ENVIRONMENT 2045:
Future Directions for Environmental Progress and EPA's Role

A project of American University in partnership with the EPA Alumni Association

Focus Group 1:
Future Environmental Challenges

This report, facilitated and made public by the EPA Alumni Association, was developed by a Focus Group composed of the alumni listed below. The views expressed, including priorities and recommendations, are those of the authors and do not necessarily reflect the views of the Association or its Board of Directors. The Board of Directors did not review or comment on the Focus Group report. This document has not been peer-reviewed.

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1. Introduction

This report provides a summary of what we believe will be the major challenges to environmental protection unfolding over the next 25 years. FG1 members [see list in Appendix A] represent a diverse cross-section of EPA alumni with many years of experience in managing environmental protection activities. Some have authored insightful published articles relating to the FG1 assignment [see appendices for references].

2. Background/History of Issues:

Since its creation, EPA and its many partners have made considerable progress both in improving and protecting the environment in the USA and assisting the global community in addressing environmental and health challenges around the world. Challenges in the future will be driven, in part, by forces outside the direct control of EPA. These mega-trends include increasing population, changing demographics and settlement patterns, competing political ideas, growing affluence, rapidly- changing technology, and related issues such as jobs, the economy, infrastructure, immigration, and trade [see Appendix B for readings regarding future megatrends]. The list of environmental challenges that the U.S. and the world will face in the next 25 years is informed by the United Nations Sustainable Development Goals (SDGs), adopted by U.N. members, including the U.S., in 2015. The 17 SDGs, each with a series of specific targets running to the year 2030, cover a wide variety of future environmental and development challenges. Some of the goals are very directly tied to the challenges that EPA and its partners will face [see Appendix C for more information on the SDGs]. The ideas below from FG1 align with the SDGs.

3. Ideas from Focus Group 1:

In this report the future challenges are expressed from two perspectives---"environmental and sustainability" and related "systems" challenges, the latter being defined for this report as laws, procedures, institutions, or practices on which the operations of EPA depend. FG1 believes that all challenges listed below are important to address. The overarching challenges of most concern to the group are:

- Climate change and its mitigation through emission reductions and response to its multiple impacts [e.g. on water, ecosystems, biodiversity, material resources, health, and infrastructure]
- Sustainable management of water, energy and material resources
- Demonstrating that the environment and a robust economy are mutually supportive
- Ensuring that EPA will have access to, and employ, the best and most relevant science
- Enabling EPA to anticipate emerging environmental threats, provide leadership, and effectively communicate its mission, activities, and science, within and outside the government
- Support of past environmental gains and the scientific and procedural methods which have supported the environmental improvements over the past 50 years [regarding the latter, see http://www.epaalumni.org/hcp/ for reference to the EPA Alumni Association report entitled "A Half Century of Progress for multiple practitioners views on the challenges, actions initiated, and progress made since EPAs inception in 1970].

The views expressed in this report generally reflect those of the individual EPA alumni who participated in the focus group and do not necessarily represent the views of the EPA Alumni Association.

3.1. Environmental and Sustainability Challenges:

Below are ideas representing the major challenges for EPA unfolding over the next 25 years as identified by FG1 in environmental and sustainability terms. FG1 believes strongly that action is needed NOW, or environmental degradation, resource depletion, and scarcity will become limiting factors for economic sustainability and political stability in the future.

a. **Challenge #1 Climate Change:** Humanity has emitted billions of tons of greenhouse gases (GHGs). As a consequence, the resulting global warming has led to significant changes in Earth's climate, which have begun to have deleterious impacts. In order to minimize potentially catastrophic impacts later this century, GHG emission reductions are needed as soon as possible. However, even assuming an aggressive emission control program, climate change impacts will be serious, so that responses necessary to minimize such impacts must also receive serious attention. As a premiere environmental organization respected for its accomplishments around the world, EPA, together with other Agencies with related responsibilities for both the emission mitigation and impact response components, must play critical roles in addressing this monumental problem. On the emission mitigation side, EPA should regulate key GHG sources as soon as possible. In order for the U.S. to reduce emissions consistent with the 2 C global community's goal, GHG emissions need to be reduced by at least 80% by 2050, relative to 2005. Focus should be on power generation, mobile sources and key industrial and agricultural emitters. In addition, EPA should assess low C technologies and CO2 capture activities whose utilization could accelerate the phase out of fossil fuels. On the impact response side, EPA should study the science and relevant projections to attempt to quantify and put timelines around key climate environmental impacts such as rises in sea levels. Other climate change impacts of concern include: increased exposure to air pollution, deadly storms, contaminated drinking water, ocean acidification, ecosystem damage and accelerated species extinction [See Appendix D for related information].

b. **Challenge #2 Energy:** Energy activities will continue to be closely related to climate change. Given the many impacts of energy on the environment [e.g., the impacts of fossil fuel extraction on water, oil spills during transport, local air pollution and climate change resulting from burning fuel]. In the coming decades, Congress will be increasingly challenged to determine EPA's role in the area of energy as a regulator; assisting in promoting renewable energy sources; etc. Since fossil fuel combustion is responsible for most of the current and projected climate change impacts, EPA will need to work collaboratively with Congress, other federal agencies, and other partners to institute policies that will accelerate the phase out of coal, oil and natural gas in favor of low- carbon- emitting and end- use technologies. [See Appendix E for more comments on energy]
c. **Challenge #3 Water Resources:** The nexus between energy, food, and fresh water will increasingly be a major focus in the future, both in the USA and globally. With respect to fresh water, protection from new pollutants and nutrient pollution, addressing the infrastructure deficit, population changes, and equitable allocation of limited water resources, will all be factors that will demand integrated solutions at all levels of 3 government. Climate change will make these concerns even more critical in the coming decades. EPA, the states and local governments, and the private sector will need to work collaboratively to find integrated solutions. To the extent that the federal government does not adequately address the water crisis, local governments may expand their role, as some cities in Florida currently are doing.
d. **Challenge #4 Protection of biodiversity and ecosystems:** On the current track, half of all species could be made extinct by the megatrends outlined above by climate change and by other non-sustainable actions. The protection of ecosystems will take on added importance as we continue to learn about the importance of these systems and biodiversity. Economic valuation of ecosystem services is an ongoing and robust field of research and the evidence is increasingly compelling that environmental services are of high value, particularly in the built environment.
e. **Challenge #5 Sustainable Materials Management:** How society uses materials [i.e., biological/renewable materials such as food, forest products, etc. and nonbiological/non-renewable materials such as metals, minerals] and the products made from them over their life cycles is a key challenge to our environmental and economic future. Over their life cycles – from materials extraction, to production, to product use, to end-of-life management – materials and products have a very wide variety of serious, interconnected environmental impacts, including air, water, waste and habitat destruction. Economic and population growth drive these impacts and also fuel the global competition for finite resources. Global use of raw materials rose at about twice the rate of population growth during the 20th century. Finding ways to use and reuse materials more productively over their life cycles is a major opportunity to improve environmental quality and to make the economy more robust in the coming decades [see Appendix F for more information].
f. **Challenge #6 The human health and environment connection:** The public will continue to want to understand the degree to which the ambient environment may be a cause of the most widespread health issues [e.g., emerging infectious diseases, Alzheimer's], and what methods can be developed to control or mitigate such issues. The connection between the ambient environment, human and animal health will

continue to be viewed as important to understand, especially as it relates threats that may continue to emerge such as low-level toxins, plastics, and nanotechnology. For more information go to http://www.onehealthinitiative.com/.

g. **Challenge #7 Protecting urban residents from environmental impacts:** In the US, environmental infrastructures [e.g., water systems] will continue to wear out. Globally, populations are expected to continue to move to cities in large numbers. This greater concentration of people will continue to put pressures on the ability to address local air, water, and waste issues. EPA will be required to continue to refine their partnerships with local and state governments to ensure the maximum effective use of limited funds and promote smart cities by using integrated systems, social media, artificial intelligence, and emerging technologies to address any inequities in the allocation of resources.

h. **Challenge #8 Protecting the public from new and extreme events, both natural and manmade:** the threats of pandemics, terrorism, mass migration, and war [e.g., nuclear, biological, cyber] will continue to be problems in the future. Other concerns stem from rapidly- developing new products, technologies, and practices such as nanomaterials, genetic engineering, and new chemicals. Although EPA will most likely be one of many agencies responding to these threats, it will surely have a significant role in monitoring, assessing threats, and responding to attacks related to air, water, and waste. This will include the ability to identify these threats in order to minimize damage and using appropriate tools to act on them. Additional regulatory and other actions may be needed to deal with such threats.

3.2. Systems Challenges:

The list of future environmental challenges is very broad and closely interconnected with other national challenges, implying an agenda for EPA that is equally broad and interconnected. EPA can address some of these challenges with its traditional regulatory and scientific tools, but the scope of these challenges is obviously far beyond the ability of EPA to address alone. Strategic partnerships of all kinds are imperative. With this in mind, FG1 believes that along with the environmental and sustainability challenges of the future EPA will find "systems" challenges to also be very important. The following are some of these challenges, as identified by the group:

a. **Challenge #1 Protecting Science and Procedures that have been the Foundation of EPA's Success to date; No "Backsliding":** FG1 believes that EPA and Congress will need to continue to guard against any "backsliding" of environmental gains made to date by protecting science and administrative procedures that have been at the foundation of EPA's success. The Agency will be challenged to effectively demonstrate that environmental policies and regulations be set on the basis of continued progress in science, technology and related risk assessment techniques rather than political considerations. EPA [and other agencies] will need to work with Congress to ensure that effective procedures are maintained, such as those mandated by Administrative Procedures Act (APA) which Congress enacted 72 years ago to guarantee transparent procedures including robust analyses of the impacts of proposed regulations, publishing proposed regulations, opportunities for public comment, responses to major comments before promulgating final regulations and judicial review of the adequacy of the legislative mandate to the regulatory agency and that the due process requirements of the act were fulfilled. FG1 strongly

recommends that past gains be protected by putting in place systems that will fund and promote environmental science and protect science from political interference. [see Appendix G for more details]

b. **Challenge #2 Demonstrating that Environmental Protection and a Robust Economy are Mutually Supportive:** An overarching challenge for EPA in the coming decades will be how to best promote both the environment and economic growth. The supposed 'tradeoff' between economic growth and environmental protection is a false choice. For decades the US and other developed countries have enjoyed economic growth and progressive environmental protection. Ideas that consider the value of ecosystem services, incorporate negative externalities such as environmental degradation, and consider the cost of not protecting the environment should be seriously considered by Congress and EPA. The idea of using a new paradigm of the 'wellbeing economy' to 5 supplement/supplant the GDP should be debated. "Out-of-the-box" solutions should be encouraged by Congressional and Agency leaders benchmarking against experiences from other state, local, and federal US agencies and foreign countries. [See Appendix H for additional thoughts on the economy and the environment].

c. **Challenge #3 Being Leaders in Effective Communications:** The ability to effectively utilize all communication possibilities may well be one of EPA's greatest challenges in the coming decades. The Agency will need to be a leader in strategic and timely communications to ensure that accurate information reaches the public and that all stakeholders are included in decision-making processes. As public expectations continue to grow, the need for greater transparency and better tools for public involvement in environmental decision-making will be demanded. With the expansion of social media and the growing difficulty of identifying sources of valid information on the internet, members of the public need more "trusted portals" to assist in their understanding of the reasons behind environmental policies and actions, and to help inform them about personal decisions that may impact their local environment.

d. **Challenge #4 Supporting EPA Leadership on Global Environmental Issues:** Since many environmental and health issues are not restricted to one country [e.g. air-borne pollutants, plastics in the oceans, hazardous waste exports], EPA leadership on the global environmental stage will be essential in protecting the environment in the USA. To have the needed standing for this leadership, EPA will need to demonstrate scientific and managerial excellence domestically on environmental issues. EPA and Congress should take actions that will result in EPA continuing to be recognized as a world leader in environmentally-related science and policy.

e. **Challenge #5 Forecasting Future Environmental Threats:** In the coming decades the ability to predict environmental threats well before they occur will be needed. Lessons learned from failure to take timely action on critical environmental issues [such as climate change, and plastics in the oceans] should be heeded. New challenges and solutions confronting environmental protection will be driven by such innovations as the ongoing improvements in information technology, in artificial Intelligence, and in nanotechnology. Congress and EPA should consider a system for early identification of environmental/health issues, action to address them, and periodic reports to the public.

f. **Challenge #6 Ensuring Equal Environmental Protection for All:** With shifting demographics and political perspectives, EPA will need to continue to develop systems to ensure equity and environmental justice. Current evidence is compelling that the health and quality of life in communities of color and low-socioeconomic status are harmed by environmental degradation to a greater degree than other communities. Equity issues include the allocation of resources, location of polluting facilities, access to information, and inclusion in decision-making processes.

g. **Challenge #7 Maintaining Organizational and Management Excellence:** EPA is expected to be challenged by the ongoing federal deficits and a rapidly-changing world. The Agency will need to ensure that its staff is engaging in robust professional development and using the latest management tools as part of a culture of a "high-performing" organization. It will also need to ensure that it has an agile organization capable of responding to emerging environmental and health issues.

4. Appendices

4.1. Appendix A – Members of Focus Group 1

Members of Focus Group 1: FG1 authors consist of eleven [11] environmental professionals with over roughly 300 years of diverse experience with EPA and the federal government. They are all now retired from EPA after serving in a broad variety of management and scientific positions in EPA Headquarters, Regional Offices, and Research and Development. In alphabetical order they are as follows with one or more of their EPA positions listed.

Name	**Experience**
Mike Cook	HQ drinking water, wastewater grants and permits, hazardous waste, Superfund
Walter DeRieux	HQ OECA (wastewater and hazardous waste)
Harlan Green	Western Region-Public Affairs, Media/film, multi-media presentations
Alan Hecht	ORD/HQ
Jamie Heller	HQ air and water programs, worked on original effluent guidelines
Vic Kimm	HQ drinking water, pesticides and toxic substances
Stan Laskowski (FG leader)	Region 3 DRA, Superfund, NPDES, water, environmental monitoring
Roger Martella	HQ Office of General Council
Norine Noonan	AA for Office of Research and Development
Frank Princiotta	RTP, Engineering Lab, air and climate change mitigation research
Michael Shapiro	HQ senior manager in OW, OLEM, OSR, OCSPP

Additional insights were provided from Derry Allen and John Reeder.

4.2. Appendix B

Readings on megatrends: The following readings are offered by Alan Hecht: 1-- Past, Present and Future Challenges To Science and Sustainability At EPA: A Review Alan D. HechtOffice of Research and Development, U.S. Environmental Protection Agency Published: 02-25-2016; Copyright: © 2016 Alan ; this paper reviews critical actions taken by EPA since the 1992 Rio Earth Summit to overcome its single media approach to environmental protection and advance the concept and practice of sustainability. Sustainability is defined as both a goal and a process that link economic growth, social well-being and environmental protection 2--Responding to Megatrends for Resilient and Sustainable U.S. Cities Alan Hecht1*, Joyce Stubblefield 2, Keely Maxwell 3; Published: 12-22-2016; Copyright: © 2016 Alan Hecht; a megatrend is a long-term change that affects governments, societies and economies permanently over a long period of time. A number of global megatrends are interrelated in impacting the economic, social and environmental well-being of cities and society today. These include population growth, increases in extreme events and natural disasters, growing environmental and health impacts due to climate change, infrastructure decline, and land use changes Federal, state and business actions to address these trends must be done in a timely and integrated manner. This paper identifies several key EPA actions for advancing a more resilient and sustainable society.

4.3. Appendix C

The United Nations Sustainable Development Goals and their connection with future EPA activities: Derry Allen: Some of the goals are very directly tied to the challenges that EPA and its partners must face, including the following goals-- "(6) Ensure availability and sustainable management of water and sanitation for all, (7) Ensure access to affordable, 7 reliable, sustainable and modern energy for all, (11) Make cities and human settlements inclusive, safe, resilient and sustainable, (12) Ensure sustainable consumption and production patterns, (13) Take urgent action to combat climate change and its impacts, (14) Conserve and sustainably use the oceans, seas and marine resources for sustainable development, [and] (15) Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss." [For the complete list of goals and targets see https://www.un.org/sustainabledevelopment/]

4.4. Appendix D

Climate Change insights from FG1 members: FG1 members offer the following additional thoughts on the climate change issue:

a. **Frank Princiotta:** Pressures spawned by industrialization and population growth have driven unsustainable growth in greenhouse gas (GHG) emissions, yielding global warming. Such warming has now reached 1.1 °C over preindustrial levels. Serious climate change induced impacts have already occurred, and more serious ones are projected. The UN Paris COP agreement is only a small step toward meaningful mitigation. It will only slow emission growth and will not lead to near term aggressive annual emission decreases, which are needed to avoid warming of 2 °C or more. We are losing the battle to protect the planet from unacceptable climate change impacts. To minimize the impacts, the following actions are needed: more aggressive communication of the seriousness of the problem to national leaders and the public, a serious adaptation program, a dramatically expanded RD&D program to accelerate the development of low cost low C technologies, with a focus on

potentially transformational technologies, and a serious commitment to peak global emissions as soon as possible and drastically reduce such emissions annually from that point on. A global agreement to set a price on carbon (C) could be effective in helping to achieve such an aggressive emission reduction trajectory. If warming exceeds 2.5 °C, serious impacts are projected in the agricultural sector, with large areas of cropland becoming unsuitable for cultivation. Also likely are large losses in biodiversity, forests, and wetlands. Desertification would be widespread, with large numbers of people experiencing increased water stress. Human and natural systems would be subject to increasing levels of agricultural pests and diseases with increases in the frequency and intensity of extreme weather events exacerbated by substantial seawater rise. Millions of people would be at risk for premature death due to malnutrition and exposure to tropical diseases. Supporting information is available from: Princiotta, F. (2017). We are losing the climate change mitigation challenge; Is it too late to recover? MRS Energy & Sustainability, 4, E4. doi:10.1557/mre.2017.5 available at https://www.cambridge.org/core/journals/mrs-energy-and-sustainability/article/we-are-losingthe-climate-change-mitigation-challenge-is-it-too-late-torecover/7EABEBD608FC3C651FE75931B19E7157/core-reader and Stern, N.: The Economics of Climate Change: The Stern Review (Cambridge Publications, 2007); p. 57. Available at: http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview_report_complete.pdf

b. **Norine Noonan:** Climate change is inevitable, and, in fact, has already begun to have significant impacts in the US and around the world. While it may yet still be possible to slow 8 the pace of climate change (the upward trajectory of atmospheric CO2 levels), the reality is that mitigation of impacts and adaptation to the effects of global climate change must now be the foci of attention. The cost of doing nothing is great (by some estimates, in the tens of trillions) even with some continuing uncertainty about the exact magnitude of the effects of climate change. 3--Mike Cook, an outline of how EPA could approach climate change: Planning for mitigating the impact of global warming by reducing the underlying causes and adapting to what warming occurs will require a major change in how EPA does business. This new approach should be built on a foundation of multiscale strategic planning that would identify the impacts of climate change and assist with preparation or enhancement of federal, state and local programs to build resilience to and adapt to expected changes to mitigate impacts on health and the environment. The underlying approach would be to work with federal agencies to utilize available data and maps to identify nationally changes from sea level rise, increasing temperatures, more severe storms (including flooding), droughts, forest fires, biological and disease changes and their ancillary consequences from existing or developing data. Mapping layers would also show what's important to protect such as existing infrastructure, housing, important habitat, wetlands, other water bodies and drinking water supplies. These multilayered maps would form the basis for working with other federal agencies, state and local governments and communities to develop more detailed maps at state and local scales which would then form the basis for planning and implementation of efforts to mitigate impacts and build resiliency. EPA's central focus in this multiscale planning would be protection of human health and the environment related to its

responsibilities for air, land and water/wastewater, but EPA's interests would clearly overlap with and require close coordination with other government entities such as those in agriculture, forestry, energy and public health. Existing EPA programs could be adapted to this new planning framework. For example, utilities could be guided by the mapping on what would require attention and resources to continue services, meet drinking water, power and wastewater regulatory requirements and protect or create new green and blue resources such as habitat and water bodies. The maps could facilitate planning for emergency response to anticipated extreme events such as forest fires in areas of drought and flooding in areas of unusual storms. More broadly, the maps could be used by local communities and responsible agencies to design environmentally sound new communities and communities moved to avoid sea level rise and flooding. Done properly, the multiscale planning and implementation could build broad support among the public both for the need for action and investment, and for the agencies promoting it. EPA already has legal authorities to pursue much of this agenda. For example, the NPDES stormwater water program has required utility wide plans to reduce stormwater runoff and impacts. Both section 208 of the Clean Water Act and air legislation authorize broad planning. 9 The multiscale planning would require substantial resources at different levels of government. These resources might be easier to come by with new legislation fostering multiscale planning and implementation. EPA should be thinking about other major changes coming such as population shifts and technology changes. These could be addressed, at least in part, with planning for response to global warming. The consequences of global warming are going to overwhelm governments at all levels without a central focus on planning and mitigation.

4.5. Appendix E

Additional thoughts on energy and EPA [Frank Princiotta]: EPA should build upon its modeling expertise to evaluate various low Carbon incentive programs, such as Climate Lobby's Fee and Dividend program (essentially a price on Carbon) and Cap and Trade policies that could compliment and accelerate the regulatory process in facilitating dramatic reductions in GHG emissions. Such analysis could also identify key potentially transformational low C technologies whose development should be accelerated through financial incentives or federally funded research and development. For example, low cost energy storage technology could accelerate the utilization of wind and solar power generation nationally and abroad. Such modeling capability could allow EPA to productively influence Administration policies on its emission mitigation strategy.

4.6. Appendix F

Additional thoughts on materials management [Derry Allen]: Finding ways to use and reuse materials more productively over their life cycles is a major opportunity to improve environmental quality and to make the economy more robust in the coming decades. Governments and companies are responding, with particular emphasis on the built environment (focusing on roads, buildings and infrastructure), food (focusing on food loss and waste) and packaging (focusing especially on recycling). The opportunities for EPA to advance many aspects of its mission by promoting sustainable materials management in traditional and non-traditional ways are significant. (for more information see EPA website: https://www.epa.gov/smm/sustainable-materials-management-basics and to learn more about the

potential benefits of a lifecycle approach to materials management in Sustainable Materials Management: The Road Ahead.

4.7. Appendix G

Ensuring effective procedures for federal environmental programs [Vic Kimm]: Science: EPA's current practices of ensuring that its decisions reflect mainstream thinking in the related scientific disciplines include using peer reviewed research, employing external review panels of experts without any major economic interest in the issue at hand, and using methodological guidance form leading independent science organizations such as the National Academy of Science and related activities of international bodies such as the World health Organization etc. APA: Major existing pollution control regulations that have produced huge improvements in the quality of our environment over the past 50 years such as the permitting of major emissions and discharges under the Clean Air Act and Clean Water Act must be protected from changes that are not based in sound science. Existing law [APA] provides for judicial review if any party 10 believes that the agency lacks legislative authority for its regulatory action or fails to meet the due process protections requires under the APA. Every President since the 1970s has required that regulatory agencies prepare detailed analyses of the anticipated costs and benefits of the proposed rule for OMB review. These studies have usually shown that the dollar benefits of the environmental rules greatly exceed their associated costs. It is also noteworthy that all of these improvements in the quality of the air we breathe, the water we drink, in the quality of our rivers and streams as well as improvements in how we dispose of hazardous wastes have been attained without major industry –wide economic dislocations as often predicted by EPA's critics. [see Section 4 of the Half Century of Progress Report identified above; it contains the dollar values reported by OMB]. FG1 recognizes that some regulatory activities can be more efficient and the procedures in place can accommodate revisiting existing regulations based on advances in science and technology as long as the due process provisions of the APA are followed. These procedural steps include robust analysis of the impacts of the proposed requirements, formal proposal of the regulation, an opportunity for public comment on the proposal and a final rule that includes responding to all of the major issues raised in the public comments.

4.8. Appendix H

Additional thoughts on the economy and the environment; Harlan Green notes that included in this challenge will be "the cost of not mitigating environmental degradation, e.g., the cost of lost property due to climate change and the ASCE estimate of $2.2T in deferred maintenance and required upgrades that need to be done today, because current public infrastructure more than 75 years old". Alan Hecht offers: "EPA is both an environmental agency and an "Economic Productivity Advocate." EPA will need to increase efforts to find ways to maximize environmental protection at minimum cost.

4.9. Appendix I

Additional insights on communications; Vic Kimm --New applications of Artificial Intelligence (AI) have been described as the beginning of cognitive programming which can enable the development of software capable of reviewing huge amounts of data, detecting trends therein and assessing alternative strategies to ameliorate undesired outcomes as long as the decision logic can also be programmed. In parallel with advances in remote sensing, these advances will become very powerful tools for future environmental policy making related to forecasting,

assessing air and water quality and may offer significant improvements in compliance monitoring and enforcement activities.

4.10. Appendix J

Additional comments on forecasting; Roger Martella offers “The rapid development of technologies in energy, manufacturing, transportation sectors are expected to impact many areas which EPA regulates. It is critical for EPA to have both the scientific expertise and the legal authority to address any such disruptions”