

PICKAWAY COUNTY, OHIO

Intra-Divisional

April 5, 2022

TO: County Commissioners  
FROM: Gary Cameron, EMA Director  
SUBJECT: Letter of Information – Industrial Solar Projects

Over the preceding few weeks, signs have appeared in the front yards of homes protesting the use of farmland to build industrial solar energy plants. More specifically, residents are voicing their opinions on large scale solar panel “farms”; solar farms are typically described as 25 to 100 megawatt capacity requiring 5 acres of land per megawatt or roughly 125 to 500 acres of land in total.

**Environmental Concerns:**

- Wildlife – In Ohio, we often think of wildlife as larger mammals that are associated with recreational hunting. As urban sprawl occurs, there is some evidence that these large animals are displaced but eventually adapt to their new environment. One could easily conclude that these larger animals would simply be displaced by larger solar farms. This view is narrowly focused and ignores the true biodiversity impact of large solar farms.
  - Concentrating solar power facilities and photovoltaic power facilities pose a direct risk of physical harm and death to birds and waterfowl. The solar flare/mirror effect of panels can injure birds in flight who succumb to intense light/heat or attempt to fly into the mirror image. Waterfowl are injured from what is referred to as a “lake effect” as they attempt to land on top of panels. You could add to this risk group other flying mammals such as bats.
  - Smaller mammals, rodents and insects are also at risk of physical injury and death. Risks to flying insects are very similar to birds and insects may be at greater risk due to the heat/burning effects of panels. Other risks of injury and death include displacement during construction (loss of habitat), pollution and electromagnetic field effects.
  - There are numerous articles proclaiming a positive impact on pollinators, i.e. bees as an off-set to pesticide use. However, without a deliberate incorporation of new pollinator habitat into the new solar farm project, the original risks associated with the project remain unbalanced.
  - Wildlife behavioral response to a large solar farm is yet to be fully realized. Certainly displacement will occur as wildlife avoid the area under construction and the return of many is unlikely with new structures; some may risk injury as they cannot detect or recognize new structures. Foremost, this displacement will cause increases in population density elsewhere and have a cascading effect on food availability, reproduction and adverse interactions with humans.

- Water runoff from the site into nearby streams, ponds and lakes may contain heavy metals and chemicals from faulty/broken panels posing a hazard to fish and amphibians.
- There is a risk of attracting non-native wildlife species to the newly created solar environment and the impact is yet to be determined.
- Fire Hazard
  - Electrical equipment failure is a common ignition source for various types of fires including wildfires. Within a solar farm, the number of electrical terminations far outnumber the number of solar panels. Each termination point is an opportunity for sparking, arcing, melting or fire resulting from damage, degradation or exposure to moisture. Ohio is not particularly vulnerable to drought but dry conditions do occur increasing the probability of a wildfire sparked by a faulty electrical connection.
  - Vegetation control must be a necessary part of routine solar farm maintenance.

**Human Health Concerns:**

- Impact on Humans – There is genuine psychological impact on humans however responses are varied down to the individual level. The most common response is fear; fear of developing cancer from radiation, fear of developing cancer from chemicals and electromagnetic fields.
  - The current consensus on solar panel radiation and cancer is that there “is no evidence”. In a pessimistic view means we haven’t yet identified it as a cancer source and they may or may not in the future. While viewed as a very low risk, electromagnetic radiation is considered a carcinogenic.
  - The most common elements used in solar panel manufacturing are aluminum, glass, plastic, copper wires and silicon. While these elements may occur in nature, such as silicon, it is not found naturally in such a concentration. Solar panels may contain small amounts of hazardous materials, such as lead, but they are self-contained and in small amounts. Current consensus on the risk of exposure to hazardous elements is minimal but persists. This risk increases when damaged panels accumulate in large amounts and toxic chemicals leach out into the soil and water table.
  - Solar panels emit weak or low electromagnetic fields. There are some who are hypersensitive to electromagnetic fields and may suffer the psychological effects of such.
- Disposal of end-of-life/damaged solar panels – Solar panels, especially older versions of, may contain small amounts of toxic chemicals such as silver, cadmium, arsenic, lead, chromium coatings, copper and selenium. Due to the presence of these toxic chemicals, some types and brands of solar panels can be considered hazardous waste depending on the quantity.
  - EU laws require that solar panels are properly recycled. The state of Washington has enacted similar legislation (begins July 2023) requiring manufacturers to fund the collection and recycling of decommissioned panels. Other states and countries are considering similar legislation. The International Renewable Energy Agency calls for the passage of PV-specific waste regulations.

- Valuable recyclables include silver, silicon, copper and glass.
- The cost of waste disposal produced by solar farms increases the estimated expense to produce electricity by 400%.
- Existing producers of solar have been replacing panels with 10-15 years of service contrary to the industry's suggested lifespan of 20-25 years. Defects, installation damage and junction box failure result in a panel failure rate of 20%.
- Costs to recycle panels is significantly more than (non-toxic) landfill disposal and global PV panel waste will reach 60-78 million metric tons by 2050.
- Absent effective disposal regulation and/or funding for recycling, we could conclude that solar panels containing hazardous materials will accumulate in large quantities in landfills, will be left behind as on-site hazardous waste or disposed of in smaller quantities to avoid regulation as hazardous waste.

**Societal Concerns:**

- The nexus between food and solar is associated with the conversion of cropland. Cropland, as a potential building site, is relatively level and cleared of trees and debris reducing the need for site improvement. Similar to urban sprawl, once cropland is repurposed it is highly unlikely to be replaced/returned to food production.
- Fertile soil for crops and livestock is a valuable commodity. While the amount of fertile soil necessary to support a society is indeterminant, reaching a tipping point would be catastrophic. Solar panels are not dependent upon soil fertility and efforts are underway to repurpose sites, such as landfills and chemical spill sites, as opposed to productive farmland.
- Opinions from real estate experts are mixed but favor the idea that solar farms in a rural settings do not negatively impact nearby property value. However, these RE experts will concede that residential property immediately adjacent to will suffer some effect. Visual mitigation such as screening with trees, hedges or earth mounds can reduce actual and feared loss of property value.
- The FAA considers solar panel farms as a potential threat to air traffic control personnel and to pilots during final runway approach.
- Solar panels, generally, create a hazard for responding fire and police personnel. Beyond the need for training first responders on electrocution hazards, solar farms should include safe access to disconnect switches in the event of an emergency.

**EPA Publications on Solar Panel Waste:**

- *Solar Panel Frequent Questions*
  - Solar panels are considered solid waste when discarded.
  - Some solar panels are and some are not considered hazardous waste depending on the leachability of toxic materials. The EPA cannot say definitively if all solar panels are hazardous waste.

- *End-of-Life Solar Panels*
  - Solar panel waste that fails the toxicity characteristic leaching procedure (TCLP) must be managed as hazardous waste. If a shipment of panels failed the TCLP, they must be transported under a manifest.  
***There is no mention that this TLCP testing is required nor routinely occurs.***
  - Heavy metals are present in most solar panels and manufacturing variances may result in differing outcomes in the TLCP test.
- A 2015 study published by the National Institute of Health suggests that the TLCP testing process, specific to solar panels, underestimates the leaching of Cadmium and Tellurium. The study suggested “significant” leaching of Cadmium. Both chemical elements are hazardous to human health.
- The Ohio EPA has published whitepaper; *Storm Water Controls for Solar Panel Arrays*.

**Anhydrous Ammonia:**

- Forms explosive compounds with silver and mercury
- Corrosive to copper, zinc, tin, brass and galvanized steel
- Current research on producing ammonia as a byproduct of solar energy

**Batteries:**

- Lithium reacts intensely with water forming lithium hydroxide and flammable hydrogen gas.
- Persons working in and around battery systems should wear PPE designed for such.

In conclusion and without assessing the potential value of “green” energy, solar panel farms will have an impact on the environment and our health. As an emergency planner, I foresee there will be solar panel related hazardous waste incidents on our roads, in our landfills and on solar farm locations. The most serious of which is the creation of a hazardous waste “super fund” site resulting from a pattern of illness/death. Lesser events include transportation accidents and wildfires. Proper planning, regulation and training of first responders may mitigate many of this issues.

Respectfully Submitted,

Gary Cameron, EMA Director

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