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Supervisor Tidball and the Town Board
Jeffery Schmitt and the Planning Board
Town of Duanesburg
5853 Western Turnpike
Duanesburg, NY 12056

Transmitted via email: town clerk jhowe@duanesburg.net, rtidball@duanesburg.net,
bwenzel@duanesburg.net, mdeffer@duanesburg.net and jschmitt@duanesburg.net

October 19, 2021

RE: Precautionary Principle for PFAS at Oak Hill Solar 1, LLC and Oak Hill Solar 2, LLC

Dear Chairman Jeffery Schmitt and the Planning Board,

Saving Greene's October 12, 2021 letter to the Town of Duanesburg Planning Board should have drawn the Town Board and the Planning Board's attention to the very real possibility that PFAS were used in the manufacturing of products that may be used in solar panels and associated equipment at Oak Hill Solar 1, LLC and Oak Hill Solar 2, LLC. The October 15, 2021 letter from PrimeAE to the Town Planner, Dale Warner does not mention PFAS or include any precautionary principle measures, such as soil and ground water testing before and after construction, and annually for the lifetime of the proposed solar and battery storage project.

The purpose of this letter is to once again inform the town and planning boards that the majority of solar panels being installed today are made in Asia, where there may be lack of oversight, lack of environmental restrictions and lack of reporting material and safety data. The Applicant has not provided Material and Data Safety Sheets for the products proposed for Oak Hill solar and battery storage projects. PFAS are known to be used in the manufacture of some solar panels. The Project site soils are all either poorly drained or wetlands and steeply sloped towards residents' only source of drinking water: individual wells drilled adjacent to their homes. The site also drains into a tributary of the Schoharie Creek which feeds into the Hudson River. The site sits all or partially over a principle aquifer.

The Town's lack of due diligence to protect our soil, surface and ground waters, and major aquifer is contrary to our town's Comprehensive Plan. The Town's lack of action flies in the face

of common sense. The Board's lack of oversight concerning possible PFAS contamination of the soil, ground water and aquifer may expose the town to EPA, NYS, and resident litigation, and possibly long term financial devastation. I request that the Town Board and Planning Board perform due diligence and apply the precautionary principle concerning PFAS in the products proposed by the Applicant and that the town require the Applicant to provide escrow so that the town can hire a third-party independent environmental engineering firm to perform pre- and post-construction soil and water testing as well as annual testing for the lifetime of the project.

Town of Duanesburg's Comprehensive Plan

On December 2, 2020, the Town of Duanesburg ("the Town") issued its Comprehensive Plan¹ for the future of Duanesburg. Members of the Town Board and the Town Planning Board set out to update the prior fifteen-year-old plan, which was recognized as outdated. The Town's own Vision Statement in the Comprehensive Plan states: "*We encourage the preservation of our attractive and cultural landscape....We are committed to **sustaining our** valuable economic and **natural resources**, particularly agricultural land use, open spaces, natural habitats, and fresh watersheds. **We support thoughtful growth and development**...."* [emphasis added].

The plans for the Town of Duanesburg to have certain companies install utility scale solar power plants that may also include battery energy storage systems, at least part of which sit atop aquifers, without confirmation, certification, or even assurance of any kind that the products used on the solar plants are PFAS-free contradict the Vision Statement of the Town's Comprehensive Plan. For the reasons explained in this report, the Town's desire to proceed without documentation or warranties of any kind leaves the Town open to future state and federal legal liabilities that will have substantial financial consequences for Duanesburg residents and the Town as a whole.

Concerns About Anti-Reflective Coating on Solar Panels

The purpose of anti-reflective coatings is to increase productivity which in turn increases the investor revenue. The EPA regulates products imported into the United States that contain PFAS under the Toxic Substances Control Act (TSCA).² The EPA specifically dictates that goods containing certain PFAS "**...as a surface coating** can not be imported into the United States without EPA review." [emphasis added] The EPA goes on to state in its TSCA Significant New Use

¹ https://www.duanesburg.net/sites/g/files/vyhlif4351/f/pages/duanesburg_2021_comprehensive_plan_final.pdf

² <https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-and-polyfluoroalkyl-substances-pfas>

Rule (SNUR)³ related to PFAS and extraordinarily relevant requirement that directly relates to solar panels:

*“EPA considers any [long-chain PFAS]...from table 1 and table 2 [of the SNUR] **containing coating on any surface of any article**, whether the coating is applied to the interior facing surface or the exterior facing surface of an article... to be covered by the SNUR.” [emphasis added]*

If the manufacturer of the solar panels that will be used in the Town of Duanesburg have imported materials of any kind (or the panels in their entirety) that contain certain PFAS, they are likely required to disclose the information to the EPA and receive approval from the EPA for the PFAS use in the product. If the manufacturer is required to provide this information to the EPA, then there is absolutely no reason why the Town should not insist that it also receives the same information so that it can make a fully informed decision. The Town must insist on this as part of its due diligence process in deciding whether to approve this project. Failing to do so, or at least failing to require the manufacturer to certify to the lack of PFAS in the solar panels, turns a blind eye to potential PFAS information about these products that may exist in EPA records due to the manufacturer’s disclosure.

The Federal PFAS Landscape & Implications To the Town

President Joe Biden and Vice Present Kamala Harris campaigned on the promise of aggressively addressing environmental concerns and pushing through environmental initiatives for the country. The environment was, in fact, one of the top three campaign promises that the Biden-Harris administration made. Bound within the environmental promises made—to a level never seen by a prior administration—were promises to address PFAS issues:

Instead of making empty promises with no follow-through, Biden will tackle PFAS pollution by designating PFAS as a hazardous substance, setting enforceable limits for PFAS in the Safe Drinking Water Act, prioritizing substitutes through procurement and accelerating toxicity studies and research on PFAS.⁴

Every action taken thus far by the Biden Administration and EPA Administrator Michael Regan shows a demonstrated commitment to follow through with the campaign promises with respect to PFAS.

³ <https://www.regulations.gov/document/EPA-HQ-OPPT-2013-0225-0232>

⁴ Biden-Harris election campaign website, Environmental Justice section, <https://joebiden.com/environmental-justice-plan/>

Drinking Water Standards

The EPA is in the final stages of the regulatory process for setting drinking water limits for PFAS under the Safe Drinking Water Act. Just one month into office, Biden's EPA announced final Regulatory Determinations for PFOA and PFOS, which is the final step before the EPA announces an enforceable standard.⁵ Just five months later, the EPA issued an announcement that it was broadening its investigation of a drinking water standard **for all PFAS as an entire class**.⁶

When the EPA sets enforceable PFAS drinking water standards, enforcement actions by the New York Department of Conservation will increase as the state looks to locate sources of PFAS contamination to drinking water sources. In states like New York, which have already set out to identify and remediate PFAS-contaminated sites that are polluting drinking water, the costs are staggering:

- New Hampshire: \$30 million in overall PFAS remediation projects as of 2017, with \$14 million alone spent on one pollution site (the Coakley Landfill)
- Michigan: \$23.2 million at sites across the state
- New York: \$10 million budgeted for one Superfund site in Hoosick Falls, NY to develop alternate drinking water sources for the town due to PFAS
- New York: \$23.5 million settlement from Taconic Plastics Ltd to the Town of Petersburg for PFOA in the town's drinking water.
- Massachusetts: \$2.95 million spent by Town of Barnstable for PFAS remediation of drinking water; \$13 million budgeted by City of Westfield for PFAS remediation⁷

The above are just costs associated with remediation. Towns and municipalities are increasingly finding themselves embroiled in lawsuits in which towns find themselves with no recourse but to file a lawsuit against another town that they sourced drinking water from in order to pay for PFAS-contaminated water.⁸ Finally, in situations where a town or region's drinking water is contaminated by PFAS, private citizens are bringing more and more lawsuits seeking

⁵ February 22, 2021 EPA announcement regarding PFOA and PFOA final Regulatory Determination: <https://www.epa.gov/newsreleases/epa-takes-action-address-pfas-drinking-water>

⁶ July 12, 2021 EPA announcement regarding CCL 5 and PFAS regulation as a class <https://www.epa.gov/newsreleases/epa-takes-action-address-pfas-drinking-water>

⁷ Safer States 2019 publication: https://saferchemicals.org/wp-content/uploads/2019/02/safer_states_costs_of_pfas_contamination.pdf (state specific citations supporting data found within Safer States document)

⁸ <https://www.natlawreview.com/article/georgia-pfas-lawsuits-will-impact-product-manufacturers>

compensation for damages stemming from alleged polluted land, diminished property values, and health effects due to consumption of PFAS-contaminated water.⁹

The Town of Duanesburg should be extremely concerned about the potential financial ramifications that can stem from PFAS runoff from the solar panels and components installed as part of the project, PFAS contamination that could result from cracked or damaged panels on the site once installed, buried cables, battery energy storage, and PFAS pollution to the land in the event of a fire¹⁰ or other event on such a potentially hazardous site. All of these events leave PFAS chemicals with but one place to go: into the soil.

What geological or hydrogeological studies have been done by the Town or the solar panel manufacturers to ensure that in such an event, PFAS runoff will not contaminate the only source of drinking water for the neighbor Mrs Biggs, whose well is less than 600 feet from the Project? The site contains 100% poorly drained soils that drains down a steep slope to Schoonmaker Road where there are eight homes with wells. Adjacent to Schoonmaker Road is a tributary that drains into the Schoharie Creek, which feeds into the Hudson River. PFAS contaminate plumes can travel great distances through soils and ground waters. The Delanson Reservoir is only three miles from the Oak Hill Solar facilities.

Have the Town or the manufacturers conducted environmental assessment studies that consider the potential for PFAS contamination of other water sources that may ultimately feed drinking water sources of other towns? Further, we understand, and the Full Environmental Assessment Form confirms, that the solar panel sites are located either entirely or in part on top of aquifers that supply drinking water. This siting only exacerbates the concern for future water or drinking water source pollution. The New York Department of Environmental Conservation's own website states clearly the foremost concern with PFAS contamination from the solar projects:

...the most productive aquifers consist of unconsolidated deposits of sand and gravel that occupy major river and stream valleys or lake plains and terraces. These aquifers typically form flat areas that are suitable for development and generally provide an ample ground-water supply. **Because of development, coupled with the high permeability of these deposits and shallow depth to the water table, makes these aquifers particularly susceptible to contamination from point sources....**¹¹ [emphasis added]

⁹ <https://www.natlawreview.com/article/pfas-paper-mill-lawsuit-adds-additional-companies>

¹⁰ One organization found that approximately 350 solar systems had incidents of fire through February 2019. <https://pv-magazine-usa.com/2019/08/22/there-are-solar-power-fires-per-year/>

¹¹ <https://www.dec.ny.gov/lands/36118.html>

The State of New York recognizes publicly that aquifers are particularly susceptible to contamination. The Town must recognize and share the state's concern and ensure, through all the measures laid out in this report, that Duanesburg's water sources are not exposed to pollution risks from PFAS.

It is too easy to brush these concerns aside by believing that in the event of a water pollution event with respect to PFAS that the EPA or the New York Department of Environmental Conservation ("DEC") would look to the solar panel manufacturers as the responsible parties for the cleanup costs. First, that view is overly simplistic, as there is no exemption that the Town of Duanesburg would enjoy that would protect it from EPA or DEC action for cleanup costs. Second, if the solar panel manufacturers were held accountable, it is likely that they would in turn try to obtain contributory damages from other parties that it believes may be at fault, which would include the Town. Third, the majority of manufacturers are located in Asia, which may be beyond any jurisdiction in the United States and there is a reasonable chance that they could pay anything towards remediation costs.

CERCLA Law Concerns

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Superfund law, allows the EPA to force "responsible parties" to clean up land or sites that are polluted with chemicals that are designated as "hazardous substances" under CERCLA.¹² What should be particularly concerning to the Town in this instance is that under CERCLA, there is no requirement that a specific amount of a hazardous substance be present on the site before the EPA can hold a party liable for the cleanup costs; the release of *any* quantity of a hazardous substance can establish liability.¹³ The EPA's liability attribution would not merely extend to the company owning or operating the solar panels in the current instance; rather, the EPA makes clear that even landowners can be held liable under CERCLA.

In 2020 alone, the EPA reported that it disbursed or obligated over \$258 million for Superfund site cleanups, and the funds were all obtained from parties that the EPA believed were responsible.¹⁴ The EPA also reported that over the life of CERCLA, over \$4.7 billion had been collected from responsible parties for cleanup of hazardous substances. Several years ago, the EPA paid for a report that, in part, studied how much per designated site was spent to clean up the site. The results should be alarming to the Town. The EPA estimated that responsible parties spent an average of \$32 million per site in cleanup costs through 1991.¹⁵ A University of

¹² <https://www.epa.gov/superfund/superfund-cercla-overview>

¹³ <https://www.epa.gov/enforcement/superfund-liability>

¹⁴ <https://www.epa.gov/superfund/superfund-remedial-annual-accomplishments#2020funding>

¹⁵ https://www.epa.gov/sites/default/files/2018-03/documents/ee-0265_1-4_acc.pdf

Tennessee study, the results of which are cited in the EPA report, found that CERCLA / Superfund sites costed an average of between \$35 million and \$101 million in remediation costs, depending on cleanup levels needed.¹⁶ Also remediation is not always possible; many sites remain contaminated but are simply monitored.

Currently, PFAS are not designated by the EPA as “hazardous substances.” However, the Biden administration’s campaign website clearly states “Biden will tackle PFAS pollution by designating PFAS as a hazardous substance....”¹⁷ CERCLA allows the EPA to investigate sites and hold parties responsible for actions that polluted the land in question, *even for actions prior to the designation of a chemical as a “hazardous substance.”* Without requiring the solar panel manufacturers or suppliers to certify what, if any, PFAS are in the solar panels or the components, the Town may be opening itself up to significant financial liability once a CERCLA designation is made by the EPA. Similar to liability issues under the Safe Drinking Water Act, the EPA has the power under CERCLA to hold any party responsible for all or part of cleanup costs, including entities whose negligence (in this instance, in the lack of due diligence) contributed to the pollution events. Even if the EPA were to only pursue the solar panel manufacturers for CERCLA cleanup costs, the manufacturers would almost surely file a lawsuit against the town and any other party that it believes shared in the negligence that led to the pollution in an effort to defray cleanup costs.

Unlike the federal government, New York was the first state to designate PFOA as a hazardous substance under its state version of the CERCLA law.¹⁸ In April 2016, New York added PFOS to the hazardous substance list. Similar to the federal CERCLA regulations, New York’s designation allows the state to investigate potential sources of PFOA and PFOS contamination and hold polluting parties and landowners responsible for cleanup costs.¹⁹ By February 2019, New York had added 19 additional PFAS to its list of “contaminants of concern” and required existing or new state-designated “Superfund” sites to test for all 21 PFAS that the state found to be of concern.²⁰ The Town has received no documented assurances that any of the solar panels, batteries, or other components do not contain PFOA, PFOS, or any other type of PFAS, including the 19 PFAS that New York considers chemicals of concern. While manufacturing of PFOA and PFOS has largely ceased in the United States, those chemicals continue to be used in other countries in a variety of products, which is especially relevant since many solar panel components are manufactured in China. Further, as the evidence in this report shows, solar

¹⁶ Colglazier, Cox. and Davis, 1991, pp. 6'-05, cited within the report in footnote 13.

¹⁷ Biden-Harris election campaign website, Environmental Justice section, <https://joebiden.com/environmental-justice-plan/>

¹⁸ <https://www.dec.ny.gov/chemical/108831.html>

¹⁹ <https://www.dec.ny.gov/regulations/104968.html>

²⁰ https://alphalab.com/images/NYDEC_emergcontsamplimgext.pdf

panels contain types of PFAS well beyond simply PFOA and PFOS. The Town is potentially exposing itself to devastating financial consequences from its current-day decision to allow a project to proceed without having received proper environmental assurances.

October 2021 PFAS Actions by New York

On October 5, 2021, the New York State Department of Environmental Conservation released water quality guidance values for PFOA and PFOS. The state's recommendations are undergoing public comment until November 5, 2021.²¹ The significance of the guidance values is that the state is now pursuing regulating two types of PFAS in more than just drinking water: in this instance, both ground and surface water. The proposal shows several things, including New York's continued aggressive pursuit of remediation of all current or future sources of the state's water, whether drinking water or not. Once passed, New York will have some of the only ground and surface water regulations for PFAS in the country, and by far the most aggressive. The proposed permissible limits of PFOA and PFOS in ground and surface water are 6.7 parts per trillion for PFOA and 2.6 parts per trillion for PFOS.

These regulations should concern the Town given the potential for water pollution from PFAS stemming from the solar panels as detailed in this report, especially with regard to anti-reflective coatings that are routinely applied to panels. The Town has, in fact, already stated in its Comprehensive Plan that included in its vision for the Town is a commitment to sustaining fresh watersheds.²² The Town claims that it values protecting its water as one of the core values and visions of the Town as it moves into the future. There is no possible way that the Town can be said to uphold its vision if it pushes through a solar panel project that may result in harm to the very water resources that the Town committed itself to protect.

The EPA Requires PFAS Disclosures – Why Not Duanesburg?

Saving Greene specifically recommended that the Town to require the solar panel manufacturer and installer to certify that their panels either do not contain PFAS or, if they do, which known PFAS are contained in the panels. The Town of Avon, New York recently passed a Solar Law that prohibits solar panels and equipment that contains PFAS and GenX. The EPA already insists that certain businesses disclose PFAS information used in its manufacturing processes, and so the Town should insist on the same disclosure of information.

²¹ <https://www.dec.ny.gov/press/123915.html>

²² https://www.duanesburg.net/sites/g/files/vyhlf4351/f/pages/duanesburg_2021_comprehensive_plan_final.pdf

Under the EPA's Toxic Release Inventory (TRI), the EPA tracks certain toxic materials that may pose a threat to human health and the environment.²³ To do so, the EPA requires certain industries to report how much of certain chemicals are released into the environment. On June 22, 2020, the EPA added 172 PFAS chemicals to the TRI list, and in 2021, three additional PFAS were added to the list.²⁴ The EPA therefore recognizes the potential risk to human health and the environment of 175 types of PFAS, and requires industries discharging them to inform the EPA of that information.

Applicants documents

The Applicant dropbox contains a folder "Module Information," which was uploaded September 13, 2021. The folder contains information for two different manufacturers of solar panels: Vikram Somera 380 -420 Watt VSMDHT.72.AAA.05 panels and Stave 310-330 Watt CHSM6612P panels. It unclear which panel the Applicant may use or if they many change solar panel specifications after the building permit is issued without the Town's approval. A Material and Data Safety Sheet detailing products used in manufacturing is not provided for either panel. The Town's lack of due diligence and potential lack of oversight during the construction process may expose the town and residents to PFAS and other contaminates used in the solar projects' components.

Additionally, the folder contains a six page document from Dongguan CSG Solar Glass Co, Ltd., which provides some information about the anti-reflective coating and that the warranty is for six (6) months. A second 25 page document from Dongguan CSG Solar Glass CO, Ltd. provides some information about ARC Solar Glass but omits any information about the anti-reflective coating chemical composition and manufacturing process. Curiously these documents, and the Applicant's emphasis, is how anti-reflective coating reducing glare, but it is well documented that the purpose of anti-reflective coatings is to trap certain wavelengths inside the solar panel to increase the generation of electricity. Reports show that the use of antireflective coatings may increase solar panel productivity by as much as 3 percent.

Additional Research

In addition to Saving Greene's October 12, 2021 letter, I have attached to this correspondence some additional information for your consideration. The two patents and DuPont information sheet clearly state that PFAS is used in the manufacture of solar panels.

²³ <https://www.epa.gov/toxics-release-inventory-tri-program/what-toxics-release-inventory>

²⁴ <https://www.epa.gov/toxics-release-inventory-tri-program/addition-certain-pfas-tri-national-defense-authorization-act>

1. "An overview of the uses of per- and polyfluoralkyl substances (PFAS) published in Environmental Science: Process & Impacts Issue 12, 2020. Clearly states that "In the energy sector, PFAS are known to be employed in solar collectors and photovoltaic cells, and in lithium-ion, vanadium redox, and zinc batteries."
2. Patent Application Publication US 2014/0000674A1 for "Photovoltaic Module Back-sheet and Process of Manufacture filed by DuPont De Nemours and Company."
3. Patent Number US 8,344,238 B2 for "Self-Cleaning Protective Coatings for use with Photovoltaic Cells" filed by Chris M. Gronet and Janes K. Truman issued on January 1, 2013.
4. "DuPont Frontsheet Materials Dupont Teflon Films" indicates that the films are fluoropolymers and that the Teflon films may "last for years without degradation." It is doubtful that the films will last for the 35-40 year projected lifetime of the Project.

In Conclusion

I request that the town uphold our Comprehensive Plan and protect the soils, ground waters and drinking water supply for the residents of Duanesburg. Require the Applicant to provide Material and Data Safety Sheets and provide escrow for the pre- and post-construction soil and water testing as well as annual testing for the lifetime of the project. Contaminating the soils with PFAS would very likely be in violation of Zoning Ordinance 14.6.2.a: "such use is reasonably necessary or convenient to the public health, welfare or the economic or social benefit of the community"; 14.6.2.4.c.2: "the proposed use will not have a significant negative effect on existing adjacent land uses"; 14.6.3.1.8: "cause harmful waste to be discharged into sewer, streams, or bodies of water or to be stored on said properties." The town should look towards the future by protecting its natural resources today.

Thank you for your time and consideration.

Respectfully,

Lynne Bruning

720-272-0956

lynnebruning@gmail.com

Cc: Supervisor Roger Tidball and the Duanesburg Town Board

Enc: Four page listing of additional PFAS research

October 12, 2021 Saving Greene letter and PFAS Report

ARTICLES / STUDIES TESTING PFAS USE IN SOLAR CELLS

(Article) Facts about Solar panels: PFAS Contamination

By Dr. Annick Anctil, Michigan State University

- Academic research on how PFAS could potentially be used in photovoltaic (PV) solar panels. *(Studies are outlined below)*
 - “Self-cleaning hydrophobic nanocoating on glass: A scalable manufacturing process,” *Mater. Chem. Phys.*, vol. 239, Jan. 2020.
 - Son et al., “A practical superhydrophilic self-cleaning and antireflective surface for outdoor photovoltaic applications,” *Sol. Energy Mater. Sol. Cells*, 2012.; H. C. Han et al.
 - “Enhancing efficiency with fluorinated interlayers in small molecule organic solar cells,” *J. Mater. Chem.*, vol. 22, no. 43, 2012.
- Three parts on solar panels potentially having presence of PFAS: Self-cleaning coat, adhesives, substrate.
 - Self-Cleaning Coat: Confusion comes from the fact that some other commercialized self-cleaning coating options do make use of PFAS-based chemicals, although even those do not degrade under normal use.

Self-Cleaning Hydrophobic Nanocoating on Glass: a Scalable Manufacturing Process

S. Maharjan et al., Mater. Chem. Phys., vol. 239, Jan. 2020.

- Materials used in self-cleaning Coat: Trichloro(1H,1H,2H,2H-perfluorooctyl) silane (TCPFOS) (97%) and isopropanol were purchased from Sigma-Aldrich and were used without any further modification. Nitric Acid (ACS reagent, 70%) was purchased from Sigma-Aldrich and was diluted down with deionized water to achieve a pH of 3. Polycrystalline 0.1 μm diamond suspension (MetaDi®) and polishing cloth (MasterTex, PSA, 8 in) were purchased from Buehler. Saline solution (10% w/v) was prepared by dissolving 100 g of NaCl in 1000 mL of water.
- TCPFOS is a PFAS. The study specifically looks to determine whether TCPFOS is suitable for surfaces such as solar panels as a self-cleaning coating. The study concludes that “[TCPFOS] are therefore well suited for a range of applications including self-cleaning of solar panels.”

Enhancing efficiency with fluorinated interlayers in small molecule organic solar cells (Web link)

J. Mater. Chem., vol. 22, no. 43, 2012

- This study presents a simple approach to improve the performance of small molecule based organic solar cells (OSCs) by inserting a fluorinated buffer layer (e.g. PFAS) at the hetero interface of bilayer devices. As demonstrated in this work, the PFAS modification reduces the surface energy of the conventional PEDOT : PSS photoanode and results in a significant improvement in the pentacene based OSC.
- Concurrently, the accumulated negative charges of the fluorinated PFAS layer result in the development of interfacial dipole moments that in turn lead to an enhanced built-in potential across the devices, and consequently enhanced hole transport efficiency
- [Link to Study](#)
- This study specifically sets out to study whether PFAS improves the efficiency of solar panels, and concludes that the PFAS will lead to greater efficiencies.

MENTIONS OF PFAS USE IN SOLAR ENERGY - ACADEMIC STUDIES

Polyfluoroalkyl-silica porous coatings with high antireflection properties and low surface free energy for glass in solar energy application (Web link)

Volume 509, 15 April 2020, 144864

- *Available for purchase at the following [Study Link](#)*
- **Abstract:** Polyfluoroalkyl-silica porous coating stacks with durable antireflection (AR) properties have been obtained for photovoltaic (PV) application. The aim was to obtain a low surface energy coating, devised to mitigate soiling adherence, without losing the AR properties of a baseline coating. Those optical properties were inalterable after accelerated aging tests, which sustains the reliability of the materials for solar energy applications.

An overview of the uses of per-and polyfluoroalkyl substances (PFAS)

Environ. Sci.: Processes Impacts, 2020, 22, 2345-2373

- In the energy sector, PFAS are known to be employed in solar collectors and photovoltaic cells, and in lithium-ion, vanadium redox, and zinc batteries. In addition, fluoropolymers are also used to coat the blades of windmills.

- Under PFA Use Categories and subcategories: Solar collectors and photovoltaic cells listed.

Mechanical properties and field performance of hydrophobic antireflective sol-gel coatings on the cover glass of photovoltaic modules

Solar Energy Materials and Solar Cells, Volume 216, October 2020, 110694

- *Full Study available for purchase at the following [Study Link](#)*
- **Highlights:** Abrasion resistance of polyfluoroalkyl silica layer improved with inner dense layer.
- **Abstract:** Properties of methyl-silylated silica and **polyfluoroalkyl-silica** mono- and bi-layer stacks were compared to achieve the most rational AR design based on a proper trade-off between cost-efficiency, processability, optical properties, mechanical properties and reliability during real life operation.

PATENTS RELATED TO SOLAR PANEL COATING PRODUCTS

DuPont – US Patent for Photovoltaic Module Back-Sheet

- **Abstract:** An integrated back-sheet for a photovoltaic module is provided. A process for forming the back-sheet includes the steps of providing a fluoropolymer film...When incorporated into a photovoltaic module, the polymer layer of the back-sheet is adhered directly to the rear surfaces of a plurality of solar cells.
- List of materials and chemicals provided on Page 10-11.
- This is a patent by DuPont for a component (a sheet) used within photovoltaic solar panels. See page 9 of the patent, which states “A 5 mil thick cell support release sheet made of Teflon PTFE was place over the PVF film of the laminate, followed by a PTFE based heat bumper.” PTFE is a type of PFAS. This is direct evidence that even American-made solar components utilize PFAS.

Patent – Self-Cleaning Protective coatings for use with photovoltaic cells

- **Abstract:** Systems and materials to improve photovoltaic cell efficiency by implementing a self-cleaning function on photovoltaic cells and on albedo surfaces

associated with photovoltaic cell assemblies are provided. Materials for protecting albedo surfaces that surround photovoltaic cell assemblies, thereby maximizing energy input into the photovoltaic cell assemblies, are provided.

- Table 1 – Exemplary materials for assembling layer 208 and 306
- Table 1 of this patent is key. On page 18 of the PDF (and what is page 14 of the patent) is a section in the table titled “water-repellent fluor-resin.” There are at least 10 PFAS listed in this portion of the chart. This is direct evidence of use of PFAS in self-cleaning agents for photovoltaic solar panels.

OTHER MATERIALS

Interstate Technical Regulatory Council PFAS Guidance

- **Page 38 of PDF (page 33 of document):** “Solar industry includes Polymer and nonpolymer PFAS types. Fluoropolymer films (such as FEP, PVDF) to cover solar panel collectors, electrolyte fuel cells, PTFE expansion joint materials for power plants.”
- This would be evidence of a regulatory council acknowledging that solar panels utilize PFAS components.

DuPont Frontsheet Materials – DuPont Teflon Films

- Dupont Teflon FEP and EFTE films are used to make solar panels for portable and grid-connected applications.
- Material sheet includes information on light transmission and power output for Feflon FEP films.
- This is a DuPont information sheet that makes crystal clear that they sell fluoropolymers for solar panel coating applications. Fluoropolymers are a sub-set of the PFAS category. Also note numerous references specifically to Teflon, the trademarked brand name for a host of fluorine-containing polymers (i.e. – PFAS).