Common sense** says that this area is **inappropriate** for this plant, in addition to being so close to where people work, play and live, it is inappropriate because of the topography. It is located in a valley where dispersion of pollutants is hindered, especially during temperature inversions. Such a situation means that it could impact people in Broome County beyond Endicott.

4) **Common decency** says that siting this plant in this area is **unethical** because the Endicott community has already been subjected to a legacy of pollution**.** ***We can't change the past but we can and should protect the future*.** We should not allow this community to be subjected to any more pollution if it can possibly be avoided. **And it can be avoided.** *Endicott already has a high incidence of cancer and this plant is permitted to emit cancer-causing chemicals.*

5) T**his project should NOT go forward** and the easiest way to stop is it to prevent any change to local zoning that would allow this facility to operate. Currently local zoning does not allow either a recycling facility or an incinerating facility at this site. The mayor is proposing a change which would allow both – one openly and one covertly. Her definition of recycling, looks benign except for one word "processing." See the mayor's definition of a **RECYCLING FACILITY below.**

> **A facility used for the receiving, temporary storage, disassembling, and processing of a single category of pre-sorted recyclable object**

This would be OK it we were talking about separating bottles and cans, but the Sungeel facility will involve high temperature gasification of the batteries and burning of the gases produced. This definition would allow such operations in Endicott under the vague word "processing," which is undefined but would allow heating the batteries or components to high temperature sand burning the gases produced.

The village board will vote on this change at the **zoom public hearing on May 4 (7 pm)**.

The mayor's proposal should be rejected.

NO ZONING CHANGE INTENDED TO ALLOW THE SUNJEEL BATTRY RCYLCER/BURNER TO OPERATE IN ENDICOTT SHOULD BE APPROVED.

E. Support for Recycling but consideration of an alternative technology that might be better

1) **We are not opposed to recycling** and we are not opposed to recycling Li batteries – but this is not simply a recycling plant for dismantling batteries. **To repeat: It involves thermal treatment and burning gases in an afterburner**. Both steps can produce toxic emissions. There are alternatives ways to recycle Lithium-ion batteries which do not involve thermal treatment and burning (see 2).

2) **There Are Alternatives.** There are ways of recycling Lithium-ion batteries at room temperature which avoid gaseous emissions. Generically, these methods are called "hydrometallurgical processes" (they use water-based solutions to dissolve out the metals) as opposed to "pyrometallurgical processes" (which use high temperature processes). These are described and compared in a recent (2020) review article by Mossali et al in the Journal of Environmental Management: **Lithium-ion batteries towards circular economy: A literature review of opportunities and issues of recycling treatments** .

The authors compare the pros and cons of between pyro- and hydrometallurgical LIBs recycling processes in Table 6:

Table 6. Comparison between pyro- and hydrometallurgical LIBs recycling processes.

Process	Pros	Cons
Pyrometallurgy	Easiness of procedure; No necessity of passivation steps; Optimal technology readiness; Generation of exothermic reaction reducing energy consumption.	High energy consumption; Hazardous gaseous emissions; Material loss (Li in the slag); Need of Co LIBs chemistries (pre-sorting); High capital costs.
Hydrometallurgy	High recovery efficiency; High quality outputs; Good technology readiness; Moderated energy consumption; No gaseous emissions; Recovery of all LIBs cathodic metals; Mild reaction conditions.	Wastewater productions; Incomplete binder/electrolyte recycling; Complexity of procedure; Need of pre-treatments; Selectivity of reagents.

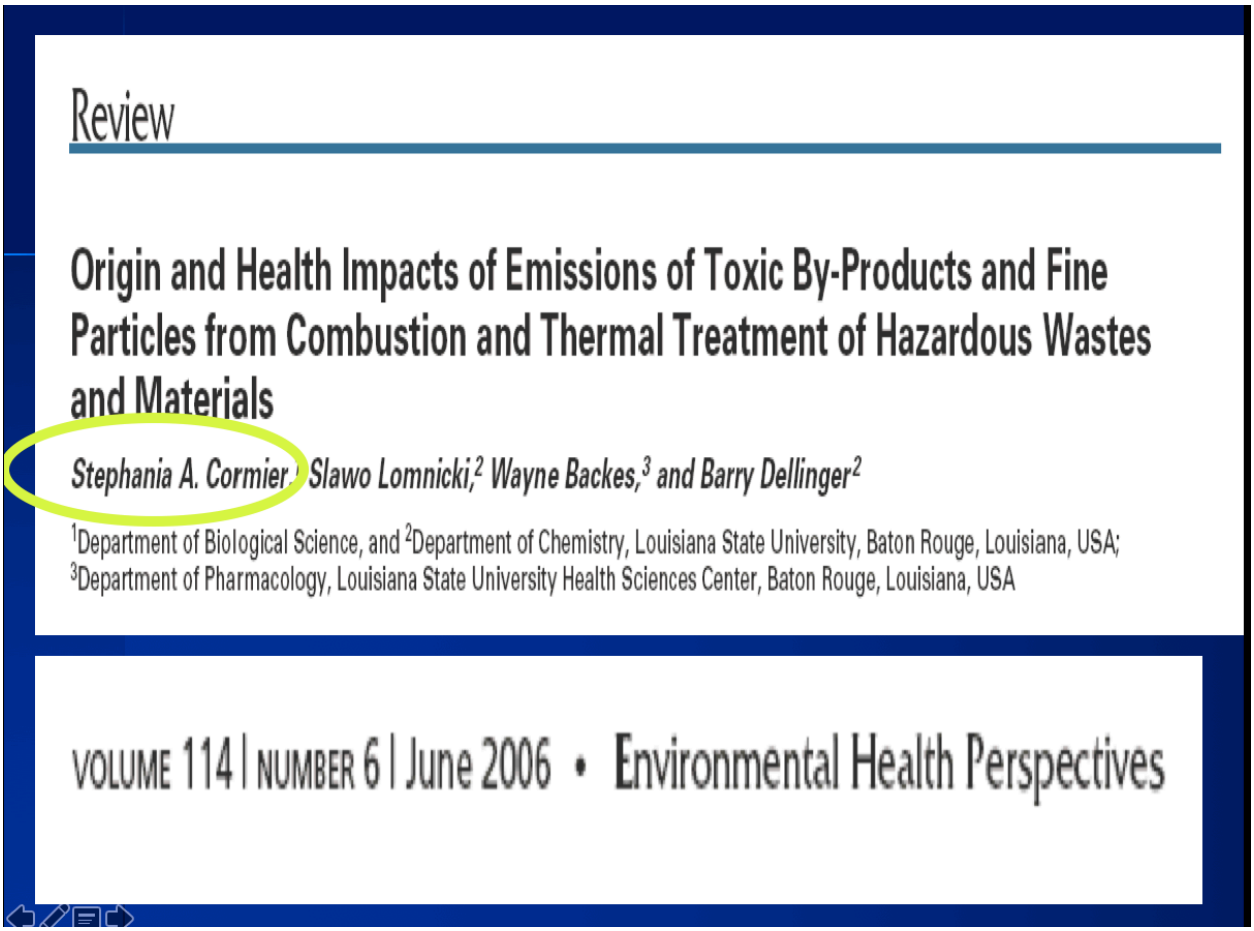
The authors of this review have this to say about the technology of the Sungeel facility proposed for Endicott:

> "High temperature thermal treatments (which) improve Lithium recovery efficiency up to 90% thanks to carbon removal, but require air-filtering systems and gas scrubbers **due to significant toxic gaseous emissions (e.g. dioxins, HF, CO, CO_2, etc.)** (Paulino et al., 2008). (our emphasis).

We hope that researchers at Binghamton University – especially those who have helped to develop the Lithium-ion battery - will examine the Mossali review and see if they can further develop recovery without polluting the air we breathe.

F. Notes on Nanoparticles

For a good review of the formation of nanoparticles in high temperature and incineration processes please see Cormier et al., 2006



Review

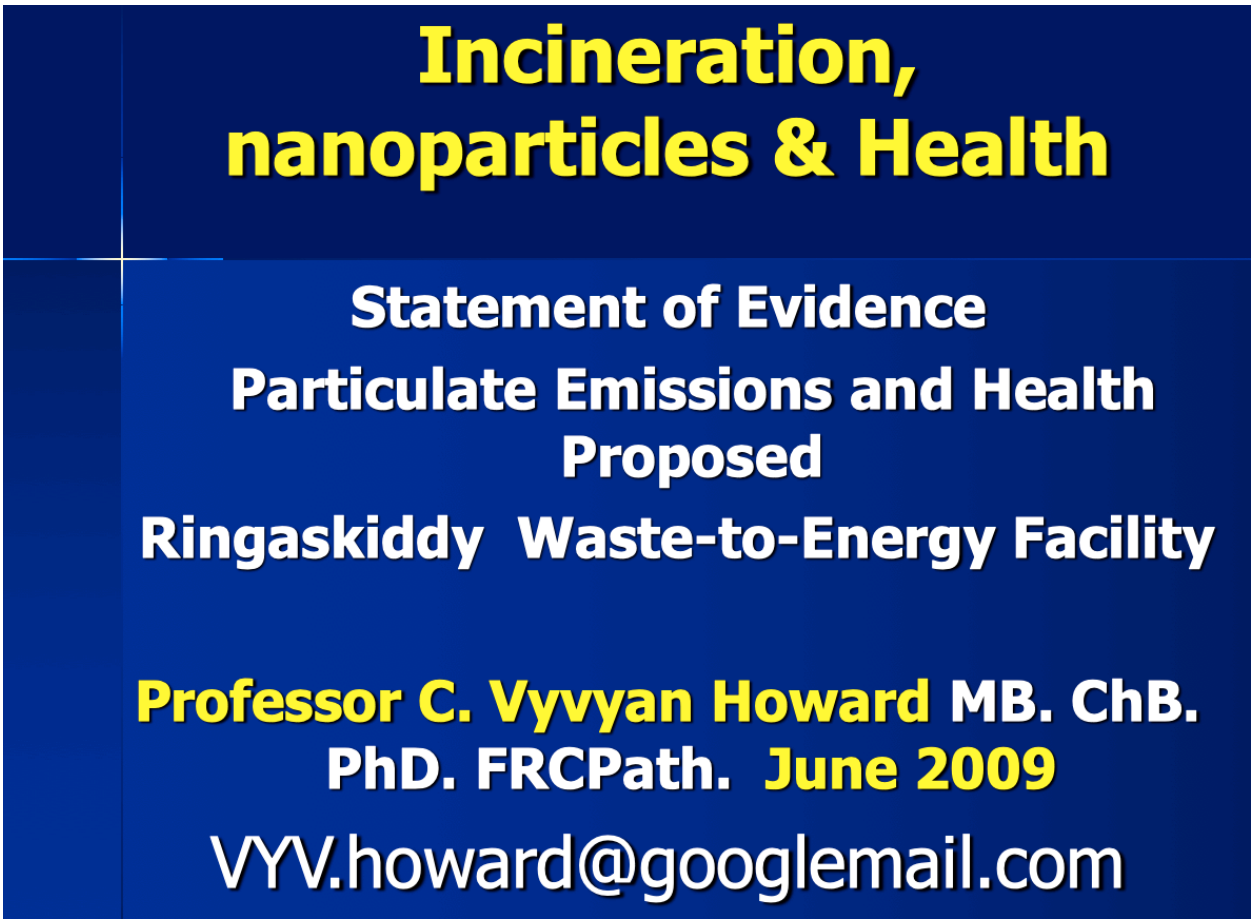
Origin and Health Impacts of Emissions of Toxic By-Products and Fine Particles from Combustion and Thermal Treatment of Hazardous Wastes and Materials

Stephania A. Cormier,[1] Slawo Lomnicki,[2] Wayne Backes,[3] and Barry Dellinger[2]

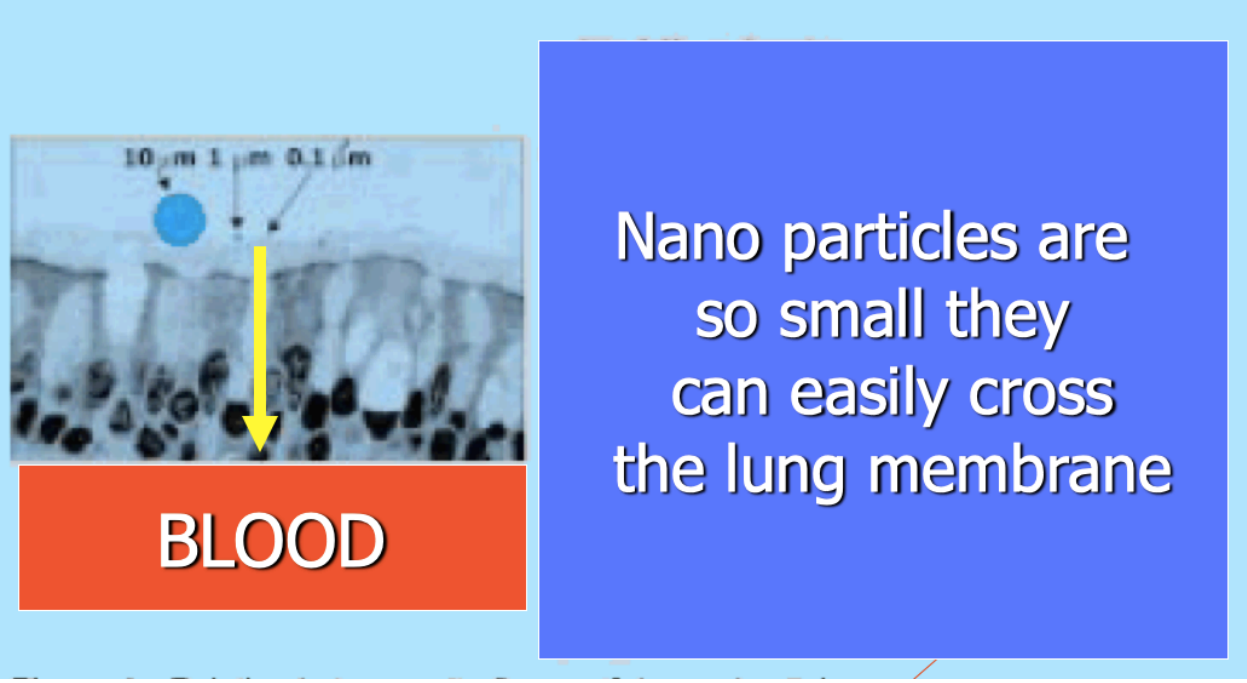
[1]Department of Biological Science, and [2]Department of Chemistry, Louisiana State University, Baton Rouge, Louisiana, USA; [3]Department of Pharmacology, Louisiana State University Health Sciences Center, Baton Rouge, Louisiana, USA

VOLUME 114 | NUMBER 6 | June 2006 • Environmental Health Perspectives

For an excellent summary of the health ramifications of the nanoparticles emitted see the 30-page presentation given by Professor Howard (in 2009), an infant and fetal pathologist from Northern Ireland.



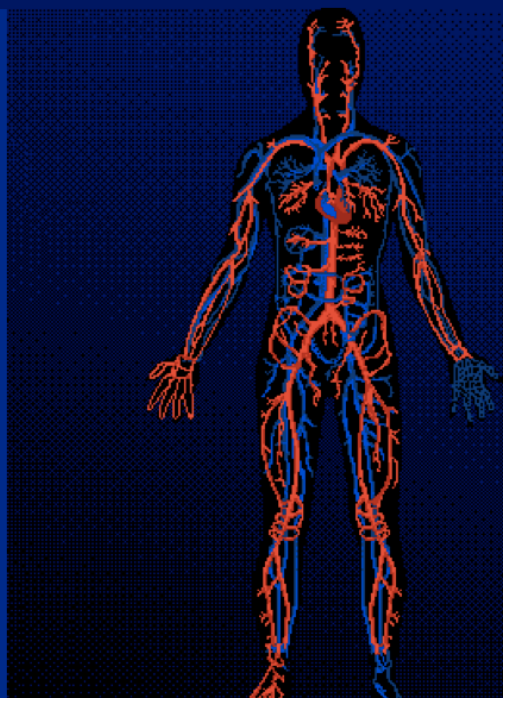
The following slides were prepared by retired professor of chemistry, Paul Connett, PhD, who resides in Binghamton, NY



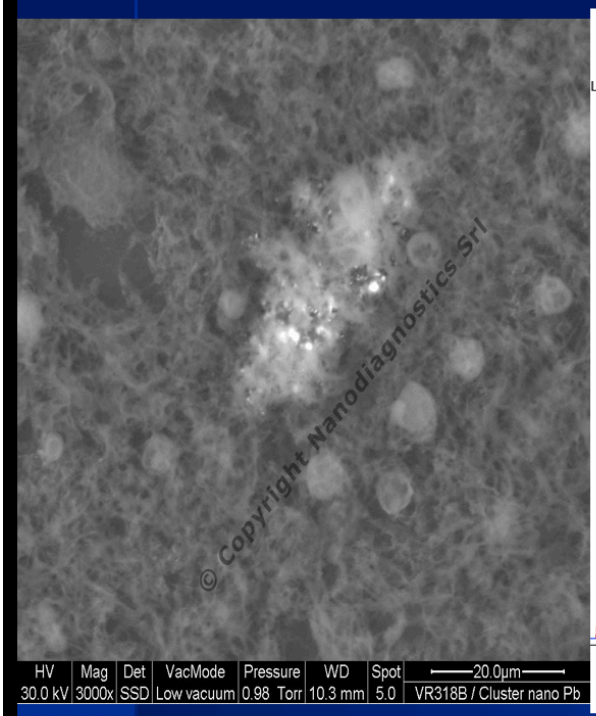
These particles will often contain toxic metals and dioxins. Recent studies that have shown a strong relationship with the number of these particles in the air and the incidence of brain cancer.

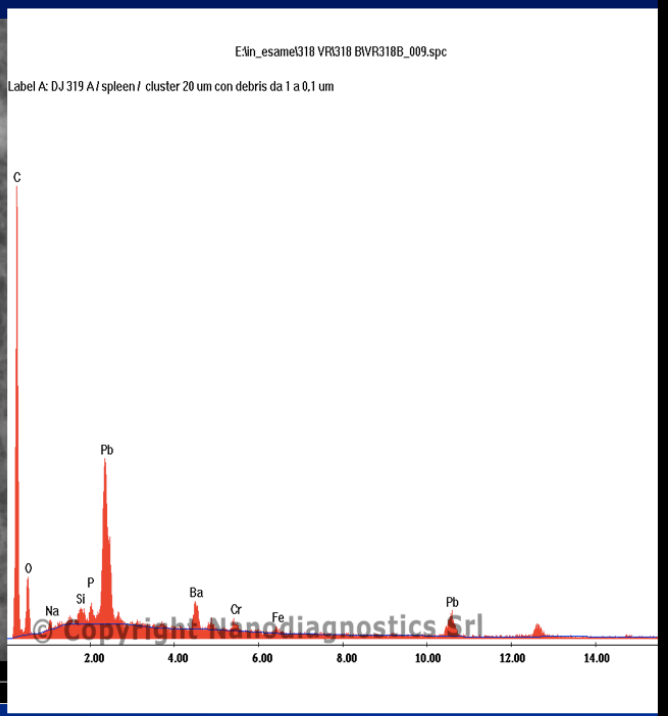
Nano Pathology

- Once nanoparticles have entered the bloodstream they can easily cross the membranes of every tissue in the body.



Aggregati di Piombo, Bario, Cromo, Ferro e Silicio in Cervello.





www.stefanomontanari.net

Guardian, Dec 18, 2019

"We know that the finest particulates from dirty air can reach the brain via both the bloodstream and the nose, and that air pollution has been implicated in increased [brain] inflammation, damage to nerve cells and to changes in stress hormone production, which have been linked to poor mental health," Braithwaite said.

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HEALTH NEWS NOV. 14, 2019 / 2:33 PM

Nano-particles in air pollution linked to brain cancer risk

A one-year increase in pollution exposure of 10,000 nano-particles per cubic centimeter could raise the risk of brain cancer by more than 10 percent, researchers report.

By Brian P. Dunleavy