CHESAPEAKE ENVIRONMENTAL PROTECTION ASSOCIATION, INC.
P.O. Box 117, Galesville, Maryland 20765

NEWSLETTER **Fall 2020**

TRUSTEE'S MESSAGE

By Scott Knoche

In past newsletters, our president has provided messages about issues of concern to CEPA. In this newsletter, and in many future newsletters, one of our Trustees will discuss an issue that is particularly important to him/her.

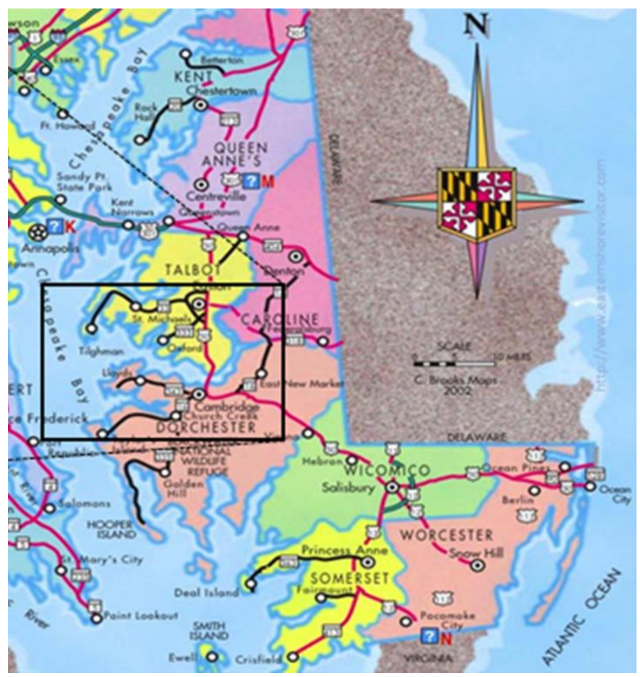
Potential Commercial Fishing Benefits and Regional Economic Impacts Generated by Oyster Reef Restoration in the Chesapeake Bay

The oyster reef system in the Chesapeake Bay was so extensive that 18th century European visitors often remarked on the threat these reefs posed to nautical navigation. Large-scale exploitation of the oyster began in the 19th century through the dredging of oysters, with Maryland harvest peaking in the late 19th century at an estimated 15 million bushels annually. In contrast, in the 2016-2017 wild oyster harvest season, 224,609 bushels were harvested – about 1.5% of the 19th century peak. Less than 1% of the historic oyster population remains in Maryland Chesapeake Bay waters due to a combination of overharvesting, habitat loss, and disease.

The profound decrease in oysters in the Chesapeake Bay resulted in a concomitant decrease in ecosystem services provided by oysters. Water filtration by oysters can reduce excessive nutrient loads from waterways and increase water clarity, which can in turn potentially enhance growth of submerged aquatic vegetation. Oyster reefs also provide habitat and forage, increasing faunal production and potentially increasing seafood harvests. Restoration efforts to restore oyster populations in the Chesapeake Bay were driven by the Executive Order 13508 for Chesapeake Bay Protection and Restoration (2009) and supported by the Chesapeake Bay Watershed Agreement (2014) that was signed by governors of the six states of the Chesapeake Bay Watershed, mayor of Washington D.C., and officials from the U.S. EPA and Chesapeake Bay Commission. Specifically, these Chesapeake Bay Program partners have a stated goal to "*Restore native oyster habitat and populations in 10 tributaries by 2025 and ensure their protection*" in the Chesapeake Bay.

An interdisciplinary team of investigators led by Morgan State University researchers Dr. Scott Knoche and Dr. Thomas Ihde explored the potential changes in commercial fisheries harvest and regional economic impacts resulting from the oyster reef restoration efforts in the Choptank River System on the Eastern Shore of Maryland. To accomplish this, the project team developed an ecological trophic model of the Choptank River System which also incorporated commercial fishers as top predators in the food web. The abundance of oysters were manipulated across different scenarios to examine the effect of these organisms on ecological production and ultimately, seafood harvested and regional economic impacts to Dorchester and Talbot counties – the two Maryland counties in the NOAA-defined Choptank Habitat Focus Area. Specifically, these scenarios are:

Scenario 1 – Young Reef in current sanctuaries,
Scenario 2 – Mature Oyster Reef with Oyster biomass increase in sanctuaries, and
Scenario 3 – Fished Down Oyster biomass, sanctuaries opened to harvest, and oyster density back to pre-restoration levels.



In addition, the existence of other filter feeders attaching to oysters (e.g., hooked mussels, tunicates, barnacles) were assumed to co-exist at levels consistent with oyster abundance in each scenario.

Harvested biomass estimates from the scenarios described above were translated into commercial fisher harvest revenues by applying mean, species-specific prices by fishery to the biomass harvest estimates. An original cost-earnings data collection effort involving 12 commercial fishers active in the Choptank River System used with regional economic impact modeling software enabled the calculation of total regional economic effects (that is, initial spending + multiplier effects) for four key economic measures: output, labor income, value-added and employment. The key findings are:

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Key Finding 1: Increase in Commercial Harvest
The Mature Oyster Reef scenario supports an increase in annual commercially harvested finfish and shellfish biomass of about 45%, relative to the Young Reef scenario. These Mature Oyster Reefs are predicted to increase total harvested biomass by about 80% relative to the Fished-Down scenario in which restored oyster reef sanctuaries have been harvested down to a level that reflects the pre-restoration status of the area.

Key Finding 2: Large Predicted Increase in Blue Crab Harvest with Oyster Reef Restoration
The ecological model predicts large increases in Blue Crab commercial harvest due to the trophic effects of the restored oyster reefs. The Mature Oyster Reef scenario predicts an 80% increase in Blue Crab harvest relative to the current Young Reef scenario, and a 160% increase in harvest relative to the Fished Down scenario. These gains are specific to the Choptank River system analyzed in this project. The project team urges caution with respect to assumptions about the transferability of these predicted gains to other areas of the Chesapeake Bay, where factors not present in the Choptank could affect harvest.

Key Finding 3: Total Dockside Sales
The changes in commercially harvested biomass have the potential to contribute to millions of dollars in additional sales for commercial seafood harvesters. The Mature Reef scenario is projected to increase dockside sales receipts by more than $4.5 million relative to the Young Reef scenario and by about $11 million relative to the Fished Down scenario. These changes in dockside sales are primarily driven by Blue Crab harvest increases.

Key Finding 4: Regional Economic Impacts for Dorchester and Talbot Counties in Maryland
This modeling effort predicts sizable increases in total annual regional economic effects in Dorchester and Talbot Counties, Maryland from oyster reef restoration for four key economic measures: output, labor income, value-added, and employment. Total economic effects reflect the initial change to the economy resulting from the dockside sale of harvested seafood in the region, the additional inter-industry regional spending generated by the initial dockside sale, and the spending of labor income at regional businesses that stem from both the direct and indirect effects.

Differences in Total Annual Regional Economic Effects Across Scenarios

	Young Reef -> Mature Reef	Fished Down Reef -> Mature Reef
Output (Sales) ($million) Total value of production	+ $9.9	+ $22.8
Labor Income ($million) All forms of employment income (employee and owner compensation)	+ $3.3	+ $7.8
Value-Added ($million) Difference between output and cost of intermediate inputs	+ $6.0	+ $13.3
Employment (jobs) Annual full and part-time	+ 142	+ 319

Fisheries managers, seafood harvesters, and other commercial fishing stakeholders are increasingly seeking information regarding the regional economic impacts resulting from fisheries management decisions. This project contributed to addressing this need by generating estimates of key economic measures associated with the Choptank River commercial fishing industry and connected industries.

DRAFT OF AA COUNTY'S GENERAL DEVELOPMENT PLAN IS AVAILABLE FOR COMMENT
By Mike Lofton

The following is excerpted from the Alliance for Livable Communities latest newsletter: https://www.annearundel-livable.org/

The preliminary draft of Plan2040, the General Development Plan for Anne Arundel County, is now available for public review. Please visit https://www.aacounty.org/departments/planning-and-zoning/long-range-planning/general-development-plan/index.html to download the draft plan document and to submit your comments.

Next Steps for Plan2040

- 45-day public review period for draft of the full Plan2040 document: September 30 - November 15.
- Planning Advisory Board briefing and public hearing to occur in December and January (dates to be determined)
- County Council introduction of Plan 2040 is anticipated in February 2021 with public hearings to begin in March 2021 (dates to be determined).

The four sections contain over 400 Goals, Policies, and Implementation Strategies. In addition, comments were solicited on proposed development policy areas and approximately 250 land use changes that have been requested by landowners or proposed by the OPZ staff. Just presenting this mass of data in a coherent manner and processing citizen responses is a challenging problem. OPZ staff has responded with skill and innovation. Video tutorials and County town hall meetings have been employed to assist citizens with navigation of the portal, and there is good reason to expect that a wealth of feedback data that is amenable to statistical analysis has been gathered.

The full set of 400 Goals, Policies, and Strategies can be downloaded as a 42-page document from the Community Engagement web portal. As currently written, Plan 2040 provides guidance, but not enough specificity to serve as an implementable plan of action. However, Plan2040 can still play a strong role in shaping our future.

The 2009 GDP was broadly characterized by an earlier County Council and Administration as "just guidance" that could be ignored, almost at will. Legislative and administrative actions were supposed to be consistent with the plan, but that concept was honored more in breach than observation. In many ways, the 2009 GDP was similar to Plan2040 in that descriptions of actions were often not specific, with no office given responsibility, no timeline indicated, and no priority assigned. Although it outlined many good aspirations, it was considered guidance and not afforded the respect it deserved. Had the guidance been respected and later legislative and administrative activities been consistent with it, the 2009 GDP could have had a much greater positive influence on the progress of the County.

An effective long-term planning effort can be composed of broad statements of guidance implemented by a combination of consistent legislative code and smaller actionable plans. The smaller plans should outline specific tasks with:

1. Assigned priorities,
2. Designated responsible parties,
3. Schedules, and
4. Reporting requirements.

Plan2040 can function as the guidance in this combination provided that the Regional Plans and any relevant legislation are consistent, detailed, and implementable. The requirement of consistency should be formally stated in Plan2040 and approved by the Council. Although Plan2040 could be renamed Guidance2040, it should be firm, thorough, and respected guidance. The value of Plan2040 will be determined by consistency of following legislation and its enablement of effective regional planning. The current draft of four important sections of Plan2040 is a good start.

LITHIUM

By Gary Antonides

The Stanford University Report "World Lithium Supply," by Eric Eason, Nov. 30 2010, describes lithium, the third element in the periodic table, as a soft, highly reactive, silvery-white alkali metal, the lightest of all metals, with excellent heat and electrical conductivity. It is sometimes called "white petroleum." (http://large.stanford.edu/courses/2010/ph240/eason2/#:~:text=Instead%2C%20lithium%20is%20usually%20extracted,at%20the%20Atacama%20Salt%20Flat.)

Lithium has many industrial uses. It is used in the manufacture of glasses, ceramics, pharmaceuticals, and aluminum and magnesium alloys. But the highest potential for growth is in the battery market, where lithium is used as electrode and electrolyte material in both lithium disposable batteries and in lithium-ion rechargeable batteries. By 2009, the battery market had grown to 31% of global lithium consumption. In 2018, the International Energy Agency (IEA) predicted that by 2030, there would be nearly 125 million electric vehicles on the planet. That compares to 3.1 million electric vehicles in 2017.

In terms of energy, Cairn Energy Research Advisors estimates the lithium ion industry is expected to grow from 100 gigawatt hours (GWh) of annual production in 2017 to 800 GWhs in 2027—not only as a result of electric cars, but also of many other things, including mobile phones.

In terms of lithium production, by the year 2025, lithium demand is expected to increase to over five times 2019 levels. Auto manufacturers account for much of this. Volkswagen, by itself, plans to launch more than 70 electric car models in the next 10 years. Also, in 2015, China announced it was prioritizing electric vehicles as part of its five-year plan.

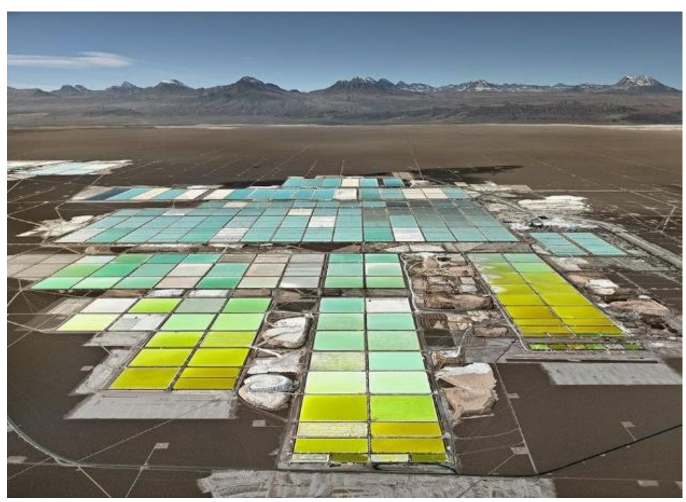
As a result of demand, over the period from 2016 to 2018, lithium prices more than doubled and are expected to keep increasing. Clearly, as the automotive industry begins to manufacture large numbers of hybrid electric vehicles and electric vehicles that use lithium batteries, we have to ask if there will be enough lithium.

Where Lithium Comes From

Lithium is never found in its elemental, metallic form because it is highly reactive, highly flammable, and will even react spontaneously with water. (This high reactivity is why some lithium-ion batteries ignite or explode when exposed to high temperatures.) Instead, lithium is usually extracted from lithium minerals that can be found in igneous rocks (chiefly spodumene) and from lithium chloride salts that can be found in brine pools.

Spodumene (lithium aluminum silicate) is used as a commercial source of lithium (U.S. Geological Survey)

As of 2015, most of the world's lithium production is in South America, where lithium-containing brine is extracted from underground pools and concentrated by solar evaporation. The largest producer of lithium in the world is Chile, which extracts it from brine at the Atacama Salt Flat. Argentina produces lithium from brine at the Hombre Muerto Salt Flat. There is also an enormous lithium deposit in Bolivia at the Uyuni Salt Flat (the world's largest salt flat, over 4,000 square miles), but this resource remains untapped for now due to political and economic reasons. The largest producer of lithium from spodumene is Australia, which has a large deposit near Perth. Other major lithium producers include China, which produces it at salt lakes, and the U.S., which produces it from brine in



Separation ponds at SQM Lithium mine, Atacama Desert, Chile. OPEN COMMONS.

Nevada. Extracting lithium from brine is currently cheaper than mining it from spodumene, so there are many deposits of spodumene that are not now being mined.

As of January 2010, the USGS estimated world total lithium reserves at 10.9 million tons (economically extractable now) and identified potentially economic lithium resources at 2.6 times that. Most of the identified resources are in Bolivia and Chile (35 and 29% respectively).

Some History

According to https://en.wikipedia.org/wiki/Lithium the production and use of lithium underwent several drastic changes over the years. The first major use of lithium was in high-temp lithium greases for aircraft engines and similar applications in World War II and shortly after. Lithium was also used in soaps. The small demand for lithium soaps and greases was satisfied by several small mining operations, mostly in the U.S.

The demand for lithium increased dramatically during the Cold War with the production of nuclear fusion weapons. The U.S. became the prime producer of lithium between the late 1950s and the mid-1980s. Lithium was used to decrease the melting temperature of glass and to improve the melting behavior of aluminum oxide and these two uses dominated the market until the middle of the 1990s.

After the end of the nuclear arms race, the demand for lithium decreased and the sale of Department of Energy stockpiles on the open market significantly reduced prices. In the mid-1990s, several companies started to extract lithium from brine which proved to be less expensive, and many of the mines closed, including the U.S. mines near Kings Mountain in N. Carolina.

The development of lithium ion batteries increased the demand for lithium and it became the dominant use in 2007. Brine extraction efforts were expanded to meet the demand. It has been argued that lithium will be one of the main objects of geopolitical competition in a world running on renewable energy and dependent on batteries.

Lithium in Car Batteries

The maximum realistic energy capacity for lithium-ion (rechargeable) batteries is about 4.6 kw-hours per pound of lithium. Lithium-ion electric vehicles have a large variation of battery capacities, but the Nissan Leaf, as an example, has a 24kw-h battery and it takes about 5.3 pounds of lithium to make it. If all of the world's economically extractable lithium were used to make Nissan Leafs. we could make 4.1 billion of them. If we assume a North American standard of living for everyone in the world (about 1 car for every 2 people), we would need about 3.4 billion Nissan Leafs. That seems unlikely. Perhaps if all the world's cars are going to be made electric, a mixture of battery technologies will have to be used.

Cars and trucks now account for nearly one-fifth of all carbon emissions in the U.S., according to the Union of Concerned Scientists. Fossil-fuel vehicles emit an average of 24 pounds of CO_2 and other hazardous gases for every gallon of gas used. With regard to emissions, electric cars are a significant improvement. Yet some regions of the world will suffer as we transition to electric cars. Mining for lithium is associated with serious environmental problems, as discussed later.

In "Are Electric Vehicles Really Better For The Environment?," (https://www.forbes.com/sites/jamesellsmoor/2019/05/20/are-electric-vehicles-really-better-for-the-environment/#643d59b476d2), James Ellsmoor says that the country in which the batteries are being produced will have a large impact on emissions, even though EVs have considerably lower emissions over their lifetime than vehicles running on fossil fuels regardless of the source that generates the electricity

A range of rare earth metals make up the composition of the battery, and their extraction and manipulation contribute to carbon emissions. A 2018 International Council on Clean Transportation (ICTT) report illustrates that the country in which the batteries are produced has a large effect on emissions .

A comparative study between EVs and internal combustion engine vehicles (ICEVs) in China corroborates the ICTT report. Chinese EV battery manufacturers produce up to 60% more CO_2 during fabrication than ICEV engine production, and they could cut their emissions by up to 66% by adopting American or European manufacturing techniques. In most developed countries, the pollution created through the extraction process and production of batteries remains about the same as manufacturing ICEVs.

In its study, the ICTT also notes the stark difference in emissions between electric and internal combustion over the course of their lifetimes. With no tailpipe emissions, EVs produce essentially all of their emissions through their manufacturing process and the sourcing of their energy. Several studies show that an electric vehicle charged on an exclusively coal-powered grid would have similar lifetime carbon emissions as an ICEV. But, in 2019, only 23.5% of U.S. power came from coal (https://www.eia.gov/tools/faqs/faq.php?id=427&t=21). All other sources, including gas are much cleaner, making EVs markedly less polluting over their lifetimes.

ICEVs have been steadily reducing their emissions since 2000, but electric vehicles still have a marked edge, and, as EVs become more common, as the technology improves, as EV production is scaled up, as recycling increases, and as power sources get cleaner, EVs will greatly reduce emissions.

Energy Storage

As the world moves towards a low-carbon future, energy production, as well as transportation, desperately needs to reduce emissions, and developments in both electric vehicles and battery storage are rapidly changing both markets. Lithium is a key component in energy storage.

Large scale batteries as a storage option for renewable energy on main electricity grids was shown to be feasible when Elon Musk upgraded South Australia's energy grid. It took only sixty-three days for Tesla to build a 100MW lithium-ion battery, the largest in the world, capable of kicking in within a second as the backup power source. With renewable energy as the prime power source, this mega-battery kicks in if wind farms (or coal-powered plants) unexpectedly shut down. In December 2017, a major coal generator in the neighboring state of New South Wales tripped, and the batteries did indeed kick in within a second, avoiding a blackout.

This storage system has cut energy costs for consumers in South Australia, and, by buying and selling power during fluctuating demand, the Tesla battery generates revenue. Its success has led many utility companies to consider using large-scale batteries.

A 2015 study by Stanford and USC Berkeley, http://web.stanford.edu/group/efmh/jacobson/Articles/I/CombiningRenew/CONUSGridIntegration.pdf shows how the U.S. could reach 100% of its energy demands through renewable energy. This would necessitate building infrastructure to store power (not necessarily batteries) which could be very costly.

Many startups and investors are looking for a breakthrough in energy storage technology. One effort, Breakthrough Energy Ventures, is funded by several billionaires including Bill Gates, Jeff Bezos and Richard Branson, and aims to find solutions for a zero-carbon future with over $1 billion in investment.

Environmental Effects

The subject of lithium mining is discussed in the Jan. 2020 report https://www.zmescience.com/science/lithium-mining-098534/#:~:text=Mining%20starts%20by%20drilling%20a,in%20Salar%20de%20Uyuni%2C%20Bolivia, by Fermin Koop.

It says brine mining in salars (salt flats) is normally a very long process that can take from eight months to three years. After drilling a hole and pumping brine to the surface, they leave it to evaporate for months, creating a mix of manganese, potassium, borax, and salts. That mix is filtered and placed into another evaporation pool. It will take between 12 and 18 months for that mix to be filtered enough to extract the lithium carbonate, also known as white gold. It's cheap and effective, but it takes about 500,000 gallons of water per ton of lithium extracted. This creates a lot of pressure in nearby communities. For example, in Chile's Salar de Atacama, mining has caused the region to lose 65% of the region's water. This has impacted local farmers, who now need to get water from somewhere else.

Also, toxic chemicals can leak from the evaporation pools into ground water. This can include hydrochloric acid, which is used in the processing of lithium, as well as waste products that can filter out of the brine. In the area near Salar del Hombre Muerto in Argentina, residents complain that lithium polluted streams are used by humans and livestock. In Nevada, impacts on fish were found 150 miles downstream from a lithium processing operation.

In the U.S., Canada, and Australia, lithium is usually extracted from rock with more traditional methods. This also requires the use of chemicals that can cause environmental problems. Friends of the Earth reported that extracting lithium can pollute the soil as well as cause air contamination.

https://www.forbes.com/sites/jamesellsmoor/2019/06/10/electric-vehicles-are-driving-demand-for-lithium-with-environmental-consequences/#1ab504d962e2, by James Ellsmoor, discusses how electric vehicles are driving demand for lithium and what the associated environmental consequences are.

The drawbacks of the mining industry itself have weighed heavily on the rise of batteries. Mining rare earth and heavy metals emits large amounts of emissions and has a noticeable impact on the environment. Although most lithium comes from brine extraction, some is from hard rock mining, which has more damaging environmental consequences. Getting these resources from brine rather than hard rock helps, along with new eco-friendly technologies that use less energy.

Hexagonal formations on the surface of the Salar de Uyuni as a result of salt crystallization from evaporating water. Credit Wikimedia Commons

In order to manufacture batteries in a more environmentally friendly way, new alternatives, such as battery chemistries that replace cobalt and lithium with more common and less toxic materials are being investigated.

Recycling

There are also concerns around how to recycle lithium. Nonprofit Friends of the Earth notes that lithium recycling is difficult, because the metal is toxic, highly reactive, and flammable. It tends to be incinerated or end up in landfills. Low collection rates, and the high cost of recycling relative to primary production have contributed to the absence of lithium recycling. In Australia, research showed that only 2% of the country's 3,300 tons of lithium-ion waste was recycled. Unwanted electronics with batteries can end up in landfills and metals and ionic fluids can leak into underground water reservoirs.

The Birmingham Energy Institute in the U.K. is using robotics technology to look for ways to remove and dismantle potentially explosive lithium-ion cells from electric vehicles. There have been a number of fires at recycling plants where lithium-ion batteries were stored improperly.

Unfortunately, manufacturers are usually secretive regarding what actually goes into the batteries, which makes it difficult to recycle them properly. At present, recovered cells are mostly shredded, leading to a mixture of metals that can be separated using pyrometallurgical techniques (using high heat).

A Finite Resource

To create lithium batteries, there is a need for a range of rare earth metals that require heavy mining and manufacturing that emit significant emissions. Becoming more important is the fact that major components such as lithium, nickel, and cobalt exist in a finite amount that is unlikely to meet future demands for batteries.

Studies looking into the sustainability of electric vehicles point out that with the high demand for new electric vehicles, the auto industry will need to adopt economies of scale and more efficient and less polluting manufacturing processes. Certainly, as more batteries are created for these electric vehicles, a market for the recycling of these batteries will have to be created, thereby reducing the need for increased mining.

PROFILE OF A TRUSTEE

Joan Turek

Dr. Joan Turek joined the Board of Trustees in 2012. She has been very involved in community activities for many years, and is a valuable addition.

She was born in California, the daughter of a Naval Officer specializing in special weapons, and lived all over the U.S. while growing up. She went to 15 schools before going to college. She graduated from high school in Clarksville, Tennessee. She earned her BA from the University of Connecticut with Distinctions (1960), and her Masters (1962) and PhD in Economics (1968) from Yale.

Dr. Turek was employed in the Office of the Assistant Secretary for Planning and Evaluation (ASPE), Department of Health and Human Services (HHS) from 1972 until January 2017. In her last position she was a Senior Economist in the Office of Science and Data Policy. For over 25 years, she managed ASPE's technical support operation which provided a full range of services including scientific programming, computer and graphics support, centralized access to information through the Policy Information Center and statistical policy coordination. Since 1976, she was responsible for managing the Transfer Income Model (TRIM) a key tool in ASPE's analytic capacity which is used in providing policy advice to the Administration, the Secretary and other senior governmental officials on alternatives to existing tax, income transfer and health programs. She was the primary contact for the Federal Poverty Guidelines issued by HHS for much of that time. In recent years, she has conducted research on the quality of income data on Federal surveys. Her last article was published in the International Journal of Public Statistics. Throughout her career, she has directed and conducted applied quantitative research, both in governmental and private organizations. She retired with 47 years and 10 months of Federal service.

Dr. Turek is past chair of the American Statistical Association's Committee on Statistics and Disability. She was President of the Federal Executive Institute Alumni Association in 1994 and 1995 and also served in other positions within the organization.

Dr. Turek is also very active in her community. She retired from the Board of Owensville Primary Care, a Community Health Center, and was a member of AA County's Planning Advisory Board (PAB) for seven years. In addition, she was a member of the first South County Small Area Planning Committee (1999-2000). She was Secretary of the South County Coalition from 1995 to 2000. She was a founder of the Harwood Civic Association and is the current president. She was chairman of the board of the South County Exchange (2003-07) which grew out of the International Exchange (1998). She is also a board member of the Sierra Club AA Chapter. She received their award for community service in 2008. In 2018, the County Executive appointed her to the AA Commission on Disability Issues.

She lived in Harwood for 39 years at Oakwood, which was the main house of a tobacco plantation. It was built by Sprigg Harwood who was a Maryland State Senator, State Treasurer and one of the two leaders of the movement to get Maryland to secede from the union. Oakwood is on the National Register of Historic Places. In 2018, She moved to Heritage Harbour, an over-55 community, in Annapolis.

Joan's hobbies include bridge, mahjong, gardening, needlework and painting. However, she says her main hobby is working on local issues.

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