Date: February 19, 2016

To: RGGI 2016 Program Review

From: Chesapeake Physicians for Social Responsibility

Chesapeake Physicians for Social Responsibility (CPSR) appreciates the opportunity to comment on issues associated with the 2016 RGGI Program Review. As a health-based organization, we urge the RGGI states to consider the substantial health co-benefits associated with reducing the annual cap on greenhouse gas emissions.

Overview. The medical profession characterizes climate change as "an unacceptably high and potentially catastrophic risk to human health"[1]. The substantial and varied impacts that climate change is already having on health in the US are clear cut and have been extensively documented (for reviews, see refs 2, 3 and 4; for details see below). In this light, RGGI's success in reducing CO_2 emissions is not only a major step forward in limiting future climate change, it is a source of significant and immediate health co-benefits for the member states. Lowering the emissions cap reduces the air pollution from power generation; the lower the annual cap, the greater the health benefits.

The RGGI states aim to reduce total greenhouse emissions by an average of 40% from either 1990 (seven states) or 2006 levels (Maryland)[5]. These emissions reductions will produce billions of dollars in health co-benefits just by reducing the health costs of disease caused by air pollution[6].

While we encourage the RGGI states to model the two policy cases identified in the February 2nd reference materials, we are concerned that neither Clean Power Plan compliance nor the proposed 2.5% annual cap reduction will be sufficient to enable states to achieve their 2030 emissions goals. Historic emission data show that steeper reductions are achievable: annual incremental reductions to date have been approximately 5% per year and actual emissions for 2014 were 5% below the cap[5], making it clear that more aggressive cap reductions are feasible with no negative economic impacts on the states.

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[1] Watts, N. et al, 2015. The Lancet Commissions: Health and climate change: policy responses to protect public health. www.thelancet.com, http://dx.doi.org/10.1016/S0140-6736(15)60854-6.

[2] Luber, G. et al. 2014. Ch. 9: Human health. Climate change impacts in the United States: The Third National Climate Assessment. US Global Change Research Program. Available at: http://nca2014.globalchange.gov/report/sectors/human-health

[3] Portier, CJ et al. 2010. A human health perspective on climate change. Environmental Health Perspectives, National Institutes of Environmental Health. Available at: www.niehs.nih.gov.climatereport.

[4] USCGRP 2015. Climate and Health Assessment (draft), 405 pp. Final report due in 2016.

[5] Synapse Energy. 2016. The RGGI Opportunity. Available at http://www.synapse-energy.com/sites/default/files/The-RGGI-Opportunity.pdf

[6] Acadia Center. 2015. Monetized benefits of avoided emissions. Available at http://acadiacenter.org/wp-content/uploads/2015/07/Appendix_Monetized-Benefits-of-Avoided-Emissions.pdf

Lowering RGGI's emissions cap will immediately reduce toxic air pollution and lower our region's high rates of pollution-related premature mortality, hospital admissions and emergency room visits. A recent study estimates that for every MT decrease in CO_2 emissions, 7.3 premature deaths could be averted[7], putting the health benefits of the RGGI cap reduction in stark focus.

Currently, the health impacts of air pollution are felt most strongly in low-income communities where the oldest and most polluting generating units are disproportionately located[8,9]. For example, Baltimore is home to three of Maryland's oldest coal-fired EGUs as well as to other industry that contributes to air pollution. Baltimore's asthma rates are three times the national average, and twice Maryland's statewide average[10]. In 2009, asthma in Maryland resulted in 11.474 hospitalizations, 39,834 visits to hospital emergency departments, thousands of hours of lost school and work days and 67 deaths[10]. In 2009 alone, Maryland costs for asthma in hospital and emergency departments totaled over $99 million. Medical costs for other respiratory and cardiovascular disease related to ozone and fine particulate matter from electrical generating units[11] were undoubtedly much higher.

Air pollution reductions associated with a lower annual emissions cap will reduce the avoidable morbidity and mortality attributable to air pollution, reduce lost school time by asthmatic children and keep workers in the commercial sector at work instead of home with acute and chronic illness[11]. Cleaner air will alleviate the personal suffering of those sickened each year by air pollution and will improve the overall quality of life for all citizens in the region.

RGGI states have shown that annual emissions reductions on the order of 5% can be achieved while lowering electric rates and growing the economy[5]. In addition, recent modeling suggests that the additional funds generated by a reduced cap will increase the penetration of energy efficiency and accelerate the switch to clean renewable fuels in RGGI states. Reducing demand for non-renewable power will result in long term reductions in air pollution and concomitant increases in human health. The available data show that far from being a drag on the economy, reducing emissions is an engine of economic development, saving up to $9.1B and creating a yearly average of almost 50,000 jobs (ref. 5, Table 5).

Chesapeake Physicians for Social Responsibility urges the RGGI states to consider the substantial health co-benefits associated with accelerating the reduction of greenhouse gas emissions through larger annual cap reductions. During this Program Review, we urge the states to:

1. **Approve an annual cap reduction that is adequate to meet the 2030 greenhouse gas emission targets of RGGI states** (40% reduction from 1990 levels over all sectors), and that will also align with their goal of an 80% reduction in emissions by 2050.

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[7] Driscoll, DT et al. 2015, http://nca2014.globalchange.gov/report/sectors/human-health.
US power plant carbon standards and clean air and health co-benefits. Nature Climate Change 5, 535-540. Available at: http://www.chgeharvard.org/resource/health-co-benefits-carbon-standards-existing-power-plants

[8] Amer. Lung Assoc, 2001. Urban air pollution and health inequities. A workshop report. Env. Health. Persp. 109S3, 357-374.

[9] Clark, L. et al. 2014. National patterns in environmental injustice and inequality: Outdoor NO_2 air pollution in the United States. PLoS One, 9, issue 4, e94431. doi:10.1371/journal.pone.0094431.

[10] http://phpa.dhmh.maryland.gov/mch/documents/asthma_control/Profile_BaltimoreCity.pdf

[11] Fann, N. et al. 2012. Estimating the national public health burden associated with exposure to ambient $PM_{2.5}$ and ozone. Risk Analysis 31. Doi:10.1111/j.1539-6924.2011.01630.x

2. **Model policy scenarios that include cap reductions aggressive enough to achieve the 2030 emissions goals adopted by RGGI states.** An annual cap reduction of only 2.5% will not produce enough reduction in emissions to meet the state's 2030 goals, so we suggest including policy modeling of scenarios with annual cap reductions of at least 5%. Models and analyses of a 7.5% annual cap reduction would provide states with the full range of information bracketing the options from "business as usual" to "aggressive". Examining a wide range of outcomes is important to identify the best scenario to pursue.

3. **Ensure that the modeling of each scenario include a full cost-benefit analysis that considers environmental, economic and health co-benefits of reducing the cap along with the costs.** This will provide a more realistic picture of the outcome of each scenario. Environmental co-benefits of cap reduction include limiting the devastating impact of future climate change while producing immediate reductions in air and water pollution. Economic benefits include the availability of additional funds for investments in energy efficiency and accelerating the transition to clean renewable power in RGGI states. Finally, there are significant health benefits (both monetary and social) from reducing the toxic air pollution currently associated with electrical power generation.

4. **Increase assurances that member states will invest RGGI proceeds primarily in energy efficiency (particularly in low-income neighborhoods), renewable energy and other programs that reduce demand.** These investments synergize RGGI's progress toward permanent emissions reductions and increase environmental justice by helping low income families reduce the outsized fraction of their income currently spent on power.

What are the health co-benefits of reducing the emissions cap?

Reducing the cap on greenhouse gas emissions enough to meet states' 2030 goals will have significant positive health co-benefits, both direct and indirect. Here we discuss the details:

1. Direct health impacts of electric power generation: The RGGI states generate an average of 40% of their power from burning coal. Emissions from coal-fired generating units have immediate and direct impacts on human health from the air pollutants that are emitted along with the climate-changing CO_2. Coal -fired power plants release hazardous air pollutants, nitrogen oxide compounds, sulfur dioxides, and fine particulate matter, all of which cause significant health problems[12]. The impacts of this air pollution are particularly critical in the most vulnerable populations: children, the elderly and people who are economically disadvantaged and have low educational levels[9].

a. Hazardous air pollutants: Burning coal for electricity releases 84 of the 187 hazardous compounds that the U.S. 2008 Environmental Protection Agency (EPA) has identified as toxic for humans and the environment such as hydrochloric acid, carcinogens such as arsenic and benzene, radioactive elements such as radium, and potent organic carbon-based toxins such as dioxins and formaldehyde[12].

b. Nitrogen Oxide Compounds and Sulfur Dioxides: Burning coal releases large quantities of nitrogen oxide compounds (NOx) and sulfur dioxides (SO2) which can cause severe respiratory problems[13]:

[12] American Lung Association. 2010. Emissions of hazardous air pollutants from coal-fired power plants. Report prepared by Environmental Health and Engineering. Available at http://ala1-old.pub30.convio.net/assets/documents/healthy-air/coal-fired-plant-hazards.pdf

[13] USEPA, Nitrogen Dioxides: Health. Retrieved from www.epa.gov/oaqps001/nitrogenoxides/health.html.

- Exposures ranging from 30 minutes to 24 hours to NO_2 (nitrogen dioxide, a NOx compound) reduce pulmonary function, increase respiratory infections and increase sensitivity to compounds that constrict air passages, worsening asthma.

- NOx is a primary cause of ground-level ozone. Long-term ozone exposure is associated with significant increases in respiratory disease, hospital admissions and premature death.

- SO_2 emissions particularly impact adults with asthma, adults who exercise, and those exposed to peak levels of the pollutant for 5-10 minutes. Short-term exposures can result in the narrowing of airways and enhanced asthma symptoms. Children and older persons are also particularly susceptible to SO_2 emissions.

c. Fine Particulate Matter: Burning coal for power is also a major source of fine particulate matter (PM 2.5), the leading cause of death from air pollution[14,15]. Hazardous air pollutants, such as arsenic, beryllium, cadmium, chromium lead, manganese, nickel and other metals are emitted as fine particulate matter directly from coal-fired power plants. NOx and SO_2 react with other pollutants in the atmosphere to create additional fine particulate matter, onto which the minute bits of hazardous air pollutants can adsorb[12].

Smaller than 1/20th the width of a human hair, this fine particulate matter is carried deep into the lungs, where the tiny particles and their cargo of toxins can cross into the blood stream, greatly increasing the risk of heart attacks, strokes and lung cancer[11].

According to one study[16]particulates and oxides of nitrogen and sulfur from coal-fired power plants annually kill more than 24,000 people across the US, including 2,800 from lung cancer, and result in 28,300 non-fatal heart attacks. This study further estimates that the economic impacts in the US of air pollution from coal are between $65.1 and 187.5B annually.

Air Pollution has Real, Negative Outcomes in RGGI states. In Maryland, a study published in 2013 (data from 2005)[14], found that Baltimore had the highest mortality rate from air pollution of all cities in the country. The study found that 130 of every 100,000 residents (> 800 people) were likely to die prematurely each year of causes related to air pollution, more than in New York City, Los Angeles or Washington, D.C.

Who Suffers the Most? Pollutants such as mercury, SO_2 and NO_2 come to ground level very quickly. Because of this, people living near power plants have been found to suffer 2 to 5 times the health impacts of people living farther away[17]. Maryland asthma data from 2010 show that the black population suffers

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USEPA, Sulfur Dioxides: Health. Retrieved from www.epa.gov/airquality/sulfurdioxide/health.html.
USEPA, Particulate Matter: Health. Retrieved from www.epa.gov/airquality/particlepollution/health.html.
[14] Fabio Caiazzo, et. al., Air pollution and early deaths in the United States. Part I: Quantifying the impact of major sectors in 2005, Atmospheric Environment, November 2013, Volume 79, Pages 198-208. Retrieved from www.sciencedirect.com/science/article/pii/S1352231013004548.
[15] Brooke, RD et al. 2010. Particulate Matter Air Pollution and Cardiovascular Disease: An Update to the Scientific Statement From the American Heart Association. Circulation 121:2331-2378. Available at http://circ.ahajournals.org/content/121/21/2331
[16] Paul Espstein, et. al., 2011. Full cost accounting for the life cycle of coal, Annuals of the New York Academy of Sciences, Vol. 1218, Pages 73-98. Retrieved from www.chgeharvard.org/sites/default/files/epstein_full%20cost%20of%20coal.pdf.
[17] Levy JI and JD. Spengler 2002. Modeling the benefits of power plant emission controls in Massachusetts. J. Air & Waste Manage. Assoc. 52:5-18.

disproportionately, with five times as many visits to emergency rooms, three times more hospitalizations and two and a half times more premature deaths than the white population[18].

Reducing CO_2 emissions from power generating units automatically reduces release of the hazardous substances that are so injurious to human health. By lowering RGGI's emissions cap and reducing regional air pollution, RGGI can help decrease the economic and social burden of suffering associated with pollution-related disease.

2. Indirect health impacts of CO_2 emissions resulting from climate change. Increased concentrations of CO_2 and the other greenhouse gases such as methane slow heat loss from the Earth and lead to a net warming of the planet. This is the greenhouse effect. We are already experiencing the consequences of this warming-- rising temperatures cause a suite of impacts including more variable and extreme weather, increased flooding and drought, more common heat waves and fire and the spread of new and existing vector-borne disease. This "new normal" has many impacts on health.

The manifestations of climate change in the Northeast and their health impacts include:

a. Increases in severe and extreme weather. Given the high population density of the coastline from Maryland to Maine, storms and flooding are likely to be very problematic for the RGGI states. Hurricanes and other coastal storms gain energy from the warming ocean, and increasing temperatures cause air masses to hold more water, further increasing storm severity. For every 1°C increase in air temperature, the frequency of storms as damaging as Hurricane Katrina is expected to increase by 200-700%[19,20]. Severe storms cause a host of health impacts, many of which have long-lasting effects:

- **Damaging winds, flying debris and flooding cause injuries.** In addition, damage to hospitals or other infrastructure and widespread power outages are likely to interfere with proper treatment of wounds, while flooding can lead to contamination of public water supplies.

- **Floodwaters can distribute dangerous chemicals or pathogens** across wide areas, contaminating drinking and recreational waters, food crops, stored food and fish or shellfish stocks. In Maryland, flooding on the Eastern Shore has been linked with an increased frequency of intestinal illnesses[21] .

- **Flooding can overwhelm sewage treatment plants and aged sewer systems,** releasing large quantities of sewage into waterways, spreading pathogens, contaminating drinking and recreational water and infiltrating residences. During Hurricane Sandy, 84 million gallons of raw or partially treated sewage was released into Maryland waterways, while nearly 6 billion gallons of sewage was released into waters around New York City[22].

- **Floodwaters can drive rodents and other animals from cover,** increasing the potential for injury and spreading disease[3].

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[18] MDHMH, Asthma in Maryland 2011. Retrieved from http://phpa.dhmh.maryland.gov/mch/Documents/Asthma_in_Maryland-2011.pdf

[19] Climate Nexus, 2015. Hurricanes. http://climatenexus.org/learn/extreme-weather/hurricanes

[20] Grinsted, A. et al, 2015. Projected Atlantic hurricane surge threat from rising temperatures. PNAS 110, 5369–5373, doi: 10.1073/pnas.

[21] Jiang, C et al, 2015. Climate change, extreme events and increased risk of salmonellosis in Maryland, USA: Evidence for coastal vulnerability. Env. Int. 83: 58-62. doi:10.1016/j.envint.2015.06.006

[22] Kenward, A. et al, 2013. Sewage overflows from Hurricane Sandy. Climate Central. http://www.climatecentral.org/pdfs/Sewage.pdf

- **After floodwaters retreat, damp conditions in homes and buildings foster the growth of mold** and mildew in walls and furniture, aggravating asthma and other respiratory problems. In addition, furniture and possessions may be contaminated with bacteria and toxins from floodwaters[2,3].

- **Destruction of residential property can result in large-scale displacement, social disruption and illness**, as documented in New Orleans after Hurricane Katrina, where looting and violence was widespread and inadequate food and sanitation in crowded shelters lead to illness, anxiety and social unrest[23].

- **Hospitals may flood or lose power,** requiring evacuation and preventing chronically ill or injured persons from obtaining required care or medicines.

- **Damage to transportation systems or other infrastructure** may interfere with access to food and medicine and prolong the period of recovery.

b. Dramatic increases in routine tidal flooding. Coastal regions and communities near the Chesapeake Bay are increasingly subject to flooding as sea level rise causes high tides to wash over low-lying areas. Baltimore, Washington, D.C. and Annapolis are among the nation's most flood-prone cities and each will experience a dramatic increase in flood incidence by 2030[24]. All of the risks from flooding after coastal storms also pertain to tidal flooding.

c. Longer and more severe heat waves. Heat is a serious problem in urban areas, where temperatures can be 5-8°F warmer than in suburban areas. Heat stress is particularly serious for children exercising outdoors, the elderly, persons without access to air conditioning and outside workers. Early stages of heat stress can easily be confused with fatigue. If ignored, heat stress can lead to coma and even death[2].

d. An increase in the risk of toxic algal blooms due to warming river and coastal waters, could contaminate drinking water and harm seafood.

e. Droughts. The Mid-Atlantic will experience periodic drought as temperatures warm and weather becomes more variable. Drought will impact Maryland's agriculture and add to the risks of food and water insecurity[25]. Under dry conditions, toxins and pathogens can become concentrated in recreational waters, posing an increased health risk[21]. Moreover, drought and heat together greatly increase the risk of heat stress.

f. Declining air quality as ozone production increases during hot weather, particulates from fires blow through and the concentrations of aerial pollen increase[2]. This will aggravate Maryland's already serious asthma problem, and add to the risk of other respiratory disease, heart attack and stroke.

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[23] American Psychological Association Task Force. 2009. Psychology and Global Climate Change: Addressing a Multi-faceted Phenomenon and Set of Challenges. http://www.apa.org/science/about/publications/climate-change.aspx

[24] Union of Concerned Scientists, 2014. Encroaching Tides: How Sea Level Rise and Tidal Flooding Threaten U.S.East and Gulf Coast. http://www.ucsusa.org/global_warming/impacts/effects-of-tidal-flooding-and-sea-level-rise-east-coast-gulf-of-mexico#.VscpttCgtaU

[25] USDA Northeast Climate Hub. 2015. Northeast and Northern Forests Climate Huba assessment of climate change vulnerability and adaptation and mitigation strategies. Available at: http://www.climatehubs.oce.usda.gov/sites/default/files/Northeast%20Regional%20Hub%20Vulnerability%20Assessment%20Final.pdf

g. An increase in the geographical distribution of insect vectors of disease[2]. Lyme disease is spreading in our region as the ticks, mice and deer are able to survive in greater numbers. In addition, the insect vectors that spread diseases like Dengue fever, malaria and chikangunya are increasingly found in the U.S., including the Mid-Atlantic.

Conclusions. Reducing the RGGI cap by at least 5% annually will allow states to meet their 2030 emissions goals and achieve the deeper reductions in greenhouse gas emissions desired by 2050[5]. Reducing the emissions cap is the single most effective way to limit the economic and environmental risks of climate change, increase human health in the RGGI states, and alleviate the burden of pollution-related disease, all while saving billions of dollars, creating jobs and accelerating the transition to a low-carbon economy.

Thank you.

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