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NoBurnBroome Position Paper on the SungEel project proposed for Endicott (updated).

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The following is NoBurnBroome's **updated** position paper which was originally released on April 24, 2020.¹
The following issues are discussed:

The Background

Section A. **The Project**

Section B. **The Location**

Section C. **The Process**

Section D. **Safer Alternatives**

Section E. **NYS DEC's SEQA Failure**

Section F. **What a Full EIS would show**

Section G. **Inadequacies of the DEC Air Permit**

Section H. **The Science: NoBurnBroome concerns**

Section I. **"The chemistry is not well understood" NYS DEC**

Section J. **PFAS discovery puts the permit on hold**

Section K: **The Politics**

Section L: **No Burn Broome**

Section M: **What we want to happen**

Section N: **Breaking News on the Empire State Development – The prime mover of this project**

References

Background

1.1 In September 2018, the New York State Empire State Development (ESD) agency, the chief agency responsible for the coordination of the state’s economic development programs, announced it was giving **\$1.75 million** to SungEel MCC Americas LLC (“SungEel”) to support their lithium-ion battery recycling plant proposed for Endicott, NY. The ESD stated:

“The essential recycling and recovery of lithium-ion batteries will help ensure continued access to precious and limited supplies of materials used to make the batteries.”²

1.2 Good intentions. For many this was seen as a well-intentioned effort to provide much needed economic development for both the Huron Campus (a 2.9 million sq.-ft. industrial-zoned complex in Endicott³), and the Village of Endicott as a whole. In addition, this would be part of a lithium ion-battery hub, with another company, Imperium3, manufacturing new lithium-ion batteries in the Huron Campus and receiving “performance-based incentives totaling \$7.5 million” from the Empire State Development agency⁴. “Additionally, Imperium3 is expected to qualify for an estimated \$5.75 million in New York Investment Tax Credits.”^{4,5}

1.3 Good intentions Gone Awry. The project looked like an excellent example of “industrial ecology” where one industry’s waste would become another’s starting material. However, what has been revealed since is that this project is not in the national interest (see 1.6 below). Moreover, dubbing the SungEel project as “environmentally friendly”⁶ is now seen by many as an optimistic sales pitch for a facility which will emit many very toxic by-products into the environment (See Section H).

1.4 Purpose versus Process. We don’t object to the **purpose** of this project, we object to the **process** used. This process involves two high-temperature steps which are dangerous because they produce very toxic by-products.

- a) **Step 1**, involves heating the battery components in a **rotary kiln** in the absence of air (pyrolysis) yielding a mixture of gases and particles and
- b) **Step 2**, burning the gases produced in an **afterburner**.
- c) This two- step combination is 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.”⁷ (See schematic in Figure 5)

1.5. This project is not in the U.S. national interest. The material to be recovered in Endicott, (dubbed a “black powder”) is a mixture of metal compounds. This material is unsuitable for direct input into manufacturing as it will need further processing. The valuable materials in the fly ash and fugitive dust collected in the baghouses of the operation will also need further processing. This processing will not take place in the U.S. Instead, the black powder and baghouse material will be sent to South Korea. It is only at this point that the valuable metals in the batteries can be reclaimed for manufacturing (See Section C). **South Korea gets the benefits, not the U.S. Meanwhile, Endicott and Broome County get the pollution and the risks.**

1.6 The export of these valuable metal compounds to South Korea has national ramifications because some of these metals (e.g. cobalt, nickel, lithium and manganese) are of strategic importance and ideally should remain in the U.S. to support our own manufacturing industries. This is why former U.S. Secretary of the Department of Energy (2017-2019), Rick Perry set up a prize and a research center at the Argonne National

Laboratory to encourage American industries to recycle lithium-ion batteries in order to capture these strategic materials. According to Perry:

“America’s dependence on foreign sources of critical materials undermines our energy security and national security...DOE will leverage the power of competition and the resources of the private sector, universities, and the National Laboratories to develop innovative recycling technologies, which will bolster economic growth, strengthen our energy security, and improve the environment.”⁸

1.7 If Perry was correct in his analysis, it was a huge mistake for NY State’s Empire State Development to have put \$1.75 million² of taxpayers’ money subsidizing a company to take valuable and strategically important metals out of the country.

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Section A: The Project

A.1 The applicant is a joint South Korean and American company, SungEel, Americas LLC with headquarters located at 222 Bloomington Road, White Plains, NY 10603 (hereafter referred to as “SungEel”).

A.2 SungEel proposes to run a lithium-ion battery (LIB) recycling plant at 801 Clark Street in Endicott, NY (on the very edge of the Huron campus) with a battery storage facility located nearby in South Franklin Street.

A.3 The facility will run 12 hours a day, 5 days a week. It will process 1 ton of batteries per hour (12 tons per day) and probably need at least two-days’ supply (24 tons) held in the storage facility. The company will initially hire 20 people and expects to employ about 100 within three years. According to the ESD, “The initial project aims to recycle 3,000 tons of spent lithium-ion batteries annually and will create at least 86 new hi-tech manufacturing jobs with average salaries of over \$50,000.”² To begin with they will initially hire 20 people.⁹

A.4 The project was given a New York State Department of Environmental Conservation (DEC) State Facility Air Permit¹⁰ on March 30, 2020, but as yet has received no other permits (e.g. building or operating permits). Currently, industrial zoning in Endicott¹¹ does not allow either recycling or incineration and this type of industry, as well as its location, is not consistent with the Town of Union’s “Comprehensive Plan.”¹²

A.5 In May 2020, the Air Permit was put on hold¹³ when the NYS DEC was informed by the Attorney General’s office - based on information obtained by NoBurnBroome – that some of the lithium-ion batteries contained PFAS compounds (per and poly fluorinated alkyl substances). These substances contain from 1 to 8 carbon chains which are saturated with fluorine atoms. PFAS have been dubbed “the forever chemicals” because the Carbon-Fluorine (C-F) bond is very stable, and these compounds are highly persistent in the environment and accumulate in the human body. They are also very toxic and have been described as the “dioxins of the twenty first century.”¹⁴ PFAS are often used as fire retardants because they resist burning and thus the

problem for SungEel is how they will destroy them *completely* using incineration in its afterburner (See more on PFAS in section J).

Section B. The Location

B.1 Unlike SungEel’s sister plant in Gunsan, South Korea, which is operating in a very large industrial area (approximately 8,000 acres) where the nearest residential community is located 3 miles away, in Endicott the plant will operate with people living literally across the street and children playing on adjoining athletic fields (see Figure 1).



Figure 1: This photo shows the Johnny Logan Little League baseball field which abuts the SungEel facility at the corner of Robble Avenue and Clark Street. Note in the background the ballfield’s floodlights can be seen only slightly in front of the two stacks of the facility (Photo April 2020)

B.2 The facility will operate at the corner of Robble Avenue and Clark Street. While this is technically in an industrial zoned area (known as the Huron Campus) it is right on the edge of that zone and abuts a residential area, with people living across the street. Directly behind the facility is the George W. Johnson Park with three baseball fields, a swimming pool, and a playground (see Figure 2). The “Comprehensive plan”¹² developed by the town of Union (for the Villages of Endicott and Johnson City as well as the Town of Union) wisely calls for buffer zones between such industrial activities and residential areas.

1. **Require buffers between industrial uses and adjacent residential uses;**^{12a}
(Comprehensive Plan, Chapter 18, page 26).

No buffer zones exist at this site.



Figure 2. *The facility is the large building at the bottom of the photo. Homes are directly across from the facility, while the George W. Johnson Park, with three baseball fields, [swimming pool](#), and playground are directly behind.*

B.3 In addition, the location is within half a mile of two Union-Endicott Schools, a Broome County Catholic School, two Nursing Homes, three Group Homes, two Preschools and several restaurants.

B.4 In Figure 3 below the location of the plant is shown in yellow and the battery storage facility in red.



Figure 3: *This aerial photo shows the location of the SungEel facility (outlined in yellow) on the corner of Robble and Clark, and the battery storage facility (outlined in red) located on West Franklin Street.*

B.5 Another aerial shot (Figure 4) shows the location of the facility, and the battery storage building, in relation to a NYSEG substation, the railway line, the Price Chopper grocery store, buildings on the edge of the Huron Campus and many southside residences.



Figure 4: This aerial photo shows the location of the battery storage facility, the recycling-incineration facility, in relation to the NYSEG substation, the railway line, the Price Chopper grocery store and residences on the southside and residences on Robble Avenue. The blue arrow indicates the path that the stored batteries would take (12 tons per day)

Section C: The Process

C.1 This is how SungEel describes the key steps of their process in their Air Permit application¹⁵ (July 2019):

2.0 PROCESS DESCRIPTION

The process steps include dismantling the battery cases to prepare the cells, heating the cells in a **rotary kiln (RK) dryer**, then cooling, shredding, grinding and separating the products. Products comprise the various metals including aluminum, cobalt, copper, iron, lithium, iron and nickel...

The RK dryer indirectly heats the spent LIBs ...Emissions from the RK dryer LIB drying section will pass through an **afterburner**, waste heat boiler, heat exchanger, fabric filter baghouse followed by a wet scrubber...

C.2 The schematic diagram (see Figure B in the introduction section), prepared by NoBurnBroome, summarizes the process.

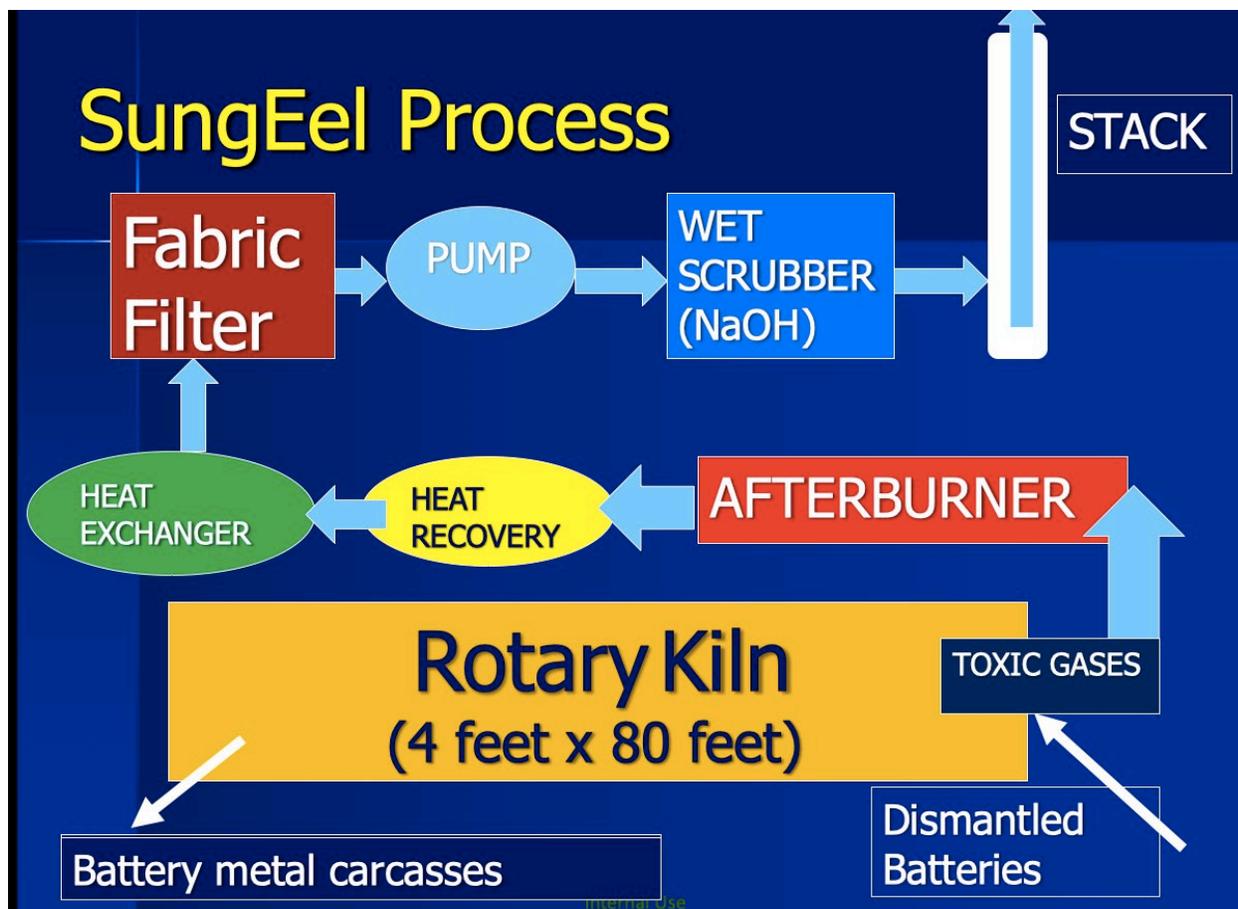


Figure 5: the SungEel process (schematic prepared by NoBurnBroome)

C.3 The heart of the SungEel process is the 4 by 80-foot rotary kiln in which the dismantled battery cells are heated externally via natural gas to a temperature of 600 degrees centigrade (1112 degrees Fahrenheit). This process is designed to **melt, evaporate and breakdown the binder (PVDF) that attaches the metal oxides in the cathode to aluminum foil** (see schematic of a typical lithium ion battery in Figure 5).

C.4 The gaseous by-products from this process pass into an **afterburner (an incineration unit or thermal oxidizer)** where they are burned at a temperature of 800 degrees Centigrade (1472 F). However, with the discovery of PFAS in some of these batteries (see section J) SungEel is now saying they will operate the afterburner at 1000 degrees Centigrade (1832 F).

C.5 The products from this burning process are then sent through a heat recovery unit, a heat exchanger and an air pollution control train which includes a baghouse (to collect particulates) and a wet scrubber (to collect and neutralize acid gases and water-soluble products) before any remaining by-products of combustion are emitted into the environment.

C.6 Is the SungEel project a recycling plant or an incineration plant? The Mayor chooses to focus on the purpose of the project to recover valuable metals from the batteries but it is the **process** that concerns the residents of Endicott. Clearly, it is not the intention of SungEel to put toxic substances into the air but that is

the inevitable consequence of the processes they have chosen (i.e. heating and burning). **Strictly speaking the batteries are not burned; the batteries are heated and the gases liberated during heating are burned.**

C.7 The ultimate purpose of the process described above is to recover the valuable materials (i.e. various cobalt, lithium, manganese, nickel compounds and possibly elemental copper and aluminum) from the electrodes and separate them from the non-metallic parts of the batteries (the electrolytes, the binders, the separators). See Figure 6 and the pie chart in Figure 7 below).

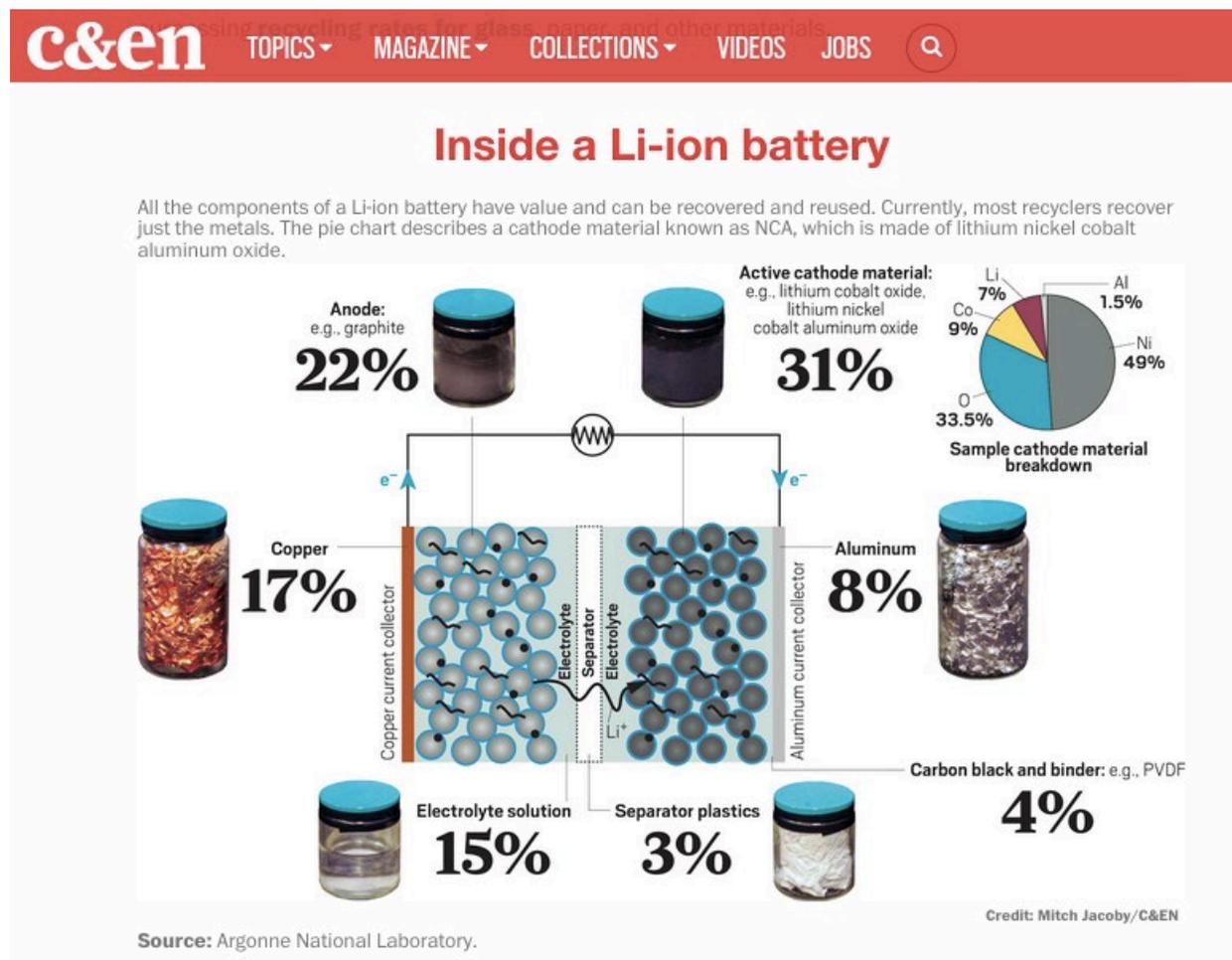


Figure 6: This graphic shows the main constituents of a typical lithium-ion battery. Source: C&EN¹⁶

C.8 When one looks at the market price of the various metals in these batteries, especially cobalt (see Table 3 below in Mossali et al, 2020¹⁷) one can clearly understand why SungEel wants to recover these metals.

Table 3. Economic value of Lithium-ion batteries components.
(Mossali et al. 2020¹⁷)

| | | Value (US \$ per ton) | |
|---------------------------|----------|-----------------------|----------|
| | 2001 | 2017 | 2019 |
| Cathode components | | | |
| Aluminum | \$1,250 | \$2,000 | \$1,800 |
| Lithium | \$7,500 | \$9,000 | \$10,000 |
| Cobalt | \$38,000 | \$55,000 | \$35,500 |
| Nickel | \$8,600 | \$10,000 | 13,200 |
| Manganese | \$1,100 | \$2,000 | \$2,000 |
| Anode components | | | |
| Copper | \$1,800 | \$5,500 | \$5,800 |
| Graphite | \$550 | \$1,000 | \$800 |

C.9 More details of the process. The heated carcass of the batteries containing the metals and metal compounds leave the rotary kiln at the lower end of the kiln and then go through a series of grinding and other physical steps to yield the “black powder.” In the rotary kiln the non-metallic parts are variously melted, vaporized and partly broken down chemically by the high temperature (600 degree C, 1112 F). The resulting gases and particles exit from the other end of the rotary kiln and are burned in the afterburner. Toxic by-products and nanoparticles will be formed in both steps (heating and burning) (See Figure 5).

C.10 Some other valuable metals will be captured in the dust in the baghouses, and this dust will also be sent to South Korea.

C.11 Recovery versus disposal. In other words, some of the metals are recovered, but in a form that cannot be used directly for input into manufacturing. The manufacturing takes place in South Korea. In the Endicott facility the non-metallic parts of the battery are destroyed (not recycled). The main functions of the Endicott facility are pre-treatment and disposal. The rotary kiln and afterburner are used to get rid of (i.e. dispose of, not recycle) the *combustible* material (40% or more of the battery) so that the *non-combustible* fraction can be further processed to the “black powder” (or “intermediate cathode powder” see Figure 8 below) which is sent to South Korea. It is only then, in South Korea, after further processing using water-based chemicals, that material can be used in manufacturing (i.e. used to make new batteries). **The main functions of the Endicott facility are pre-treatment and disposal. South Korea gets the remanufacturing.**

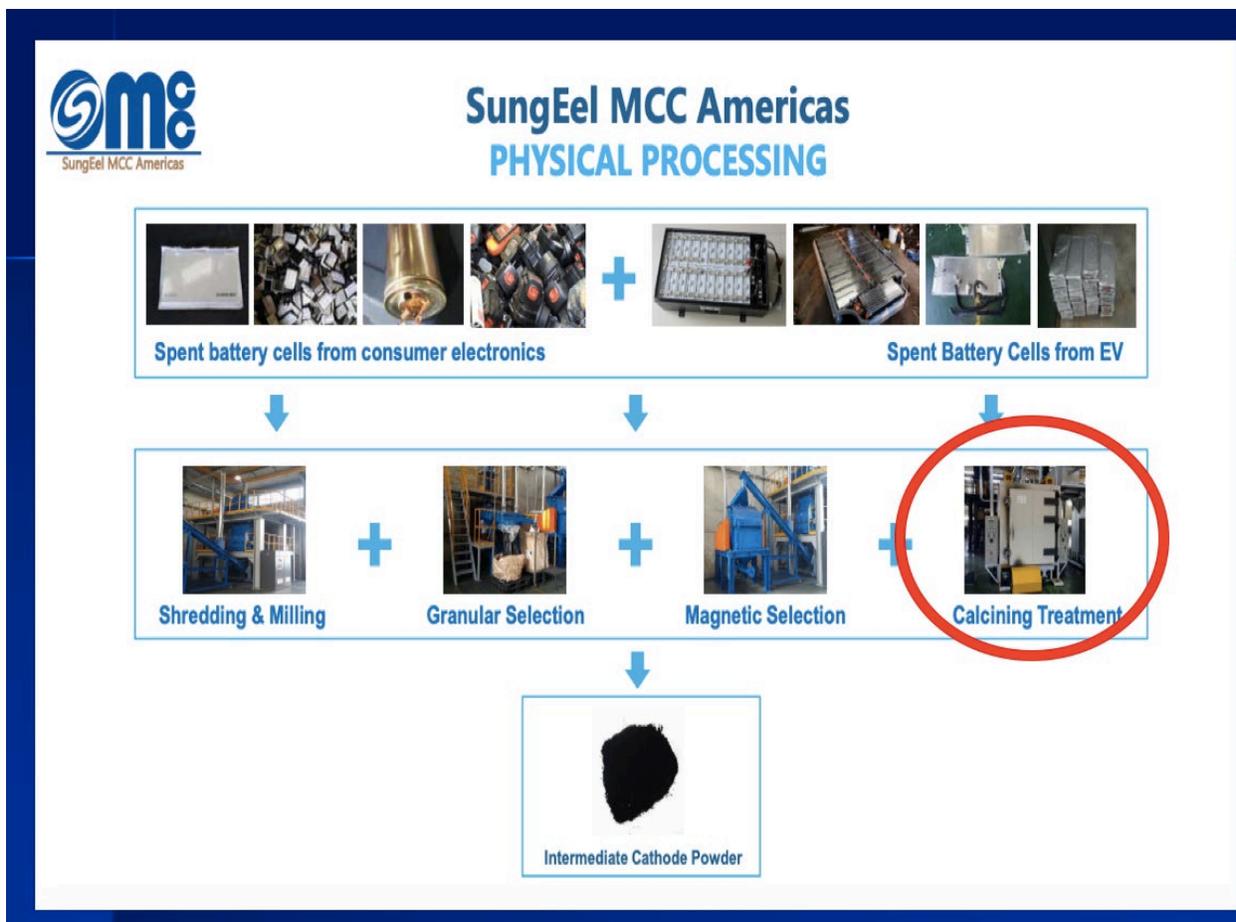


Figure 7: SungEel's summary of its process and product in the Endicott operation. Note the final product is identified as "intermediate cathode powder" (elsewhere referred to as "black powder"). This will go to South Korea in order to extract the valuable metals. Note that the "calcining treatment" (circled in red) refers to the rotary kiln and afterburner.

C.12 What Sungeel will not recover. If we look at the graphic of a typical lithium-ion battery in Figure 6 and the pie chart in Figure 8 below, we can see what SungEel will inevitably dispose of via incineration. They will not recover the electrolyte, the separator and the binder, and they will probably not recover the graphite, the copper or the aluminum. Up to 40% of these materials will be waste and converted into various toxic by-products – some of which will be captured in the air pollution control equipment and some will not.

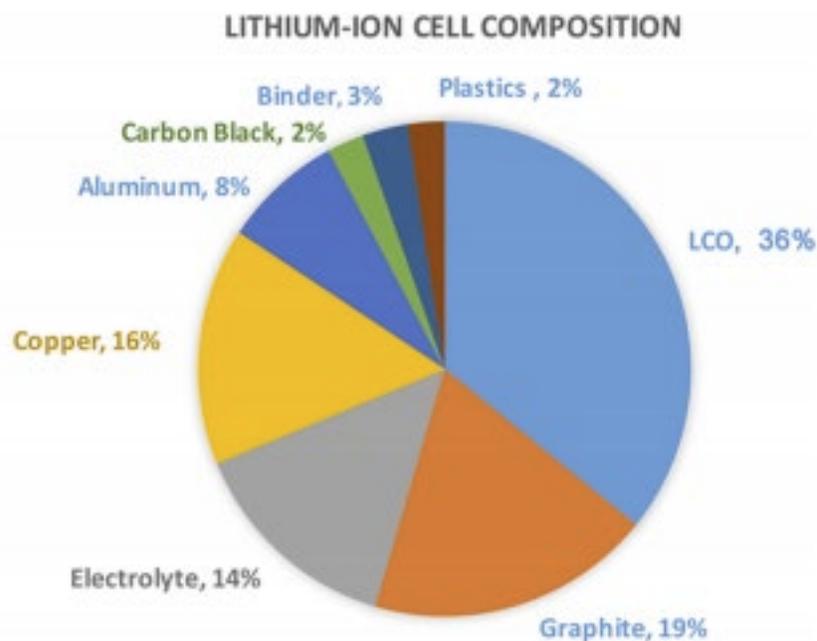


Figure 8: The pie chart shows the percentage of each material used in a typical lithium-ion battery (source: Gaines et al., 2018¹⁸).

C.13 This is not a “green” project. Endicott’s Mayor and Deputy Mayor have described the battery recycling facility “as part of a green jobs initiative.”¹⁹ From the point of view of the need to shift from a linear economy to a circular economy any process involving incineration (i.e. material destruction) goes in the wrong direction. In addition, burning processes create more carbon dioxide and contribute to global warming. SungEel is also using natural gas -- another source of carbon dioxide and global warming - to heat up the rotary kiln.

Section D: The Better Alternatives

D.1 The key and central challenge for any process that attempts to recover the valuable metals in the electrodes of lithium-ion batteries is to **separate the metal compounds from the binder (PVDF)** which attaches them to the aluminum foil surrounding the cathode and the graphite to the copper in the anode (see Figure 6).

D.2 Yu (2020)²⁰ explains in a recently published article:

“the Al foil and cathode materials are difficult to separate because they are firmly adhered by polyvinylidene fluoride (**PVDF**) binder ... **Decomposing PVDF** using thermal treatment offers advantages of high efficiency and simple operation... **although it is worth noting that the fluorine present in PVDF could be transformed and transmitted into off-gas during thermal treatment of spent LIBs, causing reactor corrosion and air pollution**” (*our emphasis*).

D.3 PVDF (Poly vinylidene difluoride) is a fluorinated polymer similar to Teflon. We discuss the hazards of burning PVDF in Section H, but the point to make here is that simply “melting and burning off the PVDF” is a

very clumsy, wasteful and dangerous way of doing this. PVDF makes up 3% of the cathode material (Gaines et al., 2018¹⁸) and comprises 60% fluorine by weight.

D.4 There are less wasteful and safer ways of removing the PVDF. The metal oxides and aluminum foil can be dissolved in mild acids (as mild as an extract from orange peels!^{21,22}) and bases; the PVDF can be dissolved in organic solvents or super-critical liquids. Another promising possibility involves using a cryogenic method. This involves separating the PVDF from the metal oxides and aluminum by freezing with liquid nitrogen. This makes the PVDF easy to separate from the metals and metal oxides using froth flotation (Liu et al., 2020²³). Interestingly, this is the exact opposite of SungEel's method – they use high temperatures to melt and burn the PVDF with resulting air pollution, this method uses low temperatures to freeze the PVDF with no air pollution.

D.5. Here are some specific references for some of these alternatives:

- a. Dissolving the Aluminum foil and metal compounds using aqueous acids or alkalis (Chen and Zhou 2014²⁴; Gao et al. 2018²⁵)
- b. Dissolving the PVDF binder using organic solvents (Natarajan and Aravindan 2018²⁶; Zeng and Li 2014²⁷)
- c. Vacuum pyrolysis in which the PVDF binder is evaporated and collected (Xiao et al., 2017, 2020)^{28,29}
- d. Cryogenic method (Liu et al, 2020)²³

D.6 The different processes have been summarized and compared in a recent review article by Mossali et al. (2020).¹⁷ Below we have printed a table from Gaines et al., 2018³⁶, which compares the pros and cons of pyro-metallurgical processes with other processes.

Table 2: A comparison of the pros and cons for pyro-metallurgical processes with other processes for recycling lithium-ion batteries (Gaines et al., 2018¹⁸)

Table 3. Pros and cons of battery recycling processes.

| Process type | Pros | Cons |
|------------------|---|--|
| Pyrometallurgy | • Flexible process input | • Li, Al go to slag |
| | • No sorting or size reduction | • Organics burned |
| | • Profit from recovery of Co, Ni, Cu | • Additional processing needed to separate metals |
| | • SO _x emissions from metal production avoided | • Expensive gas treatment |
| | • Commercially viable now | • High temperature |
| | • ... | • Capital-intensive |
| | • ... | • Requires high volume |
| Hydrometallurgy | • Substrate foils recovered directly | • Requires size reduction |
| | • Low temperature, low energy | • Acid breaks down cathode structure |
| | • Li can be recovered | • No valuable product from LFP |
| | • Output can be converted to cathode precursors | • Solvent extraction needed to separate Co and Ni (or use mixture) |
| | • Can be used for the mix of cathodes | • ... |
| | • Can be used for prompt scrap | • ... |
| Direct Recycling | • Retains valuable cathode structure | • Requires single-cathode input |
| | • Can also recover anode, electrolyte, and foils | • May recover obsolete formulation |
| | • Can be used for LFP | • Degradation may limit repeats |
| | • Could be used now for prompt scrap, low volumes | • Buyer must be assured of quality |
| | • Low temperature, low energy | • Not demonstrated at scale |
| | • Avoids most impacts of virgin material production | • ... |

Section E. The NYS DEC's SEQA Failure

E.1 NYS DEC Permit fast-tracked. The state's process to permit the facility was fast-tracked. In so doing, the NYS DEC made a fatal mistake. It issued a **"negative declaration"** (or "Notice of Determination of Non-Significance") in its SEQR review (State Environmental Quality Review Act)^{30,31} which meant this "First of its kind operation" in the U.S.³² was *not* subjected to a full Environmental Impact Statement (EIS). **This negative declaration is not defensible.**

E.2 The negative declaration is not defensible. The NYS DEC issued this “Negative Declaration” for the project on Oct 2, 2019³⁰ and an amended version March 27, 2020³¹. In both of these documents they declared:

“There is no identified creation of a hazard to human health”

E.3 This statement shows a remarkable lack of sensitivity to the fact that the local community is suffering health consequences from previous industrial operations, e.g., IBM, which presumably received NYS DEC’s permits and oversight. This compromised health situation has been well documented. Local residents have experienced statistically significant elevations of health outcomes, including leukemia, kidney and testicular cancer, measures of low birth weight, and congenital heart defects (New York State Department of Health, 2004³³; ATSDR 2006³⁴; Clapp and Hoffman, 2008³⁵; and Forand, et al. 2012³⁶).

E.4 Any site visit by NYS DEC personnel would have made it clearly visible that this project **at this location** should have triggered a full EIS (see Figure 2 above). They would have seen with their own eyes that:

- That families (many with young children), are living in homes, just across the street from the facility
- Residents are living in close proximity on the hills that are above or at the same height of the facility’s two smokestacks;
- That children and residents use the three baseball fields, a community swimming pool, and a playground in the George W. Johnson Park directly behind the facility.

E. 5 Didn’t the NYS DEC ask, “How many of these people are already suffering from cancer?” And “How much more cancer-causing chemicals can these people withstand?”

E.6 A Human Health Risk Assessment, a key component of a Full Environmental Impact Statement (EIS), would have addressed these questions.

E.7 But in addition to the obvious unreasonableness of this declaration on human health, the declaration made some false assertions on both zoning and local planning.

E.8 Zoning. In both of the Negative Declarations issued by the state, October 2, 2019³⁰ and the amended version of March 27, 2020³¹ it states

“There is no material conflict with local land use laws.”

E.9 We disagree. Neither Recycling nor Incineration were permitted uses under the Village of Endicott Zoning Codes¹¹. The first statement (Oct 2, 2019) was clearly false, and they presumably made the amendment on March 27, 2020 (just three days before they issued the Air permit) to try to compensate for this error. For the NYS DEC to issue a “negative declaration” and proceeding with the Air Permit without these zoning issues being resolved, was irresponsible and inappropriate.

E.10 Local Planning. The Negative Declarations issued by the state, October 2, 2019³⁰ and the amended version of March 27, 2020,³¹ also states:

“8. The proposed action is consistent with local planning ... There is no identified creation of a material conflict with **local land use plans.**”⁷ (our emphasis)

E.11 And on March 27, 2020³¹, this was amended to:

8. Impact on community plans/character There is no identified material conflict with **local land use plans** or **community character**. The proposed facility is to be located within existing buildings on the Huron Campus, which is zoned for industrial use and previously used for industrial activity. The facility will need to comply with all local requirements, including any applicable zoning and or special permits requirements.²⁹ (our emphasis)

E.12 Both versions of reason 8 offered include a **false assertion**. This project is not compatible with the Town of Union's "Comprehensive Plan."¹²

E.13 The "**Comprehensive Plan**" prepared by the Town of Union Planning Department for the Village of Johnson City, the Village of Endicott, and the Town of Union, wisely calls for buffer areas between industrial activities and residential areas. The Plan specifically requires,

"buffers between industrial uses and adjacent residential uses."^{12a} (page 26)

E.14 **No such buffer zone exists for this facility at its location.** In fact, there are people literally living across the road (i.e. less than 100 feet) from the proposed facility.

E.15 In addition, the "Comprehensive Plan" also makes clear what future industrial activities they preferred. They stressed a preference for "light industrial" over "heavy industrial" uses and spelled out what they meant by light industrial uses:

"Light industrial uses include manufacturing establishments, wholesalers, research laboratories, and office parks. The desired development pattern is the industrial park or campus, including office parks and a combination of office and light industrial uses. Very little land in the Town of Union is suitable for heavy industrial uses and this use is being phased out."^{12b} (Chapter 10, page 21)

E.16 We do not believe that the SungEel facility with its high temperature processes and smokestacks would fit this description of a light industrial use.

E.17 *Thus we call upon the NYS DEC to vacate its "Negative Declaration" (Notice of Determination of Non-Significance) of March 27,2020, in its SEQR review of this project and to rescind the State Facility Air Permit it issued on March 30, 2020.*

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E.18 Clearly there are many questions that demanded a full EIS. Claudia Braymer made many of the same points in her May 3rd letter³⁸. Even though her comments were directed towards the Mayor's proposed zoning change, the arguments she used pertain to the specific location of the SungEel project itself. She wrote:

"A zoning amendment of this magnitude, which impacts all of the Village's land that is zoned Industrial (approximately 562 acres), requires the preparation of an environmental impact statement ("EIS")

"... the zoning amendment, which allows recycling facilities anywhere in the Village's Industrial zones, has the potential to result in a "moderate to large" adverse impact on human health ...

"Also of importance is that the zoning amendment as currently proposed is contrary to the future land use plan for the Village (#17c), which indicates that the Village's Industrial zones are meant to be for "mixed use" purposes, like commercial office parks, not heavy industrial uses...

"Finally, the proposed zoning amendment - permitting recycling facilities without any restrictions - poses a threat to the existing community character of the Village (#18e), which is mostly dense areas of relatively smaller residential structures.

"Additionally, the proposed zoning amendment has the potential to cause adverse impacts to the use and enjoyment of public resources (#18d), such as Logan Field, George Johnson Park, the public swimming pool, the carousel, and the Susquehanna River, which are all in close proximity to an Industrial zone.

"All of these potential impacts demonstrate that the Village must require the preparation of an EIS before rushing to adopt changes to the zoning code that allow a potentially dangerous new use to be permitted in the Village..."³⁸

Section F: What a Full Environmental Impact Statement would show.

F.1 We believe that a full EIS would have led to quick rejection of this project for multiple reasons:

- 1) Neither recycling facilities nor incinerators (or facilities using incineration) are permitted in Endicott's Zoning Codes.¹¹
- 2) The project is incompatible with the Town of Union's "Comprehensive plan" (which includes the Villages of Endicott and Johnson City and the Town of Union).¹²
- 3) The site chosen in Endicott is inappropriate for such an operation for the following reasons:
 - a. The high temperature processes used by SungEel have the potential to emit many toxic and carcinogenic substances into the air. These include formaldehyde, dioxins, furans, hydrogen fluoride, many fluorinated by-products including PFAS, toxic metals and nanoparticles. (See Section H).
 - b. Unlike SungEel's sister plant in Gunsan, South Korea, which is operating in a very large industrial area (approximately 8,000 acres) where the nearest residential community is located 3 miles away, in Endicott the plant will operate with people living literally across the street.
 - c. Local residents have experienced significant adverse health outcomes due to previous and continuing industrial pollution in the area (including the IBM trichloroethylene, or TCE, plume). Residents are still dealing with these health outcomes.

- d. The hilly topography will reduce the dispersion (i.e. dilution of the stack emissions) of the pollutants, especially for those living at elevations at and above the height of the stack.
- e. The heavy rain in the area would bring pollutants to ground without the benefit of much dispersion. This could contaminate people's vegetable gardens. Rain would also wash out pollution onto the adjacent George W. Johnson Park and its three baseball fields, community pool, and playground (See Section C). **Note:** Endicott shares the same weather as Binghamton. Binghamton has the 9th highest precipitation rate compared to 27 cities/areas in the state in averaged data from 1981-2010.³⁹

F.2 In addition we believe that a full EIS would have explored the fire risks posed by this project.

F.3 The Fire Risks. The biggest and most obvious risk for SungEel's proposed operation in Endicott is the risk of a major fire either in the recycling facility itself or in the battery storage facility. Lithium-ion batteries are a well-known fire hazard and yet there has been no fire or accident analysis performed for this operation. Such a fire could pose catastrophic problems for the Village of Endicott and possibly beyond.

F.4 At the very least, such a fire would require mobilization of multiple fire departments and emergency services but the county so far has had little say in this. This issue has only been discussed locally with little formal input from either the county, nearby towns or independent experts.

F.5 The NYS DEC has stated,

"The risk of a chain reaction fire is a real risk.

"DEC agrees that there is a real risk of fires. DEC does not regulate this, nor does DEC have the expertise. Fire prevention is the purview of local authorities. Nonetheless, DEC included a condition that will cause SMCC to focus on fire prevention. The condition may be unnecessary; we are aware that SMCC has considered fire prevention independent of DEC."⁴⁰

F.6 Among other problems posed by a major fire would be the possibility of the large quantities of water used to put out the fire carrying pollution into the soil, ground water, Susquehanna River, and possibly the Village of Endicott's water supply, which is worrisome to start with.^{41,42,43}

F.7 In terms of fire risk the battery storage facility – see photo below – in contrast with the recycling facility itself, is a rather flimsy metal structure that would not contain a major fire or explosion. It is also located immediately adjacent to a NYSEG relay station (see Figure 9).

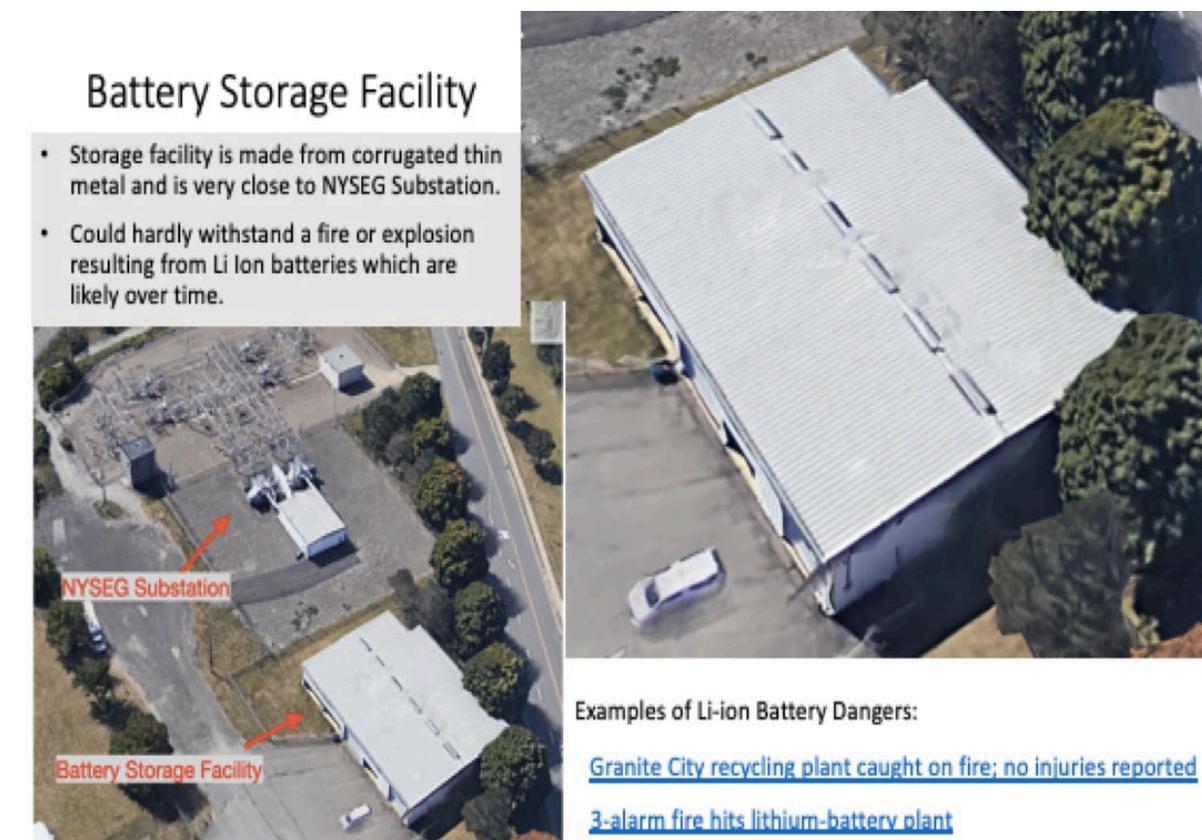


Figure 9: The battery storage facility located on West Franklin Street. Note the adjacent NYSEG substation.

F.8 It is inexplicable that the NYS DEC did not require a Full Environmental Impact Statement (EIS) for this project. We call on Governor Cuomo to insist that a Full EIS be performed BEFORE any consideration be given to re-instating the State Facility Air Permit (currently on hold).

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Section G: The Inadequacies of the DEC Air Permit

G.1 On March 30, 2020, the NYS DEC gave a State Facility Air Permit¹⁰ for the project even though the basis for the emission claims from the company's plant in South Korea was inadequate (e.g. single data points cannot be subjected to statistical analysis and thus useless for predicting annual emissions, see G.9 below).

G.2 Dioxin. The NYS DEC relied on SungEel for an estimate of dioxin emissions based on a single measurement made on a single day. Typically, three tests are done within a 24-hour period to assess the range of emissions. Moreover, experts in the field know that dioxin measurements from trash incinerators

can vary by a factor of 1000 within a single day – especially during start-up, shut-down and upset conditions. 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 an *extended* sample collection time. In Europe many countries use a commercially available 4-week sampling system called AMESA (Adsorption Method for Sampling Dioxins and Furans).⁴⁴ In the recent monitoring of a state-of-the-art trash incinerator in the Netherlands, two **4-week** sampling tests of dioxins indicated 1200 and 500 times higher dioxin emissions than the traditional **6-hour** tests. Moreover, a more reliable measure of cumulative dioxin emissions can be obtained by monitoring the levels in chickens' eggs at different distances from the plant.^{45,46,47}

G.3 Moreover, the NYS DEC relied on the company itself to organize the dioxin testing without a third party (approved by, or hired by, the NYS DEC) to oversee how the testing was done.

G.4 Despite the inadequacy of this testing the dioxin emissions were still 12% of the regulatory threshold levels – based upon a single test – this is far too close for comfort.

G.5 The dioxin emissions monitored only included *chlorinated* dioxins and furans and not their *fluorinated* cousins even though it is known that there are several fluorinated compounds present in the batteries and thus a source of fluorine available for their formation.

G.6 Considering this plant has been operating for 12 years in South Korea, it is surprising, or even astounding, that they offered so little data for dioxin emissions – one single 4-hour test in 12 years!

G.7 This also applies to the other data provided in their air permit application.

G.8 Metal emissions were based upon single spot tests performed in 2019. Have they not monitored metal emissions before this? The NYS DEC actually accepted single spot tests for 12 years of operation!

G.9 The NYS DEC used data that was statically invalid. All the pollutant emissions measured at the kiln exit, and the dioxin emissions from the main stack exit, were based on single measurements at the South Korean facility. All the other measurements at the stack exit were based on a single measurement for three different battery types. You cannot do statistical analysis on a single data point. You need a range of values (preferably taken on different days). From this range you can assign a low value, a high value, a geometric mean and an upper 95% confidence value. Only on this basis do you have grounds to estimate annual emissions.

The NYS DEC used data that was statistically invalid.

All the pollutant emission measurements at the South Korean facility (dioxins, metals etc.) were based on a single measurement on a single day. You cannot do statistical analysis on a single data point. You need a range of values (preferably taken on different days). From this range you can assign a low value, a high value, a geometric mean and an upper 95% confidence value. Only on this basis do you have grounds to estimate annual emissions.

G.10 Based on the knowledge that there are several **fluorinated** compounds used in lithium-ion batteries, it is surprising that so little data was provided to assess either a) HF emissions or b) other fluorinated by-products emissions.

G.11 Inadequate monitoring of Hydrogen fluoride and fluorinated by-products. SungEel's permit application¹⁶ included just two categories "fluoride compounds" and "hydrocarbons."

G.12 "Fluoride compounds" would give a measure of Hydrogen fluoride (HF) emissions but were only provided for the kiln exit and the stack exit. What was needed was a measurement of **HF before and after the wet scrubber**. This would not only have given a measure of the efficiency of the wet scrubber but also have given us an indication of how effectively the afterburner was at breaking down fluorinated products produced in the pyrolytic reactions in the rotary kiln. **The more efficient the breakdown the more HF that would be produced. The less efficient the breakdown the more fluorine will end up in PICS (products of incomplete combustion).**

G.13 The "Hydrocarbons" category was very large at the kiln exit (34 ppm). This almost certainly contained a number of fluorinated organic compounds (PICs). Instead of using the somewhat crude FID (flame ionization detection) monitoring of these emissions they should have used GC-MS (Gas chromatography–mass spectrometry) so they could have identified some, if not all, of the many different fluorinated compounds emitted.

G.14 No effort was made to characterize or quantify fluorinated compound emissions. This is unfortunate because some of them could be exquisitely toxic like PFAS. Again, such a poor characterization of these by-products after 12 years of operation is inexplicable. Surely, SungEel employs chemists that could have ascertained what products they produce so their toxicity can be gauged?

G.15 Nanoparticles. These were not discussed by SungEel or the NYS DEC, even though it is well established that they are formed in any high temperature process. Even though nanoparticles are not regulated by the US Environmental Protection Agency or the NYS DEC, that does not mean that they present no health threats to the local population. Because of their importance we are devoting a separate section to this (see Section H1 below).

Section H. NoBurnBroome's scientific concerns

H.1 The Special Problems Posed by Nanoparticles

H.1.1 The problem of nanoparticles is that the pollutants of major concern (toxic metals and dioxins) deposit on the surface of particles as a function of surface area. The smaller the particle the greater the overall surface area and the greater deposition for unit mass of particulate matter; in other words, as far as particulate emissions are concerned **the nanoparticles are enriched with toxic metals and dioxins**. Thus, although nanoparticles make up only a small fraction (by mass) of the total particulate emissions, they will contain a large fraction of the toxic emissions. **It is unfortunate therefore they are not monitored by the NYS DEC.**

H.1.2 A second major concern with nanoparticles is that they are so small (less than 1 micron in diameter) they squeeze through most particulate control devices, including the baghouse used in the SungEel process.

H.1.3 A third major concern with nanoparticles is that they are so small they can pass through the human lung membrane and quickly get distributed (and can enter) every tissue in the body (see Figure 10).

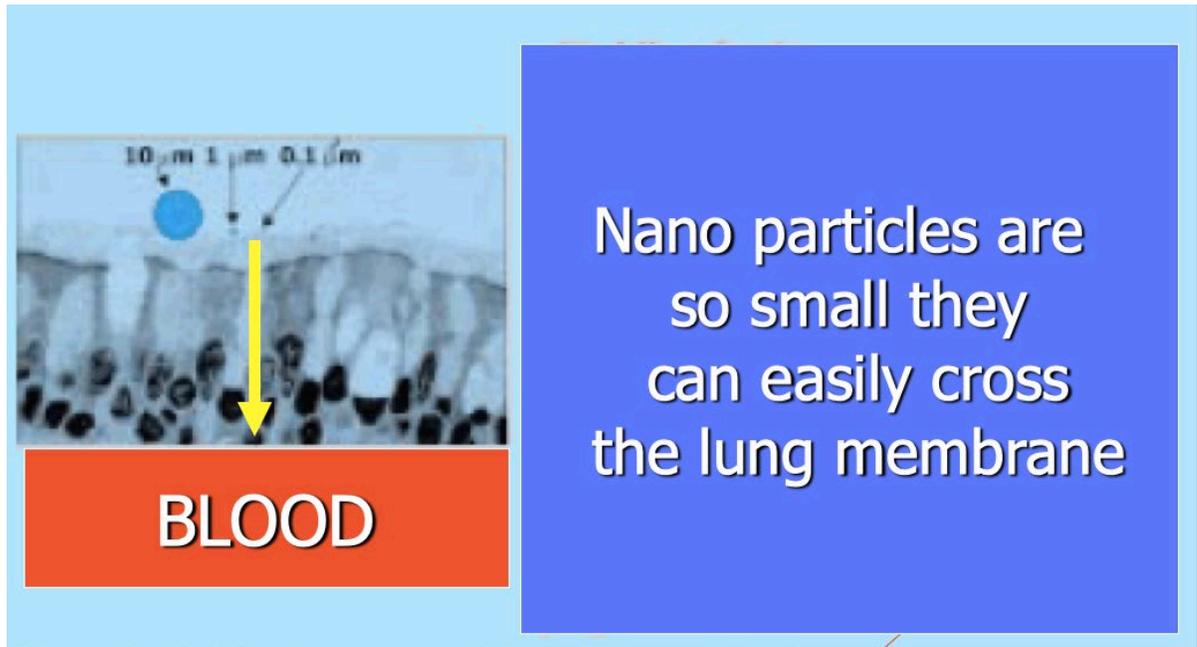


Figure 10: Nanoparticles are so small they can easily cross biological membranes

H.1.4 Figure 11 below shows a nanoparticle in brain tissue.

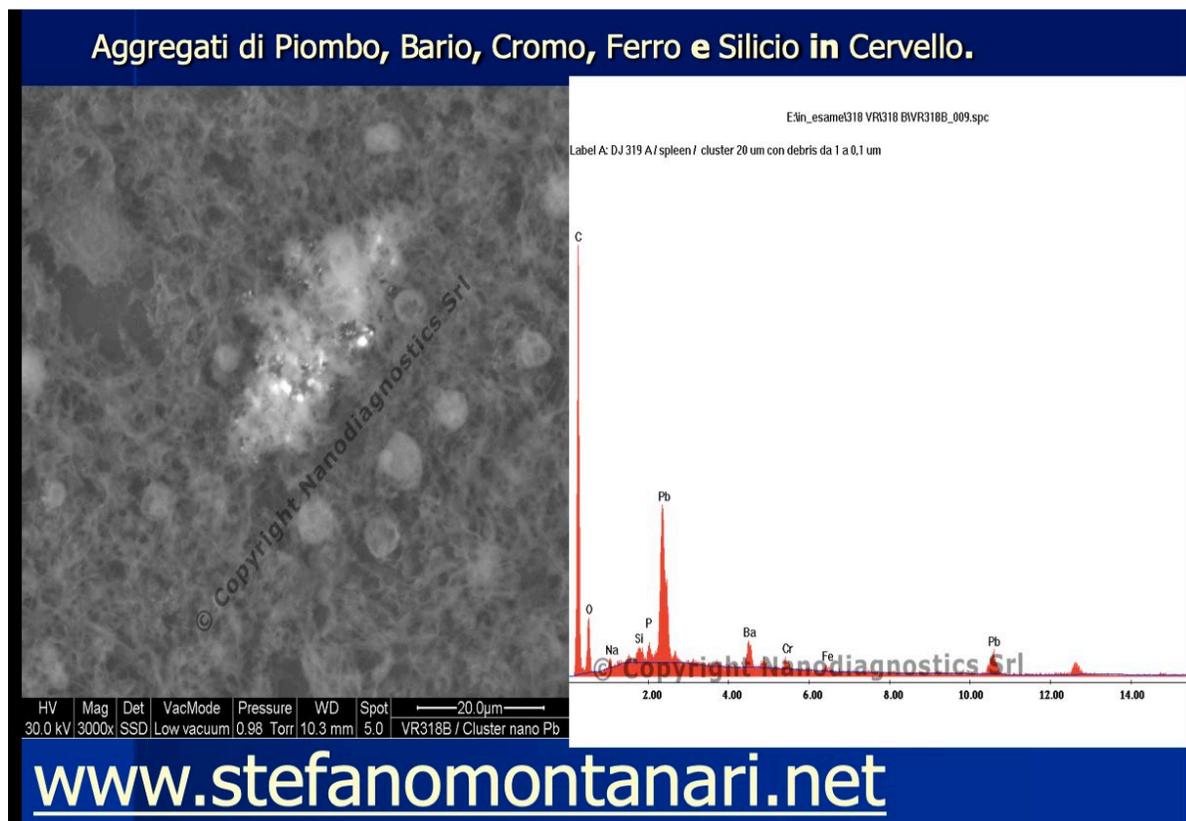


Figure 11: This electron micrograph shows the presence of a particle containing lead, barium, chromium, iron and silicon, in brain tissue.

H.1.5 Such pictures can be found for nearly every tissue in the body, but for a long time no association was found between the presence of these particles and any health effects.⁴⁸ But this has now changed. Over the last two years a number of studies have associated the presence of nanoparticles in urban air and health effects in the population. The most recent study was performed in Montreal where the authors found a relationship between a concentration of 10,000 nanoparticles per cubic centimeter in urban air and a 10% increase in brain cancer (Weichenthal et al. 2020⁴⁹). 10,000 nanoparticles would be about one billionth of a gram. See also articles from various disciplines on nanoparticles .^{50, 51, 52, 53, 54, 55, 56}

H.1.6 Specifically referring to heating of lithium-ion batteries, Jens Tubke, 2019⁵⁷, writes,

“The decomposition of the cathode material can be accompanied by phase changes at higher temperatures leading to the formation of nanoparticles of metal oxides (e.g., NiO, CoO, MnO) and metals (e.g., Ni, Co)... These particles are then present in the smoke and dust ejected from the cell and pose a health risk as well.”

Note: such particles will *not* be captured by the baghouse used by SungEel.

H.1.7 Despite many phone conversations and written communications (e.g. letter to Governor Cuomo, July 19⁵⁸) on this subject, the DEC continues to downplay these health dangers. In a letter from Tom Elter⁴⁰ NYS DEC (August 1, 2020) he trivializes the issue in the following way:

“The nanoparticles to which you refer, that is, those from combustion, are ubiquitous. We combust home heating fuel, use natural gas for cooking, combust fuel for power generation, rely on fossil-fueled transportation sectors, our industries have boilers (such as those on the Huron campus), and many of us enjoy a simple camp fire. I cannot think of a civilization without combustion and exposure to the resultant “nanoparticles.” We have been exposed to nanoparticles long before the word was coined.”³⁷

H.1.8 The nanoparticles we are talking about are far more dangerous than most of those mentioned by Elter. They will contain carcinogenic metals like chromium VI; they will contain a number of chlorinated and fluorinated dioxins and furans (the batteries contain copper which is a well-known catalyst for dioxin formation) and other fluorinated by-products, possibly including PFAS.

H.1.9 Unfortunately, the NYS DEC is not up to date on the scientific literature on the threat posed by nanoparticles and are thus incapable of protecting the public on this matter.

**NYS DEC is not up to date on the scientific literature
on the threat posed by nanoparticles
and are thus incapable of protecting the public on this matter.**

H.1.10 The simple and horrible fact is that the production of nanoparticles via incineration constitutes the most devastating delivery system of toxic substances used in consumer products to human tissues, that we have ever invented.

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H.1.11 Because of the difficulties of measuring the nanoparticles in the stacks of incinerators, we have suggested that the NYS DEC adopt a simpler approach. For any future project involving incineration, the NYS DEC should require measurement of the nanoparticles in the ambient air (as in the study by Weichenthal et al. 2020⁴⁹) before and regularly after the facility goes into operation.

H.2 Our Scientific Concerns about Other Air Pollution Risks

H.2.1 The facility is permitted to emit 100 pounds of Formaldehyde a year (formaldehyde is a known human carcinogen); 100 pounds of Hydrogen chloride a year; 10 pounds of Manganese per year; 10 pounds of Nickel and/or nickel compounds (a known human carcinogen) per year; 0.10 pounds of Chromium VI a year (Chromium VI is another known human carcinogen) and 45 milligrams of Dioxin per year (dioxin is another human carcinogen) (data from the NYS DEC Air Permit¹⁰)

H.2.2 In addition to these permitted pollutants, there are many others which were not considered by the NYS DEC. These were either inadequately monitored, or not monitored at all, by SungEel in their sister plant in South Korea, or inadequately monitored (see Section G). These include Hydrogen fluoride; *fluorinated* Dioxins and Furans; other *fluorinated* by-products (including PFAS) and nanoparticles.

H.2.3 Hydrogen fluoride is a very strange omission from the pollutants regulated by the DEC, because it is a well-known to be produced in the overheating or burning of lithium-ion batteries (Larsson et al., 2017⁵⁹).

H.2.4 SungEel has not provided an adequate starting point for an independent assessment of this “**first of its kind operation**”³² in the U.S.

H.2.5 SungEel has provided no listing of the compounds present in lithium-ion batteries or even an elemental analysis (percentage of each element in the batteries) so that a mass-balance could be attempted, especially for fluorine.

H.2.6 Nor did the NYS DEC display any curiosity as to the chemical composition of these batteries at any time to issuing the air permit.

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Nor did the NYS DEC display any curiosity as to the chemical composition of these batteries at any time to issuing the air permit.

H.2.7 Starting virtually from scratch the NoBurnBroome Science Team has tried to assess the dangers posed by SungEel’s high temperature processes from what we have gleaned from the scientific literature and from our previous extensive knowledge of the dangers posed by other incineration processes and our prior knowledge of the dangers posed by PFAS.

H.2.8 Our major concerns stem from the number of fluorinated materials used in many of the lithium-ion batteries. These concerns have been shared in the form of a white paper⁶⁰, and two letters (dated June 22⁶¹ and July 19⁶²) to Governor Cuomo. Only partial and unsatisfactory responses have been received from the NYS DEC to these communications.

H.2.9 Here are some of the fluorinated compounds present in some of the lithium-ion batteries and the concerns they raise

A) Lithium hexafluorophosphate (LiPF₆)

Most lithium-ion batteries use an electrolyte called lithium hexafluorophosphate. When this is heated and burned it produces highly toxic byproducts, which include phosphorous pentafluoride (PF₅) Phosphoryl fluoride (POF₃), and Hydrogen fluoride (HF) (Larsson, 2017⁵⁹). All of these substances are highly toxic, but are likely to be captured in the wet scrubber used by SungEel, when it is working properly.

B) Other electrolytes containing fluorine (or chlorine)

These include: Lithium hexafluoroarsenate monohydrate (LiAsF₆), Lithium perchlorate (LiClO₄), Lithium tetrafluoroborate (LiBF₄), and Lithium triflate (LiCF₃SO₃). These other electrolytes will produce many other toxic products when heated and burned, including PFAS in the case of lithium triflate.

C) Polyfluorinated vinylidene difluoride (PVDF)

Lithium-ion batteries contain a fluorinated polymer called poly fluorinated vinylidene difluoride (PVDF) which is used as a binder in both electrodes. The breakdown products from heating and burning PVDF are so central to our concerns that we are devoting a whole section to this substance.

H.3 PVDF and Products of Incomplete Combustion

H.3.1 PVDF has a formula (CH₂CF₂)_n where “n” is the number of repeated monomer units numbering in the thousands (a polymer is like a necklace; the monomer is a bead). See the formula of the of PVDF in Figure 12 illustrating the monomer (the bead) that forms the necklace (the polymer).

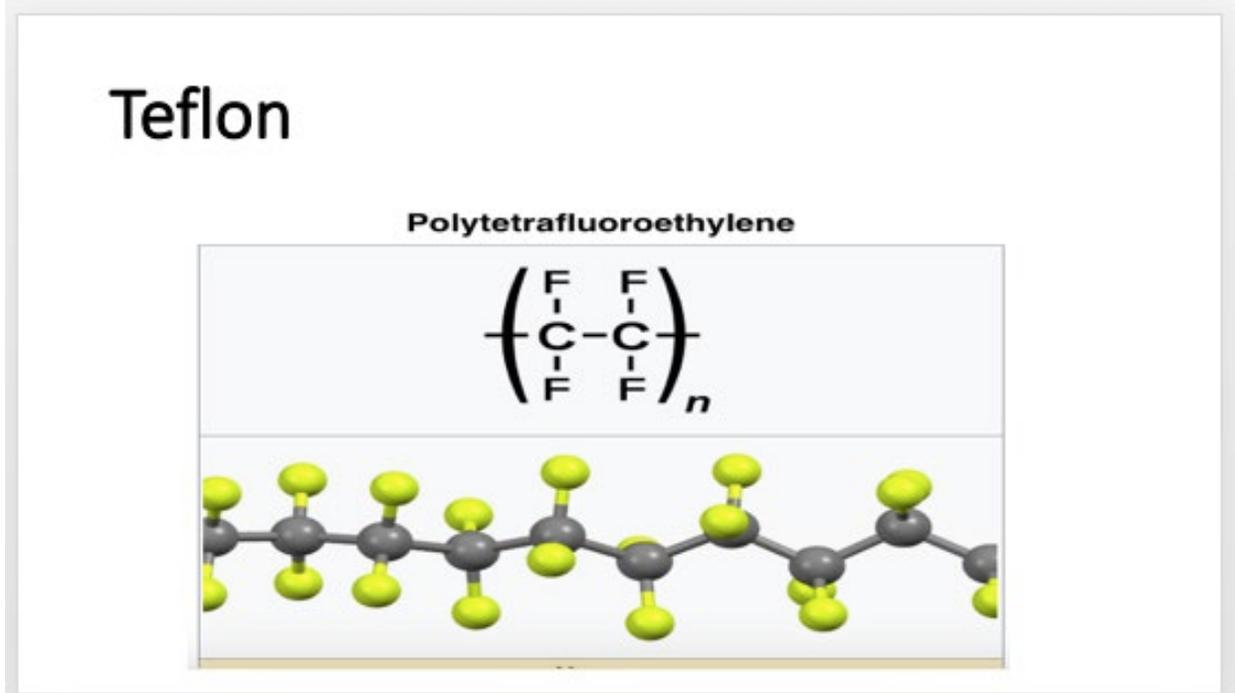


Figure 13. A depiction of the structure of the Teflon (PTFE) polymer (the green balls represent fluorine atoms and the black balls represent carbon atoms).

H.3.6 When these fluorinated polymers (Teflon and PVDF) are heated or burned, they break down to form gases which are highly toxic including HF and potentially hundreds of fluorinated by-products including smaller PFAS molecules and related compounds.

H.3.7 This what the Environmental Working Group (EWG) has said about the thermal degradation of Teflon:

“Studies show that thermal degradation of Teflon leads to the slow breakdown of the fluorinated polymer and the generation of a litany of toxic fumes including TFE (tetrafluoroethylene), HFP (hexafluoropropene), OFCB (octafluorocyclobutane), PFIB (perfluoroisobutane), carbonyl fluoride, CF₄ (carbon tetrafluoride), TFA (trifluoroacetic acid), trifluoroacetic acid fluoride, perfluorobutane, SiF₄ (silicon tetrafluoride), HF (hydrofluoric acid), and particulate matter. At least four of these gases are extremely toxic - PFIB, which is a chemical warfare agent 10 times more toxic than phosgene (COCl₂, a chemical warfare agent used during World Wars I and II), carbonyl fluoride (COF₂ which is the fluorine analog of phosgene), MFA (monofluoroacetic acid) which can kill people at low doses, and HF, a highly corrosive gas.”⁶³

H.3.8 Far less testing of the by-products formed when PVDF is heated and burned has been performed, but because of the close similarity in structures for Teflon and PVDF we can anticipate that some of these same products listed above will be generated in the heating and burning of PVDF.

H.3.9 In the case of PVDF, looking at the starting material from a theoretical point of view, it is easy to see how when burnt the CH₂ part of the monomer (CH₂CF₂) would be converted into formaldehyde (CH₂O) one of the air pollutants the DEC has acknowledged would be formed in the SungEel process.

H.3.10 It is also highly likely that the other half of the monomer CF₂ – if released as a free radical (which are extremely reactive) – would be able to form many PFAS of various carbon atom lengths. A point mentioned by Phelps (2020)⁶⁴ in a recent EPA presentation when she suggests the possibility that “CF₂ radicals” will reform “fluorinated alkyl chains” yielding numerous products of incomplete combustion (PICs).

H.3.11 Many of these fluorinated by-products, like PFAS, are toxic and highly persistent in the environment because of the stability of the Carbon-Fluorine bond. Unlike the PFAS of *original concern*, i.e. PFOA (Perfluorooctanoic acid) and PFOS (Perfluorooctanesulfonic acid), many of these shorter chain PFAS and other fluorinated by-products are likely to be fat soluble, not water soluble, and will accumulate in human body fat and will be passed to the fetus during pregnancy.

H.3.12 Yu et al. (2020)²⁰ (cited above), identified some of the following fluorinated by-products in the pyrolysis of spent lithium-ion batteries. They reported the detection of 1,4-Difluorobenzene, 1,2,4-trifluorobenzene, and 1,3,5-Trifluorobenzene. Yu et al. also cited by-products reported by other researchers (Sections 10.10 - 10.12):

H.3.13 Choi and Kim (2012)⁶⁵ reported the major products of PVDF pyrolysis as vinylidene fluoride (VDF), 1,3,5-TriFluoroBenzene, 1,4-DiFluoroBenzene, 1,2,4-TriFluoroBenzene, and 1,3,3,5,5-Pentafluorocyclohexene. *Note: Vinylidene fluoride contains a reactive C = C double bond and is likely to form many other fluorinated compounds during heating and burning, including PFAS.*

H.3.14 O’Shea et al. (1990)⁶⁶ reported that increasing pyrolysis temperature resulted in a complex degradation process and a pyrolytic residue made up of largely aliphatic and fluoro-aromatic structures. *Note: “aliphatic fluoro-compounds” would almost certainly include PFAS.*

H.3.15 Zulfiqar et al. (1994)⁶⁷ reported that the major degraded products of PVDF were HF, VDF (vinylidene di fluoride – the monomer), and C₄H₃F₃. *Note: the latter substance is a PFAS.*

H.3.13 What is important to note here is that of this list of by-products only HF would be removed by the air pollution control devices proposed for SungEel’s Endicott facility, **because most of fluorinated by-products are likely to be insoluble in water and will not be removed by SungEel’s wet scrubber.**

H.3.14 None of the research discussed above has been investigated by the NYS DEC. They have neither considered the fluorinated by-products that might be formed in the rotary kiln or the products of incomplete combustion (PICs) in the afterburner.

H.3.15 If fluorinated benzenes are formed in the kiln, then PICs formed in the afterburner would likely include *fluorinated* dioxins and furans (PFDDs and PFDf), and *polyfluorinated* biphenyls (PFBs). None of these were investigated in the single dioxin test performed at the SungEel facility in South Korea even though these compounds could pose grave toxic hazards if released into the environment. The single and unrepresentative *chlorinated* dioxin test already indicated the dioxin emissions would be 12% of the state limit – any *fluorinated* dioxins and furans would further narrow the already inadequate safety margin.

Section I: ‘The Chemistry is not well understood’ (NYS DEC)

I.1 In a letter⁴⁰ dated August 10, 2020, Tom Elter, NYS DEC wrote that “We agree that the chemistry is not well understood” but he continues to argue that the limited data provided by testing in South Korea indicates little evidence of a threat to the residents of Endicott.

We agree that the chemistry
is not well understood”
(NYS DEC)

I.2 To the science team at the NoBurnBroome, this indicates several key weaknesses in the NYS DEC’s position on this matter,

- a) very little testing of scientific value has been done in South Korea after twelve years of operation and thus the data on which the DEC is relying is statistically invalid, and does not represent a solid basis for any judgment,
- b) their implicit assumption that if something is not monitored or regulated it poses no risks to human health (e.g. nanoparticles and uncharacterized fluorinated by-products),
- c) their implicit assumption that *small* quantities of persistent and exquisitely toxic materials are tolerable, and
- d) their implicit assumption that the Endicott population can withstand more pollution despite their previous exposure to industrial pollution and the resulting compromised health situation for the local population.⁶⁸ *How much of a cancer-causing chemical could someone withstand who already has cancer? How much pollution could someone safely breathe who has had a double-lung transplant?*

I.3 We stress again (see Sections E,F) that local residents have experienced statistically significant elevations of health outcomes, including leukemia, kidney and testicular cancer, measures of low birth weight, and congenital heart defects (New York State Department of Health, 2004³⁴; ATSDR 2006³⁵; Clapp & Hoffman, 2008³⁶; and Forand et al. 2012³⁷).

I.4 In short, the NYS DEC’s optimistic assumptions (based upon the slimmest of databases) are inadequate to address the dangers and hazards posed by a “first of its kind” operation in the U.S.³² and certainly inadequate to assess the special threat to this health-compromised community.

I.5 If the chemistry of the process is not well understood, then the hazards associated with the process are not well understood and NYS DEC cannot adequately protect human health and the environment from hazards associated with the SungEel process.

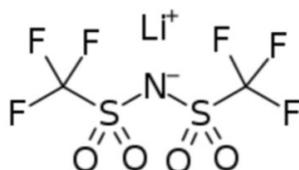
I.6 Again, we believe that a fatal flaw in the DEC’s actions in this matter was not to require a Type 1 SEQRR review,⁶⁹ which would have involved a full Environmental Impact Statement (EIS)⁷⁰. Such an EIS would have quickly established that this project in this location, in this already health-compromised community, was unacceptable by any reasonable standard.

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Section J: The PFAS Discovery Puts Air Permit on Hold

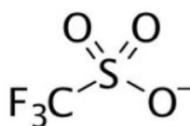
J.1 PFAS are “a group of man-made chemicals that includes PFOA, PFOS, GenX, and many other chemicals.”⁷¹ It was the science team of NoBurnBroome who first discovered that one of the electrolytes used in some lithium-ion batteries was a PFAS (per and polyfluorinated alkyl substance). This substance has the daunting name of Lithium bis(trifluoromethanesulfonyl)imide:

Lithium bis(trifluoromethanesulfonyl)imide



J.2 Recently NoBurnBroome has identified another electrolyte that contains an PFAS in the anion: Lithium Triflate, LiCF₃SO₃:

Lithium triflate
Chemical compound



J.3 The presence of these PFAS were not disclosed in SungEel's air permit application. This information eventually made its way to the NYS Attorney General's Office and thence to the NYS DEC.

J.4. NYS DEC Air Permit put on hold. To their credit, on receiving this information from the Attorney's office the DEC put an immediate halt¹³ on the Air Permit¹⁰ (issued in March 2020) until the matter had been investigated further. Here are excerpts from the May 20 letter to SungEel, from Reginald Parker, Regional Engineer for NYS DEC Area 7, the DEC states:¹³

“... Based on this new information, DEC has concluded that a modification to SMCC's ASF permit is required to process any lithium ion batteries containing PFAS compounds at the facility since this was not part of the original permit application prepared by SMCC. The application for modification of SMCC's ASF permit must include an estimation of PFAS emissions both prior to and after air pollution

control. This should be based on information from battery manufacturers regarding the PFAS content of batteries to be processed at the facility, and documentation supporting the degree of air pollution control for PFAS emissions. Please note that a permit modification will need to go through public review and comment, limited to new information in the application and the modified portions of permit.

“Alternatively, if SMCC intends to only accept batteries that do not contain PFAS compounds, DEC will require that SMCC provide a certification from each manufacturer of batteries that will be processed at this facility confirming there are no PFAS present in said battery models. To be able to operate under the current permit, SMCC must demonstrate how it will track and verify that batteries received at the facility are only those certified by manufacturers as not containing PFAS.”¹³

J.5 SungEel’s response. SungEel has said it would do testing for PFAS in its South Korea plant, however, after nearly two months (as of August 28, 2020) new testing has not been reported.

J.6 Our concerns go far beyond the PFAS parent compounds themselves. In a recent EPA presentation (EPA, April 27, 2020) regarding incineration of PFAS as a means of disposal, Phelps⁶⁴ called into question the ability of incineration units to adequately “destroy” PFAS which *are designed not to burn*. Even if high temperature processing of PFAS can break apart the “parent” PFAS, or fluorinated principal organic hazardous compounds (POHC), it is possible that fluorinated products of incomplete combustion (PICs), either larger or smaller than the POHC (will be formed). Thus C-F fragments could recombine into a wide variety of fluorinated PICs with no standards or analytical methods to measure them. The result could be “destruction” of POHC, but formation of PICs that are unmeasured, unquantified and released to the community.



Products of Incomplete Combustion (PICs)

- When formed in flames, F radicals quickly terminate chain branching reactions to act as an extremely efficient flame retardant, inhibiting flame propagation
- PICs are more likely formed with F radicals than other halogens such as Cl
- PICs may be larger or smaller than the original fluorinated Principal Organic Hazardous Constituents (POHC) of concern
 - CF₂ radicals preferred and relatively stable, suggesting the possibility of reforming fluorinated alkyl chains
 - Remaining C-F fragments may recombine to produce a wide variety of fluorinated PICs with no analytical method or calibration standards
 - May result in adequate PFAS destruction but unmeasured and unquantified PICs
- Very little information is published on PFAS destruction
 - Fluorine chemistry sufficiently different than Cl that we cannot extrapolate
 - Analytical methods and PFAS standards are lacking
 - Measurements focusing on POHC destruction may miss the formation of PICs
- Hazardous Waste Incinerators and cement kilns may well be effective, but what about Municipal Waste Combustors and Sewage Sludge Incinerators (lower temperatures)?

3

Figure 10: The Difficulty of burning PFAS (source: slide 3 from Phelps, 2020 presentation⁶⁴)

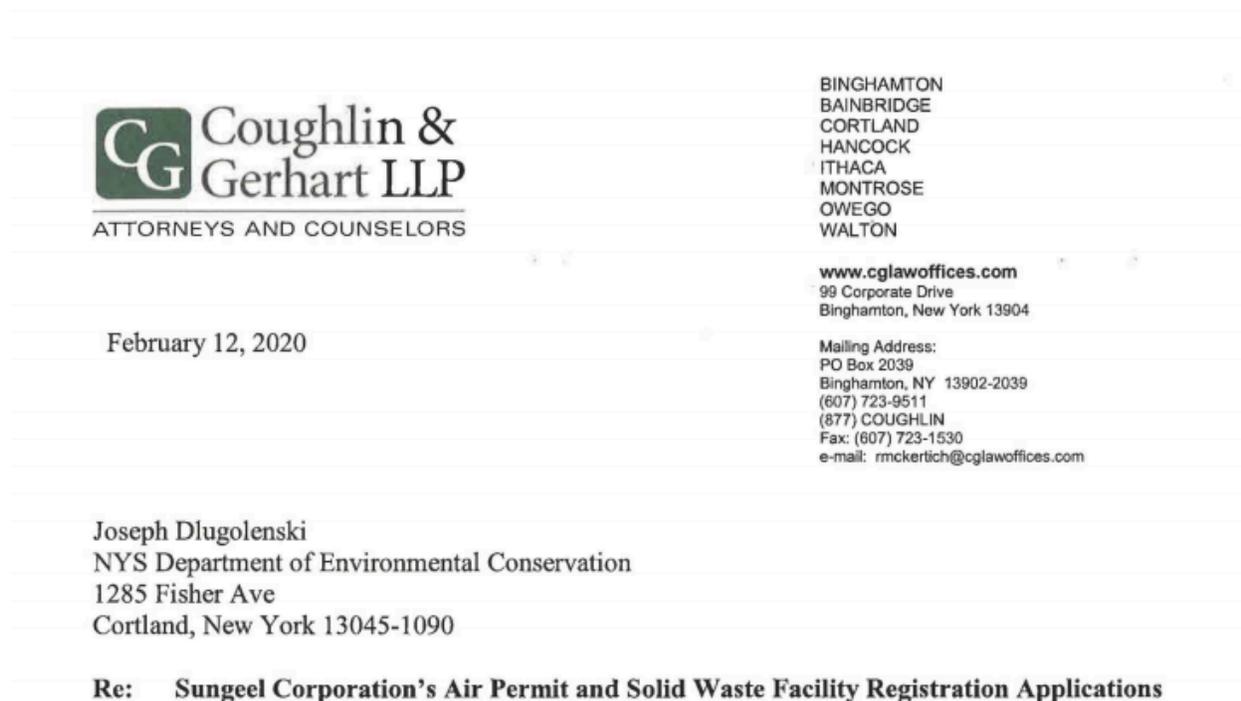
J.7 A simple example of the formation of a new PFAS would be either lithium triflate or Lithium bis(trifluoromethane sulfonyl)imide (electrolytes used in some lithium-ion batteries) breaking down to yield a very reactive CF₃ free radical. These could combine with other Carbon-containing fragments to form various fluorinated alkyl chains. The simplest would be a combination of two CF₃ radicals to form C₂F₆, a 2-carbon poly fluorinated alkyl substance (PFAS).

J.8 Empirical evidence that other PFAS and other toxic substances are formed in the pyrolysis and burning of lithium-ion battery components (including PVDF) is discussed in Section H.3. We believe that if adequate scientific monitoring of the SungEel plant is performed this will be confirmed.

Section K: The Politics

K.1 What Happened Between Feb 12 and March 10, 2020?

K.1.1 On February 12, 2020, Endicott's Village attorney Robert McKertich wrote a letter⁷² to the DEC on behalf of the Mayor and Trustees. The letter shares many concerns about the project and the way DEC was handling the permitting process. See excerpts below.



K.1.2 Here are some excerpts from the Village Attorney's letter.

Dear Mr Dlugolenski,

"the location of the plant is impacted by severe contamination due to the previous use of the site by IBM. The village and its residents have and will continue to suffer the consequences of this contamination for years. ... Village residents are concerned about the apparent lack of information and DEC's failure to conduct a thorough review of the potential environmental, health and safety consequences of this project."

“our initial review of this project demonstrates: 1) a lack of transparency with respect DEC’s review of projected impacts, 2) missing and inconsistent information submitted in the Environmental Assessment Form, 3) defects in the SEQA review process, 4) potentially severe environmental and safety impacts of the project, and 5) a complete lack of consideration for Village Zoning Laws. For those reasons, should stay any approval of the applications and rescind the project.”

“SungEel Corporation failed to identify the need for local Planning and Zoning Board approval of this project.”

“SungEel Corporation failed to identify the need for approval from the Broome County Health Commissioner to operate an incinerator.”

“Defects in the SEQR review process...”

“the DEC’s SEQR record indicates the performance of a coordinated review...given that no one contacted the Village regarding the SEQR review process, it is unclear what public body was involved in the coordinated review other than the DEC.”

“Potential Environmental and safety impacts...”

“Lithium ion batteries contain various hazardous materials, which will enter the air when burned. Once airborne, these materials may pose a threat to the health and safety of Village residents. The recent fire at the Taylor Recycling facility highlights these concerns, particularly given the fact that SungEel Corporation proposes to store over one ton of batteries on site.”

Village Zoning Laws...

“The Village’s Aquifer Protection Law requires that any activity requiring a permit from the DEC also obtain a special permit, given the presence of an aquifer beneath the Village.”

“the lack of any mention of the need for local approval beyond a building permit, or any inquiry into the matter, suggests a lack of concern for local input.”

“CONCLUSION

“In short, the Village is deeply concerned about the lack of transparency and thorough review of the SungEel Corporation’s proposed battery incinerator and recycling plant. The DEC is in a unique position to use its resources and expertise to protect the environment and health of the residents of the Village of Endicott from potentially devastating consequences. It is our expectation that you will not fast track this project and that you will conduct a full and complete evaluation of the potential environmental impacts and work with Village officials as a true partner in protecting the health, safety and welfare of the citizens.”

K.1.3 Since this letter was written, NoBurnBroome was formed and has shared many of the same concerns. For example, note that throughout the letter the SungEel project is referred to as a “battery **incineration** and recycling plant.”

K.1.4 Within a month of this letter the Mayor's position dramatically changed. Why? We believe that political and economic pressures from Albany have been used to thwart the local democratic process and fast track the NYS DEC permitting process. Within a month of this letter the mayor switched her position and became the number one promoter of this project. What happened? Listen to the taped private meeting of March 10, to get some clues:

Tape: Side A Link:

https://drive.google.com/file/d/1MVm1yfT2hLy0_STMoERBv9O06jPPKndW/view?usp=sharing

Tape Side B Link:

<https://drive.google.com/file/d/1zGkFoM1cw7fF-PHNc8ePmtVoB0jILPia/view?usp=sharing>

K.1.5 Those present at the meeting included (see attendance list in Figure 15).

3-10-20 MEETING w/ SUNGEEL

- X DAVID SCHOFIELDS / TOWN OF HURON / DSCHOFFEL@TOWNOFHURON.COM
 - THOMAS WELLS / BARCLAY DAMON - SMCC
 - Cheryl Chapman / Village Endicott
 - Nathan Van Why / Coughlin & Gerhart - Vil. of Endicott
 - Linda Jordan / NAJON / VUE / LINDA.JORDAN@NAJON.COM
 - ANTHONY BATES / Village of Endicott / abates@endicottny.com
 - Tsering Wang / SMCC / tsering@smccrecycling.com
 - Danish Mir / SMCC / Danish Mir
 - X Chris Peltto / HURON / chris.peltto@huroncompas.com
 - Brenda Grober / NYS ESD / brenda.grober@esd.ny.gov
 - Paul Yum / SUNGEEL / LDU / paulyum@sungeel.com
 - Philip Grayson / V. Endicott / pgrayson@endicottny.com
 - Frank Roma, PE / Advisor / froma@aol.com
 - RICK MARRESE / TOWN SUPERVISOR / RICK.MARRESE@TOWNOFHURON.COM
 - David Kim / SMCC / david.k@metalliac.com
- (Grober (SIS) away)

Figure 15: the attendance list for the SungEel meeting March 10, 2020

K.1.6 From this sign-in sheet and other information we believe this is the complete list of attendees at this private meeting.

Mayor Linda Jackson, Endicott

Cheryl Chapman, Deputy Mayor, Endicott

Nathan VanWhy, Coughlin & Gerhart, Village of Endicott

Anthony Bates, Village of Endicott Manager
 Robert McKertich, Village of Endicott Attorney
 Dan Schofield, Town of Union (Sewer)
 Coughlin and Gerhart, Village of Endicott law firm
 Chris Pelto, HURON CAMPUS
 Phil Grayson, Endicott Waste Management
 Rich Matarese, Town of Union Supervisor
 Nathan Van Why, Lawyer with McKertich law firm
 Brenda Groben, NYS Empire State Development
 Frank Roma, Advisor
 Danish Mir, SungEel
 David Kim, SungEel
 Tsering Wong, SungEel
 Thomas [last name unclear] SungEel
 Tom Fucillo, Barclay Damon Law Firm
 Former Regional Attorney, NYSDEC Region 7
 Paul Yum, SungEel (KR)
 Dave Meixell, Plumley Engineering

K.1.7 The Village of Endicott would have been better served if this had been an open meeting and not a private meeting so that **all** the Village Trustees could have been there. Moreover, it would have been better if experts opposed to the project had also been present.

K.1.8 NoBurnBroome remains willing to participate in any public hearing which features experts from both SungEel and ourselves so that decision-makers can get a balanced view of the pros and cons of this project.

NoBurnBroome remains willing to participate in any public hearing which features experts from both SungEel and ourselves so that decision-makers can get a balanced view of the pros and cons of this project.

K.1.9 Listening to the tapes now it is clear that by March 10 the Mayor and Deputy Mayor are growing in enthusiasm for this project. This enthusiasm was fueled by SungEel personnel who acted more like salesmen for the project than objective assessors of the hazards involved. This was clearly evident when they were discussing the wet scrubber. They gave the impression that it is used to collect dust rather than its real function which is to neutralize the Hydrogen fluoride formed in the kiln and afterburner. Had they acknowledged this it could have opened up an important discussion about what other fluorinated by-products are formed and what happens to these. The Mayor was clearly pre-occupied with the “chemicals” that they use in the plant and – unfortunately -not with the chemicals emitted into the air. The latter are many orders of magnitude more toxic than the chemicals used in the plant (e.g. sodium hydroxide).

K.1.10 Even on the fire hazards they ignore the flimsiness of the storage facility and focus on the thick concrete walls of the recycling/incineration facility itself.

K.1.11 But the key question remains: What happened between the McKertich letter of February 12, 2020, and this meeting in March 10, which reversed the Mayor’s opposition to this facility? What pressures were applied and from whom?

K.2 The Mayor and the Zoning Code issue.

K.2.1 By April, the mayor was so positive about this project that she tried to change the zoning code for industrial zones in Endicott (over 500 acres). She proposed a zoning change to allow recycling and defined “recycling” in a way which would allow SungEel to operate in Endicott. Her definition of a “**recycling facility**” for the code change includes the vague term “**processing**” which would allow SungEel’s very high temperature processes we are so concerned about:

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

K.2.2 The Mayor claims that this definition was offered to protect the village⁷³. NoBurnBroome believes that this definition provides *no* protection to village residents and it was introduced to allow SungEel to operate in Endicott. It would also allow *any* recycling facility to use *any* process in over 500 acres of industrial zoned area in Endicott, without the need for a special use permit.

K.2.3 In a letter³⁸ sent to the Mayor and Trustees on May 3, Claudia Braymer, NoBurnBroome’s attorney, wrote the following:

“... If you want to protect the Village from waste recycling facilities and garbage incinerators that allegedly can be sited in the Village under the current zoning code, then impose a moratorium on this type of use until stringent restrictions can be put into place that effectively protect the Village...”³⁸

K.2.4. May 4 Public Hearing and May 7 vote. On May 4, a Public Hearing went on for 4 ½ hours and 58 citizens spoke up against the SungEel project and only one spoke for it, albeit with reservations!^{74,75} Owing to the length of the meeting and possibly sensing she was losing her majority, the Mayor postponed the vote to May 7. On May 7, the Village Trustees voted 3 to 2 to approve the zoning change^{76,77} despite very strong opposition from citizens and the important information in Claudia Braymer’s letter of May³⁸. See also Braymer’s letter of May 13.⁷⁸

K.2.5 A Super effort to get “Supermajority” vote. Volunteers from NoBurnBroome – fearing the Mayor’s built-in majority of 3 to 2 – spent a few frantic days prior to May 7 getting *property owners* with land adjacent to Endicott’s Industrial Zone to sign a **petition** opposing the Mayor’s “recycling resolution.” If signatures could be obtained from land owners *owning 20% of land area* within a 100 -foot border of the industrial zone (largely the Huron campus - the rules are a little complicated) then the Mayor would need a supermajority vote of 4 to 1 to pass the resolution.⁷⁷ With two Trustees (Ted Warner and Patrick Dorner) adamantly opposed to the SungEel project this would have meant the resolution would have failed. Because only a few days were available to collect the signatures for the May 7 vote, NoBurnBroome didn’t get signatures. Even though it appears that not enough signatures were collected, the actual count (i.e. estimated land area owned by signers) has not yet been revealed. A firm was hired to estimate this land area for the signatures collected and we are still waiting (as of August 28) for this area to be confirmed. Meanwhile, this effort did two things: a) it put the zoning change vote on hold and b) it showed that given more time this strategy can be used successfully to stop any other action pertaining to the industrial zone that property owners and well-organized citizens oppose.

K.2.6. NYS DEC Air Permit put on hold. On May 20, 2020¹³, after the NYS DEC was informed that some of the batteries contain PFAS (Per- and polyfluoroalkyl substances) they put the Air State Facility Permit on hold (See Section J for details).

SECTION L: NoBurnBroome

L.1 Since its formation on April 15, 2020⁹, NoBurnBroome has shown that the majority of citizens in Endicott are opposed to the SungEel project. These include over 4,000 people who have signed our online petition; 57 out of 58 people who spoke at the public Zoom hearing on May 7, with 290 people signing in at the peak and 180 participants staying to the end of this 4 ½ hour hearing⁷⁷; the many who have written letters to the local newspaper; the many others that have contacted their local, county and state representatives; the many supporters who have donated to our legal fund; many others who have displayed signs on their lawns and the hundreds who have attended our rallies and marches. This community opposition contrasts sharply with the lack of **any** visible community support presented by proponents of the project.

L.2 Our web page NoBurnBroome.com has described many of the events that have occurred since our formation (and before).

L.3 From the outset, NoBurnBroome described its mission as

“Citizens united for technologies that respect our health and our environment”

Broome County residents want elected officials to represent their best interests in the pursuit of expanding opportunities for everyone. But they do not want to sacrifice either their health or the environment in the process.

The group recognizes society’s need to find ways to recycle lithium batteries, especially those used for electric cars, but a review of the [scientific literature](#) indicates that there are other ways of doing this which do not involve incineration (see Section D).

L.4 This battle is as much about securing Endicott’s democracy as it is about securing our citizens’ health.

L.5 From its outset NoBurnBroome has made its actions and discussions visible and open to all.

L.6 Our arguments are based on an objective assessment of the facts as we know them and backed up with rigorous documentation from the scientific literature.

L.7 At the core of this effort, has been the support and integrity of residents who have shown a remarkable loyalty to this village and its future, despite the past pollution they have had to endure.

L.8 If there is one word that sums up our efforts it is “respect.” NoBurnBroome respects the heritage of this remarkable village and we do not want that heritage thrown away. We have tried to respect our opponents as much as we can. We have tried to disagree without being disagreeable and finally we respect the truth. We firmly believe that this battle will be won with the truth.

Section M: What Do We Want?

M.1 We want the Village Trustees to

- a) Respect the concerns of their constituents and represent their best interests;
- b) Choose technologies that respect our health and our environment;
- c) Follow through on their promise to withdraw the proposed zoning amendment that defines recycling in a way that would allow SungEel to operate in Endicott;
- d) Prohibit unspecified recycling facilities, including facilities processing waste that includes hazardous chemicals;
- e) Prohibit the use of high temperature processes and the burning of gaseous byproducts in such facilities which can produce hazardous air pollutants;
- f) Take the necessary steps to have the NYS DEC rescind the Air Permit granted for the proposed facility and initiate a Type 1 SEQR Review⁶⁹ and require full Environmental Impact Statement for the project⁷⁰;
- g) To ensure that all future projects follow the “Comprehensive Plan” developed by the Town of Union by insisting on the provision of “buffers between residential and industrial districts”^{12a} and favoring light over heavy industrial activity.^{12b}

M.2 We would like Governor Cuomo to understand that it is a mistake to allow – let alone subsidize – SungEel’s efforts to export from the shores of the U.S., the recovered metal compounds from lithium-ion batteries, which are both valuable and have strategic importance.

We would like Governor Cuomo to understand that it is it is a mistake to allow – let alone subsidize – SungEel’s efforts to export from the shores of the U.S. the recovered metal compounds from lithium-ion batteries, which are both valuable and have strategic importance.

M.3 Broome County residents want elected officials to represent their best interests in the pursuit of expanding opportunities for everyone. But they do not want to sacrifice either their health or the environment in the process. Accordingly, we reject the assertion by any who would brand Endicott as “business unfriendly.”

M.4 A matter of Honor. We want SungEel to withdraw this project. We ask that they don’t dishonor Endicott by exposing an already health-impacted community with more pollution.



July 25, 2020, photo of citizens who marched around the proposed Sungeel facility calling on the owners not to dishonor our village.

M.5 Finally, we seek your help and the help of all our governmental representatives to get these messages to all of these parties above.

M.6 We want to acknowledge and thank NY State Senator Fred Akshar II and the three Broome County Legislators, Daniel Reynolds (5th District), Matthew Pasquale (7th District) and Greg Baldwin (6th District), who wrote to the Commissioner of the NY DEC, on August 27, 2020, requesting a full Environmental Impact Statement. They stated:

... In order to fully understand the potential impacts, we'd request that the DEC prepare a full environmental impact statement under State Environmental Quality Review Act requirements and that the community be fully engaged in the process to ensure that residents have the opportunity to express concerns and have questions answered...⁸⁰

M.7 To all those who read this position paper, please contact these representatives: Donna Lupardo (NYS Assembly), Fred Akshar (NYS Senate), Jason Garner (Broome County Executive), Anthony Brindisi (US House of Representatives) and Senator Schumer and Senator Gillibrand (US Senate). **Here are their contact details:**

Assemblywoman Donna Lupardo (NYS Assembly), LupardoD@nyassembly.gov
 Senator Fred Akshar (NYS Senate), akshar@nysenate.gov

Jason Garner (Broome County Executive), jasongarner.com
 Anthony Brindisi (US House of Representatives), ny22abima@mail.house.gov
 Senator Schumer (US Senate), senator@schumer.senate.gov
 Senator Gillibrand (US Senate), senator@gillibrand.senate.gov

Section N: Breaking News on the Empire State Development – The prime mover of this project

N.1 On August 21, 2020, an audit report on the Empire State Department (ESD) was released by the NY State Comptroller Thomas DiNapoli⁸¹.

According to an editorial in the Albany Times Union, of August 25, 2020,

“...a stinging audit from state Comptroller Thomas DiNapoli found that investments made by Empire State Development, the state’s economic development arm, were often reckless, lacked proper oversight and did not deliver the jobs they promised...”⁸²

According to the Buffalo News, August 21, 2020,⁸³

... DiNapoli’s auditors said that Empire State Development was responsible for oversight of the Buffalo Billion program since it was announced by Gov. Andrew M. Cuomo in 2012. The project was the focus of a federal bid-rigging investigation that led to the convictions of Ciminelli and others, including the former head of a SUNY college in Albany who Cuomo tapped to oversee several high-tech developments in upstate...”

N.2 This concerns NoBurnBroome because the ESD has offered SungEel \$1.75 million to recycle lithium-ion batteries using **the most polluting process**. We are concerned that no one at ESD compared the environmental impacts to other lithium-ion battery recycling alternative processes. Comptroller DiNapoli’s audit makes us question even more why the ESD selected SungEel.

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|-------------------------------|--|---------------------------------------|---|
| January | 16 | 2.5 | 11 |
| February | 13 | 2.3 | 10 |
| March | 15 | 3.0 | 1 |
| April | 13 | 3.4 | 3 |
| May | 14 | 3.6 | 1 |
| June | 13 | 4.3 | 3 |
| July | 12 | 3.7 | 3 |
| August | 11 | 3.5 | 5 |
| September | 11 | 3.6 | 10 |
| October | 13 | 3.3 | 7 |
| November | 15 | 3.3 | 3 |
| December | 16 | 2.8 | 10 |
| ANNUAL | 159 | 39.3 | 9 |

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