April 22, 2016

COMMENTS OF COUNCIL ON INTELLIGENT ENERGY & CONSERVATION POLICY (CIECP) and PROMOTING HEALTH AND SUSTAINABLE ENERGY (PHASE)

Re: New York Department of Public Service (NY DPS)
Staff White Paper on Clean Energy Standard
CASE 15-E-0302 Large-Scale Renewable Program and Clean Energy Standard

Hon. Kathleen H. Burgess
Secretary
New York Department of Public Service
3 Empire State Plaza
Albany, NY 12223-1350

Via email to: secretary@dps.ny.gov

Dear Secretary:

Preliminary Statement

The State of New York and its energy officials have a genuine opportunity to alter the course of history. You have the chance to help direct America and the world towards a more secure and prosperous future.

This is not hyperbole. Energy is one of the few core realms that directly and powerfully connect to virtually all human endeavor. Energy policy will largely determine whether the planet remains habitable. Energy policy will affect whether future generations are sick or well. Energy policy directly ties to issues of global security and nuclear proliferation.

America is a global economic superpower. New York State is a prime national economy engine. What the New York Public Service Commission does today will reverberate and affect policy and investment decisions around the world.

With vision and resolve, our state can be at the vanguard of a new global energy era.

New York State's Reforming the Energy Vision (REV) is full of fantastic ideas and many programs initiated and proposed are excellent. There are many ways those ideas and the best models can be pulled together under a streamlined, user-friendly schema that is also versatile and adaptable.

But the January 25, 2016 NY DPS Staff White Paper on Clean Energy Standard ("Staff White Paper") contains an egregious flaw which could utterly undermine, not only the enunciated goals of New York's new energy policy, but the primary goals articulated by the nation in the Clean Power Plan and the 195 nations which supported the historic Paris Agreement on Climate Change. (See, https://www.epa.gov/sites/production/files/2015-11/documents/fs-cpp-renewable-energy.pdf and https://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf.)

Hope that a less toxic and more just world may be achievable is inspired by the fact that – on the very day of this filing – nations are signing their commitment to the climate accord in New York at the headquarters of the United Nations.

Notably, the national and international frameworks make allowance for the exigencies of time needed for transition away from dependence on dirty industrial infrastructures. Time is also needed to build and incorporate truly clean, renewable and sustainable forms of energy generation and savings into our regulations and infrastructure.

Yet the exigency of time also presses humanity to prevent climate and environmental disaster.

Both exigencies mandate policymakers use every available modality to push for rapid transformation to a truly clean, renewable, sustainable global energy economy.

You will note that neither the Clean Power Plan nor the United Nations accord describe nuclear power as "clean" or "renewable" or "sustainable" or "zero carbon" or "carbon free" or by any other false euphemism.

For pure economic reasons alone, nuclear should not continue to be supported by the taxpayers and ratepayers. The technology is also dangerous, risky, and threatening to the life and wellbeing of millions of New Yorkers. It generates vast amounts of nuclear waste for which there is no viable solution. Despite over half-a-century of effort, funded by many billions of taxpayer dollars, there is still no solution to the disposal problem. Every year New York's nuclear plants operate they will generate more nuclear waste for which the taxpayers of the nation and state will be responsible.

The indisputable reality is that nuclear power is a highly polluting exorbitantly expensive form of energy generation that imposes shackles the state to an outmoded, inflexible regulatory scheme.

We will respond to the economic fallacies underpinning promotion of nuclear power in a response to the NY DPS Clean Energy Standard Cost Study. Here we focus exclusively on the false characterization of nuclear as zero carbon or as somehow in furtherance of the goal to stem the ravages of climate change.

And we want to place the strongest emphasis possible on the following point: Whatever policy might end up being promulgated in the near term in furtherance of immediate electrical grid reliability needs, resource constraints, or even political necessity, the one thing that absolutely must not be done is for the State to mischaracterize the science.

Nuclear Power is not a zero-carbon form of energy.

Nuclear power is not clean. Nuclear power is not sustainable. Nuclear power is not carbon free.

Nuclear power is a highly-polluting form of power, producing prodigious amounts of long-lived radioactive waste, heat, and greenhouse gases throughout its entire full fuel cycle.

A. Nuclear's Substantial Greenhouse Gas Contribution

Nuclear power contributes substantially to global warming. Unfortunately, the promotional literature and greenwashing ads of the industry have been swallowed by many without considered thought.

Other kinds of pollution (like chemical spills) stay more or less within a geographic region. Greenhouse gasses, however, pollute not because of where they sit, but because they rise into the atmosphere and alter atmospheric conditions. From a climate change perspective, it is entirely irrelevant where an emitter is located.

Therefore climate change analysis of every form of energy generation – and even every energy efficiency technology – must take into consideration all emissions generated throughout the *entire* fuel cycle. If one stage of a particular cycle produces minimal carbon, but every other stage produces prodigious amounts, that industry is a big climate change polluter.

The full fuel cycle shows why nuclear is a poor choice for the planet. Nuclear power is actually a chain of highly energy-intensive industrial processes which – combined – consume large amounts of fossil fuels and generate potent warming gases. These include:

- Uranium mining
- Milling
- Enrichment
- Fuel fabrication
- Transport
- Construction and maintenance of the heavy concrete nuclear reactors and all the other massive industrial structures
- **Emissions of newly created carbon atoms, released into atmosphere as Radioactive Carbon and Methane.**
- Environmental remediation of closed nuclear facilities
- Disposal and burial of voluminous amounts of so-called "low-level" nuclear waste (all the structures and components and materials which are contaminated, but not themselves spent fuel)
- Long-term on-site containment of high-level nuclear waste (spent fuel)

- Permanent disposal of high-level nuclear waste, including the construction and maintenance of all waste depositories

The creation of new carbon during normal plant operation has been ignored in federal regulation. This point must be emphasized: While burning of fossil fuels releases sequestered carbon, **nuclear fission creates new carbon** – carbon that never existed in nature. Nuclear plant carbon generation is described in a 2010 Electric Power Research Institute (EPRI) technical report titled "Estimation of Carbon-14 (C-14) in Nuclear Power Plant Gaseous Effluents."
http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001021106.

In Boiling Water Reactors (BWRs) like FitzPatrick, radioactive carbon is released from the core in volatile form such as Co-14, Co^2-14. In Pressurized Water Reactors (PWRs) like Indian Point, EPRI states: "Carbon-14 is produced in the reactor coolant during power operation, and its production rate increases during the fuel cycle due to increasing neutron flux and ingress of nitrogen. … Analyses of pressurized PWR reactor coolant samples shows that the ^{14}C species are essentially 100% organic, and ~50% of the coolant activity is a volatile species (most likely methane)." (Chapter 4, p 1.) Most of the C-14 – or methane – is released to the atmosphere via plant venting.

What the EPRI does not address is something which – to our knowledge – is utterly unanalyzed by anyone, and that is the additional gas effluent composition created by recent (and increasing) use of high burnup nuclear fuel. Such fuel is hotter and far more radioactive than traditional fuel.

Notably C-14 has a half-life of 5,700±30 years. Also relevant to the climate analysis is the fact that methane is 86 times more powerful a heat-trapper than Co-2 over a 20 year timeframe.

(Not germane to climate, but highly pertinent to human health, is the fact C-14 is prevalent in tritium and readily incorporated into human tissue where it's beta decay can destructively target cells.)

With regard to the mining component of the fuel cycle, it is noteworthy that the fissile form of uranium – U-235 – is found in less than 1% of natural ore. Uranium ore is a finite resource which is expected to become increasingly energy intensive to obtain because most of the globe's easy to access high quality uranium reserves have already been excavated.

Further, the huge energy debt left by nuclear power continues long, long after the reactors have stopped generating electricity.

Leaks, spills and accidental releases have occurred repeatedly at nuclear sites. Many continued for years prior to discovery; over a dozen leaks have seeped from spent fuel pools. (Indian Point is a prime example. Accidental releases from spent fuel pools and other structures at Indian Point included leaks of tritium and strontium into the site soil, groundwater, and Hudson River.) Post-operation cleanup of these sites involves and will increasingly require extensive use of heavy equipment, transportation fuel and electrical energy.

As aging nuclear power plants retire, their most radioactive steel, concrete and other radioactive structures and components remain hazardous for long durations and thus need to be shipped and buried somewhere. Cleanup of a nuclear reactor mandates the dismantling and disposition of every single part of the site.

The vast energy resources which will be needed to safeguard and store high level nuclear waste are, in fact, incalculable.

B. Radioactive Emissions and Leaks

Nuclear power continuously releases radiation into the environment as part of routine operation.

Every nuclear plant site in the U.S. has also had accidental radiation leaks. For example, the aging problem-plagued Indian Point site has had a long series of such leaks into the groundwater, its site soil, and Hudson River. Over the past six months – in November 2015 and February 2016 – two new tritium leaks were discovered. Such leaks are one of the reasons the New York State Department of State has refused to grant the plant coastal consistency certification.

It must be understood, the damage done by New York nuclear plants is not limited to New York. Leaks are despoiling waterways throughout the nation and the front end state of the full fuel cycle (uranium mining, milling and enrichment activities) have despoiled and devastated Environmental Justice communities – particularly Native American reservation areas – for decades. (See, *e.g.*, *Millet, Lydia, Selling Off the Holy Land, New York Times Op-Ed, May 29, 2015. http://www.nytimes.com/2015/05/29/opinion/selling-off-apache-holy-land.html. Moore-Nall, A, The Legacy of Uranium Development on or Near Indian Reservations and Health Implications Rekindling Public Awareness, Geosciences (2015); 5 (1): 15-29. http://www.mdpi.com/2076-3263/5/1/15/htm. Santos, Fernanda, On Parched Navajo Reservation, 'Water Lady' Brings Liquid Gold, New York Times, Jul 14, 2015. http://www.nytimes.com/2015/07/14/us/on-parched-navajo-reservation-water-lady-brings-liquid-gold.html.*)

For the populations affected by accidents and environmental poisonings, the disaster never ends – and, as with Flint, Sandy, Katrina, Fukushima, BP, Church Rock, and innumerable other disasters – impact is ruinous for those who were struggling before the calamity. With nuclear, uniquely, the sheer longevity of radioactivity in the environment, projects health impairment and economic devastation upon untold future generations.

Continuing to look the other way and continue exploitation of public waterways and lands is simply unconscionable.

C. Water Ecosystem Destruction and Thermal Pollution

Water resources are a serious and growing concern. And nuclear power plants impose a heavy burden on river, lake and marine systems. This is *aside from* their radioactive discharges into rivers, lakes, oceans and groundwater.

As the New York State Department of State notes in its November 6, 2015 determination not to grant Entergy's request for a Coastal Consistency Determination for Indian Point, Indian Point is the State's largest industrial water user. Its intake structures withdraw up to 2.5 billion gallons of water per day for cooling, which heats the Hudson River water and kills at least a billion fish, fish eggs and other organisms each year, including endangered fish species. We emphatically urge the PSC to read the NY Department of State's determination in full and extrapolate its findings

to Lake Ontario and other waters impacted by New York's reactors, including those in communities impacted by uranium mining and nuclear waste. *http://www.riverkeeper.org/wp-content/uploads/2015/11/Indian-Point-Consistency-Decision-11062015.pdf*.

Thermal pollution represents an especially negative impact in a warming world. Indian Point, for example, dumps **billions of BTUs of heat** into the Hudson River each day – approximately equivalent to detonation of multiple Hiroshima-sized bombs.

Choices should also be made with serious consideration of the changing weather patterns and strains on the environment climate scientists say nature will increasingly present. Prime among these is water stress. And nuclear is unquestionably the largest user of water among all the available forms of power.

Energy production, land use, agriculture, the ecosystem, and water resources are linked in extraordinarily complex ways. And problems in one area will ripple across multiple sectors. Water resources are a particular area of concern. Droughts – expected to increase even in the Northeast – lead to low-flowing water in lakes and rivers. This reduces both water quality (less dilution for pollution) and quantity.

D. Changing Climate Conditions Make Nuclear Power Less Reliable and More Dangerous

As detailed in our appendices, nuclear reactors are poorly suited for operation in a warming client. They become less reliant and efficient from an energy generation standpoint, and far more dangerous.

On the second anniversary of Fukushima, Naoto Kan – who was Prime Minister of Japan during the nuclear plant disaster – spoke to a New York audience of the moment, at the height of the crisis, when nuclear experts explained the worst case scenario and Mr. Kan realized he might have to order evacuation of the Tokyo metropolitan area. In his words:

"Fifty million people, almost half the entire nation of Japan, abandon homes, leave workplace, schools, hospitals all evacuated… I realized Japan would not be able to function as a nation for a very long period of time … [they couldn't] minimize spread before situation so grave." *(Opening Address, New York Academy of Medicine conference, The Medical and Ecological Consequences of the Fukushima Nuclear Accident March 11, 2013, available at: http://www.beyondnuclear.org/nuclear-power/2013/3/15/helen-caldicott-foundation-and-psrs-fukushima-anniversary-sy.html.)*

Fukushima, it bears mention, was caused by the loss of off-site electric power followed by rundown of temporary on-site backup power. These conditions are precisely those that elevate the risk of all reactors during severe storms or other conditions – like wildfires, hurricanes, snowstorms, droughts, landslides, and floods – which are anticipated to increase in quantity and severity.

A significant distinction about the Fukushima is also highly relevant. Japan was saved by the luck of winds known as Westerlies which blew 80% of the radioactivity released during the crisis phase of the accident out over the Pacific Ocean. High mountain ranges also blocked plumes. Thus the geographic scale of land heavily contaminated was much smaller than the mass

contaminated by the Chernobyl accident, which left 1,000 square miles uninhabitable – it is expected for centuries. Like Chernobyl, New York's reactors are all inland. They are not proximate to an ocean, thus there are no major release accident scenarios with "lucky" winds.

Do we really want to keep rolling the dice?

The odds are only getting worse as New York's old reactors continue to age.

Indian Point, for example, already – in its first 40 years of operation – has had fires; explosions; cooling system malfunctions; emergency sump pump defects; main boiler feed pump breakdowns; water clogged water intakes; safety injection system degradation; boric acid corrosion; nitrogen gas accumulation; hydrogen gas buildup; steam generator accidents; reactor control rod malfunctions; electrical failures; backup generator failures; security system malfunctions; emergency communication system collapses; computer software problems; pipe breaks; and a series of radiation leaks. Over just the past year it had a transformer explosion and fire, sprung a new radiation leaks, and inspection revealed significant deterioration of reactor bolts.

Heavy precipitation and wide temperature swings in the region will likely take a further toll on all of the states aging plants, accelerating corrosion and rusting in buried pipes and cables. Degraded systems could then operate seemingly fine for years, but then fail if stressed by storm or accident conditions.

Climate change exacerbates vulnerabilities.

Drought and too warm cooling supply waters increase the risks associated with the cooling systems of reactors and spent fuel pools. Paradoxically, extreme weather, intense precipitation events and flooding events put nuclear cooling systems at even more risk. This is because such events portend station blackout from the potential loss of offsite power (the direct cause of the Fukushima disaster) and challenge buried site electrical wiring, cables and other systems.

In addition, storms and floods send debris flowing. In February 2007, for example, an "Unusual Event" was declared at Indian Point. The combination of low Hudson River water level, icing conditions, and rushing debris clogged rotating screens used to prevent material from entering the water intake structure. (Entergy's poor maintenance of the screens, the NRC determined, was another contributor.) Divers had to be sent into the frigid Hudson waters to clean out the blockage.

The elevated danger engendered by severe storm conditions was evident during Superstorm Sandy when Indian Point and other plants were forced into emergency scrams.

During heat waves, nuclear plants have been forced to go offline due to overly hot or lowered waterways.

CONCLUSION

If the objective of the NY PSC is to mitigate the effects of climate change, the full degree to which New York's reactors may exacerbate climate change must be taken into consideration. A proper analysis necessarily includes the totality of the greenhouse gases they have, do, and will

contribute to the atmosphere from their full fuel cycle. A proper analysis necessarily includes the totality of nuclear power's their deleterious effects on water and the threat they pose to water security throughout the nation. A proper analysis must account for nuclear's massive BTU contribution. And a proper, honest analysis must reasonably consider the interactive and synergistic effects their toxic emissions pose to ecosystems increasingly vulnerable due to other pollutants and the climate.

Government has long used its money and power to promote nuclear power, coal, and other dirty forms of power. This has been done through massive subsidies and tax incentives, building codes and infrastructure, municipal and education expenditure, regulatory schemes and energy market design.

There is no longer any defensible argument for continuing to prop up extractive forms of power. The burden they impose – upon the environment, human health, and the climate – is increasingly untenable.

There is no longer any ethically excusable rationale for continuing to impose the burden of toxic industries upon impoverished communities, communities of color and Native American populations. Frankly, this aspect of the full fuel cycle of nuclear is flat out immoral.

And as for New York and the nation as a whole: How many more radiation leaks do we want streaming into our water supplies? How much more fission products do we want our children to draw into their lungs and bloodstreams? How many more nuclear waste dumps, Superfund sites, brownfields and hazard zones do we need? How many more cancers and neurological problems and immune disorders are enough?

New York must cease all manner of support for highly-polluting forms of power.

Make the decisions needed and marshal the resources available to accelerate the development of clean energy, distributed generation, and smart end use.

A crucial step is to send a strong signal to the energy markets that New York will no longer shackle itself to nuclear plants. These dirty dangerous lumbering giants are ill-suited to a future energy system which must be agile and efficient. Nuclear plants are a heavy drag on the system because they must run constantly and have to always dispose of their power production, regardless of whether it is needed.

Nuclear and other kinds of outmoded power plants now stand as major obstacles blocking transformation to a sustainable way of living. This opportunity cost is untenable.

The New York Public Service Commission could redirect the course of energy policy in a way that will invigorate our economy today and keep New York safe, clean and prosperous for generations to come.

As citizens, we yearn for our leaders to be bold and visionary and, most of all, determined. We want a declaration that New York will commit itself to achieving the goal, before this decade is out, of *truly* clean energy generation.

The allusion here, of course, is to the challenge President John F. Kennedy made to the imagination of all Americans some 50 years ago:

"We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too." (*President John F. Kennedy, Sep 12, 1962, Rice University, Houston.)*

New York has an abundance of sun, winds, biogases, waters, and tides to harness. Our state infrastructure can be made vastly more efficient and resilient. We have a plethora of great universities, and colleges, and schools filled with new ideas and vitality. We have a workforce that is educated, skilled, and ready for activation.

Please lead us to the future.

Respectfully,

Michel Lee, Esq.
On behalf of the Council on Intelligent Energy & Conservation Policy and Promoting Health and Sustainable Energy

APPENDICES TO COMMENTS OF COUNCIL ON INTELLIGENT ENERGY & CONSERVATION POLICY (CIECP) and PROMOTING HEALTH AND SUSTAINABLE ENERGY (PHASE)

NOTE: These Appendices are intended as an overview of selected reports, studies, analyses, articles, and visuals. Research information is presented in annotated appendix form to support brevity in the core of the filed Comments.

These Appendices are presented in a format we hope may be easy to peruse. We present materials by year and alphabetically by institution or publication, since those factors tend to be more readily recollected by readers unfamiliar with the names of specific researchers and writers in diverse disciplines and news publications.

We have annotated the referenced material with consideration to the reader's time, but, Bracketed synopses of specific points following citations have been the added in consideration of the readers' time, for the purpose of advocacy, and to support points of emphasis in the core of the Comments, and are not intended to be summaries. Whenever possible we include the link to the source and encourage the full review thereof.

Key to References & Sources

References & sources listed by year, and then alphabetically by institution or major publication. United States executive and legislative branch entities are denoted by "U.S." Courts denoted by "Court." National laboratory documents listed under the name of the lab. Other sources,

conference papers and non-publication-affiliated opinion pieces are listed under the name of the author. Internal footnote and table references are excluded.

APPENDIX A

NUCLEAR IS NOT THE ANWER TO CLIMATE CHANGE: FULL FUEL CYCLE ANALYSIS

2016

BULLETIN OF THE ATOMIC SCIENTISTS: Mez, Lutz, Climate protection through nuclear power plants? Hardly, Bulletin of the Atomic Scientists, Feb 18, 2016. http://thebulletin.org/commentary/climate-protection-through-nuclear-power-plants-hardly9170.

[Lutz Mez is from the Berlin Centre for Caspian Region Studies at Freie Universität Berlin.

Reduced carbon emissions mandates the prioritization of energy efficiency and the use of renewable energy technologies and cogeneration plants, which do not cause any more carbon dioxide emissions than nuclear power plants.

From a systemic perspective, nuclear power carbon dioxide emissions connected to production of nuclear energy amounts to (depending on where the uranium used in a reactor is mined and enriched) between 7 and 126 grams of carbon dioxide equivalent per kilowatt hour, according to an analysis by International Institute for Sustainability Analysis and Strategy co-founder Uwe Fritsche. An initial estimate of global carbon dioxide emissions through the generation of nuclear electricity in 2014 registered at about 110,000,000 tons of carbon dioxide equivalent — roughly the carbon emissions of a country like the Czech Republic; and the figure does not even include the emissions caused by storage of nuclear waste.

In the coming decades, full fuel cycle CO-2 emissions tied to nuclear will increase considerably, because high-grade resources of uranium are exhausted and much more fossil energy will need to be used to mine uranium. Thus nuclear power carbon will not even create less carbon than modern gas-fired power plants, let alone compare favorably to the advantages offered by increased energy efficiency or greater use of renewable energies.

Nuclear power plants also emit radioactive isotopes such as tritium or carbon 14 and the radioactive noble gas krypton 85.
Krypton 85 is produced in nuclear power plants and released on a massive scale in the nuclear fuel reprocessing. “The concentration of krypton 85 in Earth's atmosphere has soared over the last few years as a result of nuclear fission, reaching a new record. Krypton 85 increases the natural, radiation-induced ionization of the air. Thus the electrical balance of the Earth's atmosphere changes, which poses a significant threat to weather patterns and climate. Even though krypton 85 is ‘one of the most toxic agents for climate,’ according to German physicist and political figure Klaus Buchner, these emissions have not received any attention in international climate-protection negotiations down to the present.”

Nuclear power plants must be closed quickly “to exert pressure on operators and the power plant industry to redouble efforts at innovation in the development of sustainable and socially compatible energy technologies and especially the use of smart energy services.”]

ECOLOGIST: Diesendorf, Mark, Dispelling the nuclear 'baseload' myth: nothing renewable can't do better! Ecologist, Mar 18, 2016. http://reneweconomy.com.au/2016/dispelling-the-nuclear-baseload-myth-nothing-renewables-cant-do-better-94486.

[Mark Diesendorf, PhD is a physicist and mathematician and Australian academic who focuses and consults in the interdisciplinary fields of energy policy, sustainability theory, and ecological economics. He is author of "Sustainable Energy Solutions for Climate Change," UNSW Press and Routledge-Earthscan, London (2014)

Underlying the claim that nuclear is needed for baseload are three key false assumptions: (1) That baseload power is actually a good and necessary thing. "In fact, what it really means is too much power when you don't want it, and not enough when you do. What we need is flexible power (and flexible demand too) so that supply and demand can be matched instant by instant." (2) That nuclear power is a reliable baseload supplier. "In fact it's no such thing." All nuclear power plants cut off "trip" for safety reasons or technical faults. When they do, their power needs to be matched at moment's notice by more costly power. (3) That the only way to supply baseload power is from baseload power stations, such as nuclear, coal and gas, designed to run flat-out all the time regardless of whether their power is actually needed. That is also wrong.

Inflexible baseload power plants are unsuitable for following the variations in demand and supply on timescales of minutes and hours, so they have to be supplemented with flexible peak-load and slightly flexible intermediate-load power stations.

The assumption that baseload power stations are necessary to provide a reliable supply of grid electricity has been disproven in practical experience in electricity grids with high contributions from renewable energy. (Illustrative cases as well as major computer simulation examples are

Findings published by the US National Renewable Energy Laboratory (NREL) in a 2012 report (*Renewable Electricity Futures Study. Vol.1. Technical report TP-6A20-A52409-1*) which states: *"'renewable electricity generation from technologies that are commercially available today, in combination with a more flexible electric system, is more than adequate to supply 80% of total U.S. electricity generation in 2050 while meeting electricity demand on an hourly basis in every region of the United States.'"* The NREL study also states: *"'RE (Renewable Energy) Futures finds that increased electricity system flexibility, needed to enable electricity supply-demand balance with high levels of renewable generation, can come from a portfolio of supply- and demand-side options, including flexible conventional generation, grid storage, new transmission, more responsive loads, and changes in power system operations.'"*

In actual practice, fluctuations in variable wind and solar PV can be balanced by flexible renewable energy sources that are dispatchable, including gas turbines powered by "'green'" gas from composting municipal and agricultural wastes. In addition, "drawing on diverse renewable energy sources, with different statistical properties, provides reliability. This means relying on multiple technologies and spreading out wind and solar PV farms geographically to reduce fluctuations in their total output. This further reduces the already small contribution from gas turbines to just a few percent of annual electricity generation."

Reliability can be achieved via new transmission lines and introduction of smart demand management to handle demand peaks and periods of low electricity supply. Smart meters and switches controlled by both electricity suppliers and consumers, and programmed by consumers to switch off certain circuits for short periods can help in this endeavor. when demand on the grid is high and/or supply is low.

Transformation to a flexible, renewables-based approach would render conventional baseload power plants unnecessary. This is why industry promoters falsely denigrate renewable energy.

"In the words of former Australian Greens' Senator Christine Milne: '*We are now in the midst of a fight between the past and the future'"*.]

EARTHTECHLING: Kraemer, Susan, How a Hotter Climate Destroys Thermal Electricity Generation, EarthTechling, Mar 30, 2016. http://earthtechling.com/2016/03/how-a-hotter-climate-destroys-thermal-electricity-generation/.

RENEW ECONOMY: Diesendorf, Mark, Dispelling myth of energy payback of renewable energy systems, RenewEconomy, Dec 16, 2013. http://reneweconomy.com.au/2013/dispelling-myth-of-energy-payback-of-renewable-energy-systems-75607.

[Mark Diesendorf, PhD is a physicist and mathematician and Australian academic who focuses and consults in the interdisciplinary fields of energy policy, sustainability theory, and ecological economics. {*Subsequent to this paper he authored "Sustainable Energy Solutions for Climate Change," UNSW Press and Routledge-Earthscan, London (2014)*.}

Life cycle analysis involves calculation of all life-cycle energy inputs, e.g., all the energy inputs from the mining, milling and processing of the raw materials, through the construction, operation and dismantling of the energy conversion system, to the management of the wastes. As the easily accessed reserves of uranium are being used up, more 'difficult' sources are sought (eg, mining low-grade uranium ore) and the energy inputs to the energy system increases.

2015

BULLETIN OF THE ATOMIC SCIENTISTS: Socolow R, Climate change and Destiny Studies: Creating our near and far futures, Bulletin of the Atomic Scientists (2015); 71 (6): 18-28. http://bos.sagepub.com/content/71/6/18.full.

[Robert Socolow, PhD, is co-director of Princeton University's Carbon Mitigation Initiative. He is also a Fellow of the American Academy of Arts and Sciences; Lifetime National Associate of the National Research Council of the National Academies; Fellow of the American Physical Society; and Fellow of the American Association for the Advancement of Science. Along with the ecologist Steve Pacala, Dr Socolow authored "Stabilization wedges: Solving the climate problem for the next 50 years with current technologies" (*Science*, August 13, 2004).

"Destiny Studies encourages examination of the conditions under which the global expansion of nuclear power, as a cure for climate change, is worse than the disease. … In the spirit of {the Hippocratic} oath, if a strict greenhouse target requires casting caution to the wind, it cannot be optimal."

The strongest ways to meet climate challenges for the next 50 years "are to develop wholesome alternatives to fossil fuels; reduce energy demand by ensuring universal 'smart' energy use; remove the attractiveness of nuclear weapons; and come to terms with leaving carbon in the ground."]

ENERGY INTEL: Ramana, MV, Nuclear Power Is No Fix for Climate, EnergyIntel.com, Nov 2015. http://www.energyintel.com/pages/worldopinionarticle.aspx?DocID=906841.

[M.V. Ramana, PhD, is a physicist with the Nuclear Futures Laboratory and the Program on Science and Global security at the Woodrow Wilson School of Public and International Affairs, Princeton University, where he assesses nuclear power programs around the world.

High operational and construction costs make nuclear power uncompetitive with competing sources of electricity. These trends will likely continue for the next decade or more.

Declining costs of renewables have resulted in nuclear power industry uprising against renewables.

"In countries with privatized electricity sectors, nuclear power plants are, and given their high costs, can only be, owned by large electric utilities that profit from monopolies over power supply. Renewables, especially if rooftop solar installations generate a significant fraction of residential electricity consumption, pose a threat to their economic interests. This antagonism is most visible in the US and Japan where utilities have lobbied extensively against tax credits to renewable energy generators and net metering of distributed solar power. As electricity from renewable sources falls in price, this trend will likely only intensify."

Aside from the threat by more economically competitive gas and renewable power sources, nuclear is also burdened by well-known and widespread concerns such as the potential for severe accidents, the linkage to nuclear weapons and the high level nuclear waste.
"These challenges will not disappear and indeed may only grow worse, which is why nuclear's prospects as a significant climate change mitigator are feeble to nonexistent."]

INSTITUTE FOR ENERGY AND ENVIRONMENTAL RESEARCH (IEER), 2013. Makhijani A, IEER Short paper on Nuclear Power and Low-Carbon Alternatives (prepared for the Nuclear Fuel Cycle Royal Commission Public Session of 1 October 2015), Oct 1, 2015 http://ieer.org/wp/wp-content/uploads/2015/10/Nuclear-Power-and-Low-Carbon-Alternatives-Nuclear-Fuel-Cycle-Royal-Commission-1-Oct-2015.pdf.

INSTITUTE FOR ENERGY AND ENVIRONMENTAL RESEARCH (IEER): Smith B, Insurmountable Risks: The Dangers of Using Nuclear Power to Combat Global Climate Change, IEER Press and RDR Books (2015 update of 2006 pub) http://ieer.org/wp/wp-content/uploads/2006/05/InsurmountableRisks_2006.pdf.

NORWEGIAN SCHOOL OF ECONOMICS: Folkestad, Sigrid and Øyvind Lothe, Too warm for power plants, Norges Handelshøyskole (Norweigian School of Economics, NHH Paraplyen, August 5, 2015. http://paraplyen.nhh.no/paraplyen/arkiv/2015/mai/too-warm-for-power-plants/.

[Recent heatwaves have resulted in debate concerning vulnerability and dependency linked to electricity production in thermic power plants, and in particular nuclear power plants. These require cooling water to operate. During periods when temperatures are extremely high, these power plants experience problems relating to their access and use of cooling water.]

STANFORD UNIVERSITY: Stanford engineers develop state-by-state plan to convert U.S. to 100% clean, renewable energy by 2050, Stanford News, Jun 8, 2015. https://news.stanford.edu/2015/06/08/50states-renewable-energy-060815/.

[Reviews 2015 study by Mark Jacobson, PhD, a professor of civil and environmental engineering at Stanford and colleagues showing that all energy use in the US, including transport and heat, could be supplied by renewable – non fossil fuel and non-nuclear – electricity. The computer simulation used data on electricity demand, wind and sunshine.]

WORLD INFORMATION SERVICE ON ENERGY (WISE): Green, Jim, Nuclear power: No Solution to Climate Change, Nuclear Monitor (2015); 806, Jun 25, 2015. http://www.wiseinternational.org/nuclear-monitor/806/nuclear-power-no-solution-climate-change.

2014

CIVIL SOCIETY INSTITUTE and Environmental Groups: Over 300 Environmental and Clean Energy Groups Urge Hansen to Rethink Embrace of Nuclear Power, Jan 8, 2016. Civil Society Institute, et al, Jan 8 2014. Press Release http://www.prnewswire.com/news-releases/over-300-environmental-and-clean-energy-groups-urge-hansen-to-rethink-embrace-of-nuclear-power-239258991.html. Letter of Civil Society Institute and Nuclear Information Resource Service at: http://www.nirs.org/climate/background/hansenletter1614.pdf.

NUCLEAR INFORMATION AND RESOURCE SERVICE (NIRS): Nuclear Energy Is Dirty Energy (and does not fit into a "clean energy standard"), Nuclear Information and

Resource Service Briefing Paper, 2014.
http://www.nirs.org/factsheets/nuclearenergyisdirtyenergy.pdf.

["Proposals to include nuclear power as part of a Clean or Renewable Energy Standard suffer from three fundamental misconceptions: 1) that carbon dioxide is the only pollutant that matters when defining 'clean energy;' 2) that because radiation is invisible and odorless, it is not a toxic pollutant; 3) that nuclear power is carbon-free. None of these is true." (p 1) Report illuminates the fallacies.]

WORLD BUSINESS ACADEMY: Brutoco, Rinaldo S, Nuclear Power: Totally Unqualified to Combat Climate Change, World Business Academy, Sep 14, 2014.
https://worldbusiness.org/nuclear-power-totally-unqualified-to-combat-climate-change/.

[Those who tout nuclear power as a carbon-free solution to global warming "are missing the forest *and* the trees."

First, the forest: nuclear power plants continuously emit low levels of cancer-causing radiation during "normal" operations, and higher levels when there are serious problems such as the continuing leakage of radioactive water from Fukushima. A host of studies show that radioactive emissions increase cancer rates among those who live near the plants, especially in women and children.

"Next, the trees: nuclear power plants are not 'carbon free.'" Their carbon footprint must be assessed on the basis of their complete nuclear fuel life cycle. Significant amounts of fossil fuel are used "in mining, milling, uranium fuel enrichment, plant and waste storage construction, decommissioning, and ultimately transportation and millennia-long storage of waste. There is plenty of carbon in that footprint that is rarely acknowledged, computed, or mediated. In addition, the nuclear industry's false refrain that nuclear power plants have no carbon footprint is an attempt to obscure the fact that nuclear power plants' *radiation footprint* is far more lethal than the carbon footprint of any other industry. Additionally, the industry's rhetoric masks the astronomical costs for thousands of years of storage that could be better invested in rapidly developing renewable fuels with a zero carbon footprint like solar, wind, geothermal, and Ocean Thermal Energy Conversion, which don't carry harmful, let alone lethal, side effects."

Cost is also a prime consideration. "After decades of subsidies, nuclear power still remains the most expensive and non-competitive form of base power generation that takes decades of lead-time before a single electron is produced." In attempting to promote nuclear power, industry advocates focus only on certain limited costs for heavily subsidized fuel, labor, materials, and services that are characterized as "production costs." But these limited costs are just part of the economic picture. "The real challenge facing nuclear power becomes clear when 'life cycle' production costs are compared, including construction, operations, maintenance, fuel, decommissioning, *and* millennial waste storage."

These serious challenges "make nuclear technology a very bad deal."]

2013

RENEW ECONOMY: Diesendorf, Mark, Dispelling myth of energy payback of renewable energy systems, RenewEconomy, Dec 16, 2013. http://reneweconomy.com.au/2013/dispelling-myth-of-energy-payback-of-renewable-energy-systems-75607.

[Mark Diesendorf, PhD is a physicist and mathematician and Australian academic who focuses and consults in the interdisciplinary fields of energy policy, sustainability theory, and ecological economics. {*Subsequent to this paper he authored "Sustainable Energy Solutions for Climate Change," UNSW Press and Routledge-Earthscan, London (2014)*.}

Life cycle analysis involves calculation of all life-cycle energy inputs, e.g., all the energy inputs from the mining, milling and processing of the raw materials, through the construction, operation and dismantling of the energy conversion system, to the management of the wastes. As the easily accessed reserves of uranium are being used up, more 'difficult' sources are sought (eg, mining low-grade uranium ore) and the energy inputs to the energy system increases.

"A useful indicator of net energy generation of a technology is the energy return on investment (EROI), which is simply its lifetime energy output divided by the life-cycle energy inputs. Natural RE inputs – such as the solar energy used to grow biomass used to produce bioenergy – are not usually counted in the energy input. The bigger the EROI, the better. If the EROI is less than one, the technology is a net energy sink rather than a source."

"Another useful indicator is the energy payback period, the number of years that an energy conversion system must operate in order to generate its total life-cycle energy inputs. It is equal to the lifetime of the technology in years multiplied by the ratio of energy input to energy output. Thus it is the lifetime divided by the EROI. The smaller the energy payback time, the better.

Nuclear plants using low-grade uranium take ~14 years of their operational life just 'paying back" the energy it took to build them.

While the calculation of the total energy input is not simple (as decisions have to be made as to where to make a cut-off in what could be an infinite set of inputs), a robust life-cycle analysis calculates inputs up to the point where they become negligible.]

2012

Hynes, H Patricia, Climate Silence, Nuclear Silence and Solar Silence: An Unholy Trinity, Truth-out.org Op-Ed, Dec 5, 2012. http://truth-out.org/opinion/item/12966-climate-silence-nuclear-silence-and-solar-silence-an-unholy-trinity

2011

ENERGY AND WATER IN A WARMING WORLD INITIATIVE: Averyt K, Fisher J, Huber-Lee A, Lewis A, Macknick J, Madden N, Rogers J, Tellinghuisen S, and EW3 Scientific Advisory Committee (Frumhoff P, Hornberger G, Jackson R, Newmark R, Overpeck J, Uda Freshwater Use by U.S. Power Plants Electricity's Thirst For a Precious Resource, Report of the Energy and Water in a Warming Word Initiative, Nov 2011. https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR953.pdf

[Authors are from the University of Colorado-Boulder, NOAA Western Water Assessment; Synapse Energy Economics; Tufts University; Duke University; the National Renewable Energy Laboratory; Union of Concerned Scientists; Western Resource Advocates; Vanderbilt University; University of Arizona and University of Texas, Austin.

Power plants are the largest abusers of water resources in the U.S., consuming trillions of gallons of water per day. Nuclear reactors are the most water-intensive form of power generation, consuming even more water than coal, per unit of energy generated.]

2010

ELECTRIC POWER RESEARCH INSTITUTE (EPRI): Estimation of Carbon -14 (C-14) in Nuclear Power Plant Gaseous Effluents, Electric Power Research Institute Technical Report, Dec 2010. Link to pdf at: http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001021106.

[Nuclear power plants during the process of nuclear fission create and release new carbon.

In Boiling Water Reactors (BWRs), radioactive carbon is released from the core in volatile form such as Co-14, Co^2-14.

In Pressurized Water Reactors (PWRs) like Indian Point, EPRI states: "Carbon-14 is produced in the reactor coolant during power operation, and its production rate increases during the fuel cycle due to increasing neutron flux and ingress of nitrogen. … Analyses of pressurized PWR reactor coolant samples shows that the ^{14}C species are essentially 100% organic, and ~50% of the coolant activity is a volatile species (most likely methane)." (Chapter 4, p 1.)

Most of the radioactive C-14 – or methane – is released to the atmosphere via plant venting. C-14 has a half-life of 5,700±30 years.]

2009

MODERN ENERGY REVIEW: Shrader-Frechette, Greenhouse Emissions and Nuclear Energy, Modern Energy Review (2009): 54-57. http://www3.nd.edu/~kshrader/pubs/final-mod-energy-review-2009-SF_revised2.pdf.

[Kristin Shrader-Frechette, PhD, is a professor in the departments of Biological Sciences and Philosophy at University of Notre Dame. Her research focuses on quantitative (human health) risk assessment, environmental impact assessment and energy policy.

Nuclear is a poor choice for lowering greenhouse gas emissions (GHGEs).

“Citing poor nuclear credit ratings, high nuclear construction costs, numerous plant cancellations, equipment malfunctions, a competitive energy market and a long history of reactor cost over-runs and delayed plants, the World Bank, the European Bank for Reconstruction and Development (EBRD), the Asian Development Bank (ADB), the African Development Bank (AFDB), the European Investment Bank (EIB), the Inter-American Development Bank (IADB) and most other market lenders say nuclear power is ‘uneconomic’; as a matter of policy, most refuse nuclear loans or investments. Consequently, all nations who seek fission-generated electricity must heavily subsidize it. Credit-rating companies also say they downgrade the ratings of any utilities with nuclear plants; they claim that even large, continuing taxpayer subsidies may not make commercial reactors economical.” (p 54)

Assertions that nuclear power is “clean” and “emission-free” are erroneous. Analyses – including those by the Nuclear Energy Institute, the World Energy Council, the Massachusetts Institute of Technology (MIT), and the US Department of Energy (DOE) – ignore or substantially trim full fuel cycle GHGE emissions. Many pro-industry analyses also have fallacies of composition and inconsistency in nuclear emissions assessments.

Accurate evaluation necessarily recognizes that the nuclear fuel cycle has 13 stages – including uranium mining, milling, conversion, enrichment, fuel fabrication, reactor construction, reactor operation, waste processing, waste conditioning, radioactive waste storage during its high-temperature period, nuclear waste transport, reactor decommissioning, permanent storage of radioactive waste and uranium mine reclamation. “Each of these 13 nuclear-fuel-cycle stages creates high levels of GHGEs in using mainly fossil fuels for raw materials, product output and radioactive waste storage transport.” (p 54)

Proper analyses done by independent university scientists, on the other hand, use current, referenced, published, empirical data on nuclear facility lifetimes: efficiency (load factors), enrichment methods, plant types, fuel grades, and so on.

Industry assertions also disregard the fact that, even as of 2009, renewable-energy technologies (such as wind and solar), conservation and efficiencies are all much cheaper than nuclear power and produce fewer emissions. Even DOE projections reflect that adding wind power generation is, on average, more than 3 times cheaper over 7 years than nuclear and solar photovoltaic is far less expensive. DOE claims renewable energy technology could provide 99% of US electricity by 2020. “How? Wind and solar intermittencies can be solved by mixed power sources and wide geographical distributions of energy facilities so that, somewhere, wind is blowing or sun is shining. Offshore winds virtually always blow. Wind is often also available at night, while solar is often available in daytime.” (p 56)

Strong evidence suggest nuclear power has historically and continues to be sought by nations to enable a nuclear weapons option. “US government officials (such as the Chair of the Joint Committee on Atomic Energy) and nuclear scientists (such as J. Robert Oppenheimer) admit that the US wanted a ‘peaceful’ excuse for continued weapons development.” (p 56)]

2008

ENVIRONMENTAL SCIENCE & TECHNOLOGY: Mudd GM and Diesendorf, Sustainability of Uranium Mining and Milling: Toward Quantifying Resources and Eco-Efficiency, Environmental Science & Technology (2008); 42: 2624-2630. http://pubs.acs.org/doi/pdf/10.1021/es702249v.

[Report by Australian academics – Gavin M. Mudd of Monash University and Mark Diesendorf of University of New South Wales – challenges nuclear power as either a sustainable or a low carbon energy source to replace fossil fuels. Full fuel cycle analysis suggests greenhouse emissions from the mining of uranium are high and on the rise as most of the most easily mined uranium reserves dwindle.)

NUCLEAR INFORMATION AND RESOURCE SERVICE (NIRS): Mariotte M, D'Arrigo D, Olson M, Binette A, and Keesing D, False Promises: Debunking Nuclear Industry Propaganda, Nuclear Information and Resource Service report, May 2008. http://www.nirs.org/falsepromises.pdf

[Nuclear power is dangerous, promotes proliferation and is not a solution to climate change. Indeed it is vulnerable to severe climate conditions which prevent reliable operation. Nuclear does not lead to greater energy security or energy independence. Nuclear waste remains a problem without a solution. Even routine operations of reactors result in toxic emissions.]

2007

GREENPEACE: Climate Change – Nuclear not answer, Greenpeace Briefing, 2007. http://www.greenpeace.org/international/PageFiles/24507/briefing-nuclear-not-answer-apr07.pdf.

["The future of the planet's climate, the lives and livelihoods of billions of people depend on the energy generation choices being made today. We have the opportunity to stabilize climate change, end the nuclear nightmare and tackle the inequity of fuel powerty afflicting one in three people on the planet. … For the planet and its people we must all make the right choice. We must choose efficient and safe renewable energy sources over dirty and dangerous nuclear power."

OXFORD RESEARCH GROUP: Barnaby F and Kemp J, Too Hot to Handle? The Future of Civil Nuclear Power, Oxford Research Group Briefing Paper, Jul 2007. http://www.nuclearconsult.com/docs/information/proliferation/TOOHOTTOHANDLE.pdf

OXFORD RESEARCH GROUP: Barnaby F and Kemp J, eds, Secure Energy? Civil Nuclear Power, Security and Global Warming, Oxford Research Group Briefing Paper, Mar 2007. http://www.oxfordresearchgroup.org.uk/sites/default/files/secureenergy.pdf. http://www.oxfordresearchgroup.org.uk/publications/briefing_papers/secure_energy_civil_nuclear_power_security_and_global_warming

[Nuclear power is not only very and uniquely dangerous when compared to other energy sources. Risks include those attendant to radioactive waste and the threats from terrorist groups.

But notably, full fuel cycle analysis shows that nuclear cannot provide the level of carbon reduction needed to avert climate change. The claim of the nuclear industry that nuclear power emits low levels of CO2; and other greenhouse gases is not based on scientifically verifiable evidence.

Carbon emissions are a global problem and evaluation of any form of energy generation needs to take into account for the carbon released into the Earth's atmosphere by the full fuel process says Jan Willem Storm van Leeuwen, author of the report's chapter on carbon emissions. A chapter written by the scientist and energy and climate expert Jan Willem van Leeuwen concludes that nuclear will become more carbon polluting over time. The reason is that it will become more energy intensive to mine extract uranium ore and store nuclear waste.]

2006

FRIENDS OF THE EARTH: Nuclear Power Can't Save the Climate, Friends of the Earth Europe press release, Nov 7, 2016.

[Nuclear power remains the most dangerous form of energy and it condemns the world to catastrophic climate change.]

GRACE ENERGY INITIATIVE: Cullen S, Fernandes D, and Carr J, False Promises: Debunking Nuclear Industry Propaganda – Nuclear Power Is Not the Answer to Climat Change, GRACE Energy Initiative report, Oct 2006.

NEF ECONOMICS and FEASTA: Fleming David, Why Nuclear Power Cannot Be A Major Energy Source, nef (NewEconomics) and feasta, paper, Apr 2006. http://www.feasta.org/documents/drafts/Fleming_nuclear_draft.pdf.

[David Fleming, PhD, an economist, reviews how quantities of fossil energy are used in nuclear power's full fuel cycle. Every stage in the process of supporting nuclear fission uses energy, and most of this energy is derived from fossils fuels.

Paper reviews the extractive and milling processes in detail and notes: “Once radioactive rocks have been disturbed and milled, they stay around to cause trouble. Their radioactive products are free to be washed and blown away by rain and wind.”

“It takes a lot of fossil energy to mine uranium, and then to extract and prepare the right isotope for use in a nuclear reactor. It takes even more fossil energy to build the reactor, and, when its life is over, to decommission it and look after its radioactive waste.”

“Nuclear power is therefore a massive user of energy and a very substantial source of greenhouse gases.”

There is a limited amount of uranium ore in the world rich enough to allow more energy to be produced by the whole nuclear process than the process itself consumes. The ultimate waste product, high level nuclear waste, will remain radioactive for millennia, requiring even more energy to sequester.]

PUBLIC CITIZEN: Nuclear Power and Global Warming, Public Citizen brief, Apr 2006. http://www.citizen.org/cmep/article_redirect.cfm?ID=13872.

[“The vast majority of public interest and environmental groups are adamantly opposed to nuclear power. Not a single environmental group advocates for more nuclear plants.]

2005

CENTER FOR HEALTH, ENVIRONMENT, AND JUSTICE, et al: Environmental Statement on Nuclear Energy and Global Warming, Environmental groups statement, Jun 2005. http://www.citizen.org/documents/GroupNuclearStmt.pdf.

[Statement endorsed by over 300 national, state, and local organizations flatly rejecting the argument that increased investment in nuclear capacity is an acceptable or needed response to climate change.]

APPENDIX B

NUCLEAR IS NOT THE ANWER TO CLIMATE CHANGE: WATER USE AND EXPLOITATION

2016

CANADIAN ENVIRONMENTAL LAW ASSOCIATION (CELA): Jackson, John, Radionuclides as a Chemical of Mutual Concern in the Great Lakes Basin, Canadian

Environmental Law Association report (Feb 2016)
http://www.cela.ca/sites/cela.ca/files/Radionuclides-CMC.pdf.

[Report delineates the inadequacies of US and Canada efforts to track and monitor toxic radionuclides in the Great Lakes basin, which is burdened with more than 30 sites which generate anthropogenic radionuclides. Many of these are associated with nuclear power generation. These include open and closed nuclear power reactors, nuclear fuel processing facilities, old uranium mines and their tailings, and spent fuel and radioactive non-fuel wastes.

There is no comprehensive monitoring of radionuclides in Great Lake waters and the governments have failed to study and assess the cumulative impact of these nuclear facilities and waste sites on the lakes.

Cancer is the most commonly noted health effect from ongoing long-term exposure to low levels of radiation, with childhood leukemia of particular concern. However sever non-cancer effects also result from exposure to radiation. These can be teratogenic mutations which directly affect a fetus and can cause developmental problems and birth defects. Radiation can also result in genetic mutations which impact future generations, even those not directly exposed. The fact that some radioactivity is "natural" is inapposite. Current scientific understanding holds there is no dose threshold below which radiation is safe – the so-called "no-threshold" concept – and strong evidence supports a "linear-no-threshold" model whereby each additional exposure, even if small, is understood to present increased risk.

As the United Nations Scientific Committee on the Effects of Atomic Radiation has noted: "'there is a need to better understand the chronic effects at a multigenerational time scale, chronic effects for multiple stressors, and the propagation of effects at the molecular and cellular levels to higher levels of ecological organization.'" (p 5) In assessment of environmental impacts, Environment Canada concluded: "'releases of uranium and uranium compounds contained in effluent from uranium mines and mills are entering the environment … in quantities or concentrations that may have a harmful effect on the environment and its biological diversity.'" (p 6)

Many of the nuclear sites in the region are closed but the remaining facilities with their "contaminated structures and wastes that were generated while the facility or mine was in use may remain there for decades with ongoing discharges as well as the threat of failure or breach of waste containers and more sudden release." (p 7)

Even in the absence of an accident or spill, each of the nuclear facilities are releasing radionuclides to the environment every day. On the US side, the amount of spent fuel being held in Great Lakes basin nuclear facilities is estimated at 13,825 tonnes (as of 2011).

It takes a million years for radioactivity from high-level nuclear waste to return to natural ore radioactivity levels and 200,000 years for the decay heat to dissipate.
Many radionuclides fit the definition of "persistent and toxic substances" under the US-Canada Great Lakes Water Quality Agreement of 2012. (pp 13 & 16) CELA accordingly calls for the nations' to jointly designate radionuclides as "chemicals of mutual concern" according to their responsibility under the agreement. As articulated in the agreement, particular emphasis should be placed on the following listed principles: "'ecosystem approach,' 'polluter pays,' 'precaution,' 'prevention,' 'science-based management,' 'sustainability,' 'virtual elimination,' and 'zero discharge.'" (p 18)]

Chin DA, The Cooling-Canal System at the FPL Turkey Point Power Station, David A. Chin, PhD, PE, DWRE, BCEE, Professor of Civil and Environmental Engineering, University of Miami, report, 2016. http://www.miamidade.gov/environment/library/reports/cooling-canal-system-at-the-fpl-turkey-point-power-station.pdf.

[Reporting on measured increase in average temperature at the Turkey Point nuclear plant's cooling canal system (CCS).

Up to 100 million gallons per day are pumped from a canal into the CCS. (p 39)

"There has been a steady increase in CCS salinity of around 5% per decade since the CCS began operation in 1973. Recent measurements indicate that the rate of change of salinity might be increasing. … Based on available documentation and data summaries contained in numerous reports prepared by FPL, SFWMD, and DERM, there is little doubt that seepage from the CCS into the Biscayne Aquifer has caused salinity increases within the aquifer, and this impact extends several miles inland from the CCS. The strongest evidence for this assertion comes from the analysis of tritium data. … Elevated concentrations of tritium above a 20 pCi/L threshold in the deep groundwater can reasonably be attributed to the presence of water originating from the CCS." (p 2) Tritium at 20 pCi/L concentration has been reported to be 3.8 – 4.7 miles west of the nuclear site.

A significant algae bloom occurred in the CCS in 2014 and algae continues to be a problem.

"This study confirms that long-term salinity increases in the CCS are caused by evaporation rates exceeding rainfall rates." (p 44)]

COUNTERPUNCH: Kamps, Kevin, After Flint, Don't Let Them Nuke the Great Lakes, Counterpunch, Jan 26, 2016. http://www.counterpunch.org/2016/01/26/after-flint-dont-let-them-nuke-the-great-lakes-next/.

ECOWATCH: Kamps, Kevin, The Great Lakes and a High-Level Radioactive Nuke Waste Dump Don't Mix, EcoWatch, Jan 28, 2016. http://ecowatch.com/2016/01/28/great-lakes-nuclear-waste-dump/.

ENERGY MATTERS: Witherspoon, Roger, Indian Point Contaminates the Hudson River With Uncontrollable Radioactive Flow, Energy Matters, Feb 13, 2016. http://bit.ly/1Qd73lS

[Most nuclear plants in the US have had accidental radiation leaks.

Article focuses on radiation leaks at Indian Point. Two key points: (1) The Hudson River is a source of drinking water for some river towns. (2)The amount of radioactive isotopes released by accidental leak events are a small fraction of what the nuclear plant legally releases every year. Article contains a NRC graphic of a tritium leak into the groundwater discovered in 2016.]

ENVIRONMENTAL RADIOACTIVITY: Kaltofen MP, Alvarez R, and Hixson L, Tracking legacy radionuclides in St. Louis, Missouri, via unsupported ^{210}Pb, Journal of environmental Radioactivity (2016); 153: 104-111.
http://www.sciencedirect.com/science/article/pii/S0265931X15301685

[Authors are from the Boston Chemical Data Corp and the Institute for Policy studies.

Legacy nuclear processing wastes are a serious problem at numerous sites in the US. At least 90 legacy management and sites are situated in 29 states, many of which have necessitated extensive cleanup efforts.

One such legacy site is in the St. Louis, Missouri region. Uranium ore processing wastes from were disposed of around Greater St. Louis area and are being redistributed by surface waters and by winds. Public reports "document a convoluted history of waste generation, transportation, and temporary storage followed by commercial sales of wastes, reprocessing and disposal in a municipal landfill." However no detailed waste characterization or inventory exists.

Sites in the chain of facilities used for the disposal of radioactive legacy wastes is the West Lake Landfill, which holds significant amounts of long-lived radiotoxic wastes, but meets virtually none of the legal requirements governing shallow radioactive waste disposal to prevent offsite migration. Runoff from the West Lake Landfill is the Missouri River upstream of its confluence with the Mississippi River. The receiving water body for other uranium chain sites analyzed is Coldwater Creek, whose downstream floodplain is heavily developed for residential and commercial uses.

In this study, the research team found: "Isotopes of uranium and thorium reach high levels in sediments around Coldwater Creek. More disturbingly, indoor dusts in homes adjacent to Coldwater Creek have potentially higher levels of uranium and thorium than those found in sediments at known disposal sites."

The researchers also report detection of unsupported 210Pb (lead) near the legacy uranium processing waste landfill. The beyond expected atmospheric deposition suggests that offsite migration of radiological contaminants from legacy uranium processing wastes has occurred. (Lead was used as a marker for radon entering the environment from the buried uranium and radium-containing wastes.)

Specifically, authors' analysed 287 offsite soil, sediment and house dust samples collected in a 200 km2 (~124 sq mi) zone in northern St. Louis County, a populated area. They found that 48% of samples contained 210Pb concentrations above the risk-based soil cleanup limits for residential farming established by the DOE at an Ohio uranium plant storing the same type of uranium wastes. In St. Louis County, 210Pb levels in key samples were well above background activities and were significantly out of equilibrium with other members of the uranium decay

chain; strong evidence that the 210Pb originated by decay of short-lived, fugitive radon gas escaping the landfill. Also 210Pb levels were highest in areas known to be contaminated with wastes from the Mallinckrodt uranium processing wastes.

Authors contend: “Given the importance of radon releases from soils to air as a vector for public exposure to radioactivity, increasing the density and frequency of radon measurements around the West Lake Landfill should be an important priority.” Authors warn that if the West Lake Landfill fire were to intrude upon areas with buried uranium-processing wastes, radon emissions could increase further.]

MIAMI-DADE COUNTY: Mayor Gimenez, Carlos A, Memorandum to Board of County Commissioners re Report on Recent Biscayne Bay Water Quality Observations associated with Florida Power and Light Turkey Point Cooling Canal System Operations – Directive 152884, Mar 7, 2016. http://www.cleanenergy.org/wp-content/uploads/MiamiDade_DERMReportonRecentBiscayneBayWaterQualityObservations_030716.pdf.

[Water contaminated with tritium, ammonia water from the Turkey Point nuclear power station’s cooling canal system “is migrating outside the boundaries of the Cooling Canal System away from the Turkey Point facility property with impacts measured in both surface and groundwater.” (p 5)

“Over the past five-year period, tritium levels in the Cooling Canal System typically ranged between 1,200 and 16,500 picocuries (measurement of radioactive elements) per liter (pCi/L), while levels for tritium in the surface waters of Biscayne Bay were typically less than 20 pCi/L.” (p 4)

Sampling results also showed higher than normal salinities and temperatures as well as higher than expected levels for chlorophyll, a potential indicator of algal bloom. Observed increases coincide with increases in the water stage within the Cooling Canal System. (Excess salinity is caused by dissolved salts remaining from evaporation of the nuclear plant’s heated waste water.)

The Nuclear Regulatory Commission, in 2014, gave Turkey Point approval for a new intake operating temperature limit of 104°F.]

NEW YORK: Cuomo, Andrew M, governor of New York, Letter to Basil Seggos, New York Department of Environmental Conservation Acting Commissioner, and Howard Zucker, New York Department of Health Commissioner, Feb 6, 2016. https://www.governor.ny.gov/news/statement-governor-andrew-m-cuomo-regarding-indian-point-nuclear-facility.

[Governor Andrew Cuomo writes: “Yesterday I learned that radioactive tritium-contaminated water leaked into the groundwater at the Indian Point Nuclear facility. The company reported alarming levels of radioactivity at three monitoring wells, with one well’s radioactivity increasing nearly 65,000 percent.”

Gov. Cuomo directs Department of Environmental Conservation Acting Commissioner Basil Seggos and Department of Health Commissioner Howard Zucker to fully investigate this incident and take all available measures "to determine the extent of the release, its likely duration, cause and potential impacts to the environment and public health."]

NEW YORK TIMES: Alvarez, Lizette, Nuclear Plant Leak threatens Drinking Water Wells in Florida, New York Times, Mar 23, 2016. http://www.nytimes.com/2016/03/23/us/nuclear-plant-leak-threatens-drinking-water-wells-in-florida.html.

[Some 40 years after the Turkey Point nuclear plant began operation in Florida, the reactors' cooling canal system has been found to be leaking radioactive tritium and other contaminants into Biscayne Bay.

County officials and environmentalists are alarmed that the coastal nuclear plant is polluting the bay's surface waters and its fragile ecosystem. Since 2014, waters near the plant have produced a large saline plume (also containing ammonia, phosphorous and tritium) which is slowly moving toward wells miles away that supply drinking water to millions of residents in Miami and the Florida Keys.

In February, after a Florida rock mining company sued Florida Power & Light over the saltwater plume, a Florida administrative judge determined the reactor cooling canal system to be "'the major contributing cause' for the growth of the large underground saltwater plume and for its westerly move toward the drinking water well fields. The Biscayne Aquifer, the judge noted is an "'important natural resource.'" The aquifer is the County's main source of drinking water and is vital to irrigation and the marsh wetland communities.]

NUCLEAR INFORMATION AND RESOURCE SERVICE (NIRS): Abusing our Waters. Nuclear Power Threats to Water and Ecosystems, Nuclear Information and Resource Service, Briefing and Webinar, Apr 18, 2016. www.nirs.org.

PROCEEDINGS OF THE ROYAL SOCIETY BIOLOGY: Van Houtan KS, Andrews AH, Jones TT, Murakawa SKK, and Hagemann ME, Time in tortoiseshell: a bomb radiocarbon-validated chronology in sea turtle scutes, Proceedings of the Royal Society B (Biological Sciences) (2016); DOI: 10.1098/rspb.2015.2220. Abstract. http://rspb.royalsocietypublishing.org/content/283/1822/20152220. {*See also* NEW YORK TIMES: Nuwer, Rachel, Nuclear Clues to a Turtle's Decline, New York Times Science, Jan 26, 2016. http://www.nytimes.com/2016/01/26/science/sea-turtles-hawksbills-shells-nuclear-blasts-radiation.html.}

[Scientists at Duke and the National Oceanic and Atmospheric Administration (NOAA) used radiocarbon from mid-20th century atomic bomb testing as an environmental marker to ascertain information about the lifespan, growth rates, and maturity of endangered Hawksbill turtles.

The radioactive carbon-14 (C-14) accumulated in the turtles' shells through their diet.

The findings indicated that, in recent decades, the diet of the species population in the Pacific off Hawaii – traditionally omnivores, consuming sponges and crustaceans – had shifted towards vegetation at the bottom of the food chain. Authors hypothesize the change is due indirectly to coral reef deterioration which has led to declines of other species in the ecosystem.]

U.S. BUREAU OF LAND MANAGEMENT: Abandoned Mine lands Portal, accessed from web Apr 20, 2016. http://www.abandonedmines.gov/wbd_um.html.

[EPA has identified 15,000 abandoned uranium mine locations in 14 states, with about 75% on federal and tribal lands. Most legacy abandoned uranium mine sites used conventional (open pit and underground) methods. With the drop in market price of uranium in the 1980s, mining operators turned to in-situ leaching operations to extract uranium from ore. (In-situ leaching involves injecting solutions that will dissolve the uranium from the ore directly into the ground and then pumping out the uranium containing solution).]

U.S. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA): State of the Climate: Global Analysis – Annual 2015, NOAA National Centers for Environmental Information Report, Jan 21, 2016. http://www.ncdc.noaa.gov/sotc/global/201512. http://www.ncdc.noaa.gov/sotc/global/201513.

[NOAA analysis show 2015 set record-breaking warmth with 0.90°C (1.62°F) above the 20th century average. This easily surpasses the previous global warmth record set by 2014.

"The 2015 temperature also marks the largest margin by which an annual temperature record has been broken." This marks the 39th consecutive year (since 1977) that the annual temperature has been above the 20th century average. In addition, 15 of the 16 warmest years on record have occurred in the 21st century (with 1988 being tied with 2009).

Much of the record warmth for the globe can be attributed to record warmth in the global oceans. Three all-time new monthly high global ocean temperature records were set in 2015 (with 2014 previously setting 3 ten all-time records).

The western part of the contiguous US experienced record and near-record heat during much of 2015. At the end of March 2015, drought remained entrenched in the western US, where mountain snowpack was record low for many locations in the Cascade and Sierra Nevada Mountains. Moderate to exceptional drought conditions were present across more than 98% of California.]

WATER RESOURCES PLANNING AND MANAGEMENT: Goharian E, Burian S, Bardsley T, and Strong C, Incorporating Potential Severity into Vulnerability Assessment of Water Supply Systems under Climate Change Conditions, Journal of Water Resources Planning and Management (2016); 142 (2). Abstract. http://ascelibrary.org/doi/abs/10.1061/%28ASCE%29WR.1943-5452.0000579.

[Authors are from the University of Utah and the Western Water Assessment. The Journal of Water Resources Planning and Management is a publication of the ASCE (American Society of Civil Engineers).

Vulnerability assessment of water resources systems has typically been based on quantifying the severity of the failure. This technical paper introduces an approach to assess vulnerability that incorporates a new set of factors which arise as the result of climate change.

Their integrated modeling framework involves a composite hydrologic model and systems model driven by temperature and precipitation data for the 30-year (2036–2065) period using 5 simulation combinations of warm or hot, wet or dry, and central tendency projections derived from the World Climate Research Programme (WCRP)

Compared to modeling based on historic climate behavior, the analysis results show that basing vulnerability analysis based on the typical vulnerability metric of severity alone may lead to an incorrect quantification of system vulnerability. Severity incorrectly provides low magnitudes under the projected future warm-wet climate condition. The proposed new metric reveals vulnerability to be high because it accounts for additional factors. Sensitivity analysis (SA) illuminates the impact and importance of various factors on the vulnerability of the system under different climate conditions.

“The new metric provides a comprehensive representation of system vulnerability under climate change scenarios, which can help decision makers and stakeholders evaluate system operation and infrastructure changes for climate adaptation.”]

2015

BEYOND NUCLEAR: Leak First, Fix Later, Beyond Nuclear report, Mar 2015. http://static1.1.sqspcdn.com/static/f/356082/26211376/1431107993237/LeakFirst_ReportLater_BeyondNuclear_March2015.pdf?token=Z5FjPguBOf%2FT3Poo9wXK7tF2Sc4%3D

CENTER FOR WATER-ENERGY EFFICIENCY ANALYSIS: Spang E, A Thirst for Power, University of California, Davis’s Center for Water-Energy Efficiency analysis, Feb 27, 2015. http://cwee.ucdavis.edu/research/a-thirst-for-power/.

[Report by Edward Spang of the Center for Water-Energy Efficiency at University of California, Davis, emphasizes the fundamental interrelation between water and energy resource systems.

“Understanding the water demand of energy systems is fundamental to overall national water security, since producing energy requires fresh water. While agriculture dominates water demand in many regions of the world, the energy sector has become a major competitor.” Security of a freshwater supply therefore requires reducing the ways energy systems impact water use and supply.

“By benchmarking water consumption for energy to standard measures, policy makers can better understand and track the status of this coupled system,” the report notes. It adds, “Just as

monitoring greenhouse gas emissions is the first step to transforming energy portfolios to mitigate climate change, improved indicators for water consumption is required to balance the water impacts of long-term energy planning."]

ECOSPHERE: Allen CD, Breshears DD, and McDowell NG, On underestimation of global vulnerability to tree mortality and forest die-off from hotter drought in the Anthropocene, Ecosphere, ESA Centennial Paper (2015); 6 (8): Art 129. http://www.esajournals.org/doi/pdf/10.1890/ES15-00203.1.

[Authors are with the U.S. Geological Survey and the Earth and Environmental Science Division at Los Alamos and the School of Natural Resources and the Environment and Department of Ecology and Evolutionary Biology at the University of Arizona. Hot drought – or "hotter drought" – climate phenomenon is an emerging characteristic of the Anthropocene epoch.
Global vulnerability drivers that are known with high confidence include: (1) droughts eventually occur everywhere; (2) warming produces hotter droughts; and (3) atmospheric moisture demand increases nonlinearly with temperature during drought.

Authors aver: "Based on our review of contrasting perspectives, it appears that the future vulnerability of forests globally is being widely underestimated, including the vulnerability of forests in wetter regions." (p 26)]

NATIONAL ACADEMY OF SCIENCES (PNAS): Mazdiyasni O and AghaKouchak A, Substantial increase in concurrent droughts and heatwaves in the United States, Proceedings of the National Academy of Sciences (PNAS) (2015); doi: 10.1073. Abstract. http://www.pnas.org/content/early/2015/08/27/1422945112.

[Scientists with the Center for Hydrometeorology and Remote Sensing, Deparment of Civil and Environmental Engineering at the University of California, Irvine, analyzed meteorological drought data (1960 to 2010). They stress that climate extremes can cause special damage when multiple extremes occur simultaneously. The combination of low precipitation and high temperatures can have significant impacts upon the ecosystem and society.]

NEW YORK DEPARTMENT OF STATE: Perales, Cesar A, New York Secretary of State, Department of State, Letter to Fred Dacimo, Vice President Operations License Renewal, Entergy Nuclear Northeast Indian Point re: F-2012-1028, Coastal Zone Management Act Consistency Determination, Indian Point Nuclear Generating Unit Nos. 2 & 3, NRC License Nos. DPR-26 and DPR-64, NRC Docket Nos. 50-247 and 50-286, Nov 6, 2015. http://www.riverkeeper.org/wp-content/uploads/2015/11/Indian-Point-Consistency-Decision-11062015.pdf.

[Notification of New York Department of State determination not to grant Entergy's request for a Coastal Consistency Determination for Indian Point due to numerous concerns about Indian Point, including:

Indian Point is in the nation's most heavily populated region. The site is about 24 miles north of New York City. Some 17 million people live within 50 miles of the facility. No other nuclear reactors in the US comes close to Indian Point in terms of surrounding population. (The NRC has noted most reactor sites in the US have population densities of less than 200 persons per square mile. Indian Point has over 2,000 persons per square mile.)

For over 40 years the Indian Point nuclear facilities have been damaging the coastal resources of the Hudson River estuary.

Indian Point is the State's largest industrial water user. Its intake structures withdraw up to 2.5 billion gallons of water per day for cooling, which heats the Hudson River water and kills at least a billion fish, fish eggs and other organisms each year, including endangered fish species which use that segment of the Hudson River as spawning and juvenile nursery areas.ing aquatic life. The stretch of river near Indian point is especially narrow and deep and has inputs from three major tributaries. "This reach of the Hudson River is unique and ecologically significant, and is the narrowest and deepest segment of the Hudson River estuary." (p 5)

Radioactive leaks from Indian Point's systems have resulted in large plumes of groundwater contamination under the site and radioactive leaks from Indian Point's Unit 2 spent fuel pools have already reached the Hudson River.

Indian Point is 6 miles west of the New Croton Reservoir in Westchester County which is part of the New York City reservoir system and provides drinking water to 9 million people in New York City. New York City contemplates using water directly from the Hudson River as a backup water supply. The communities of Poughkeepsie, Wappingers Falls, Highland, Port Ewen, the Village of Rhinebeck, East Fishkill and parts of Hyde Park use the river for drinking water. Future leaks to the groundwater or airborne radiological releases risk contaminating drinking water.

"An accidental release of radiation from the facilities could contaminate drinking water supplies and render uninhabitable large swaths of property in the NYC Metropolitan region. Such a catastrophe would cause dramatic human as well as economic losses. Replacing radionuclide-contaminated drinking water resources for millions of City residents would likely be at unimaginable expense." (p 28) "Additional radiological releases could destabilize the real estate, infrastructure, and the economy in New York City and other regional municipalities." (p 30)

The Hudson River – one of the nation's designated Heritage Rivers – is a valuable national, state, and local resource. The Hudson is tidal, flowing in both directions between New York City and Troy. Bald eagles, herons, waterfowl and other birds feed from its bounty. Its habitats support a diversity of wildlife. And tidal freshwater wetlands near Indian Point support this web. "The Hudson River estuary in the vicinity of the Indian Point nuclear facilities is home to a significant concentration of wintering bald eagles, a threatened species in the State of New York." (p 10) The National Marine Fisheries Service has designated the Hudson River an Essential Fish Habitat in recognition of the role the river plays in maintaining dozens of commercially important fish species and the service specifically identified the Indian Point area as of significance to fishery ecology and management. The Hudson River estuary also supports an important recreational fishery. The Hudson River Valley is listed on the National Register of Historic Places. Federal, state, and local governments and taxpayers have invested millions in protecting, restoring, and revitalizing the Hudson River estuary. "The investment also enables

tidal wetlands to migrate landward with sea level rise and builds resilience to climate change in the Hudson River estuary." (p 7)

Indian Point was constructed close to the river bank and sits at a relatively low point in the Hudson River valley. The shoreline is at risk of flooding during extreme storm events resulting to possible shutdown of cooling water intake pumps, loss of electrical power and dispersal of contaminants into floodwaters that drain into the river. Projected future flood maps show that the water intake structures, pier, and low lying structures may flood during extreme flood events. Grade elevation at the site is approximately 15 feet. "Storm surges and sea level rise as a result of climate change are also major contributors to flooding threats and risk within the Hudson River estuary." (p 14)

Just two high powered transmission lines physically connect Indian Point to the electrical transmission grid. These are linked to the Buchanan electrical substation across the road near the entrance to the Indian Point facility. The final 100 feet of the lines are offsite and cross over a public road (Broadway) to enter a Con Edison substation. The Buchanan substation and the regional transmission system were designed and constructed before Indian Point was sited. Vulnerability to storms was illustrated when Sandy forced a scram of Unit 3 in response to electrical grid disturbances.

"[E]lectromagnetic interference can occur between electrical power lines and adjacent gas pipelines in shared right-of-ways with potentially disastrous consequences." (p 15) Overhead power lines may induce voltages on the metallic pipelines running in close vicinity leading to serious adverse effects, especially corrosion effect on metal pipelines.

The spent fuel pools at Indian Point store far more radioactive material than inside the active nuclear reactors but have no containment structure. Entergy's practice involves packing the existing spent fuel pools to their maximum capacity. When the pools were designed and constructed decades ago, the pools were deemed "'temporary'." (p18) Two of the pools on site have leaked radiation into the environment. The original licenses in 1973 (for unit 2) and 1975 (for unit 3) authorized the pools to each hold 241 spent fuel assemblies. Since then the NRC has allowed Indian Point to hold 5 times the original limit. As of 2015, approximately 1,500 tons of spent nuclear fuel is stored in Indian Point's densely packed spent fuel pools.

Some of the older nuclear waste has been transferred from the spent fuel pools into dry cask storage on site. "The dry casks are placed on an open air concrete pad with no protective barriers or containment structures. … The NRC has raised concerns about dry cask storage design flaws with the cask model currently being used at Indian Point and about the cask manufacturer's inadequate quality assurance program. In the event of a design and/or manufacturing flaw that results in even a hairline fracture in the steel casing and/or concrete casing of the dry cask, an undetermined amount of radiation may leak from the storage units. There is as of yet no safe mitigation procedure to transfer the nuclear waste from a faulty dry cask storage unit to a new safe dry cask storage unit, and there would be no room to place the spent nuclear fuel waste back into the spent fuel pools for temporary safe storage." (p 36)
An accident has the potential to "destabilize the real estate market, infrastructure, and the economy in New York City and surrounding municipalities." (p 2)

The plant's history of operational accidents including transformer explosions and other component malfunctions.

Indian Point Units 2 and 3 are in the highest category of seismic hazard in the nation relative to the original plant seismic design basis as well as ground motion. Indian Point sits extremely close to the intersection of two active seismic faults. A 2008 Columbia University seismology concluded: "'Indian Point is situated at the intersection of the two most striking linear features marking the seismicity and also in the midst of a large population that is at risk in case of an accident to the plants. This is clearly one of the least favorable sites in our study area from an earthquake hazard and risk perspective.'" (p 12) In addition, the NRC has reported Unit 3 has the highest risk of serious damage to its nuclear core in the event of earthquake.

"On May 13, 2011, the NRC issued seismic vulnerability inspection reports of Indian Point Unit 2 and unit 3. The inspection reports were written 'to capture the need to evaluate the beyond design basis aspect of simultaneous 8.5.b events on both units.' These '8.5.b events' are simultaneous external natural events and consequences beyond the original plant design basis, such as large fires, explosions on site or flooding conditions on site which test the licensee's capability to mitigate station blackout (SBO) conditions and identify the potential that the equipment's function could be lost during seismic events possible for the site. The NRC Staff reported that Entergy identified a number of potential vulnerabilities at Units 2 and 3 regarding firefighting following a safe shutdown earthquake (SSE). The potential vulnerabilities stem from the fact that the fire protection system in non-safety related buildings, buries/underground fire headers, fire pumps, and the city water makeup supply are not seismically designed which could result in a loss of portions of the fire protection system following a SSE." The NRC inspectors also identified other events beyond design and licensing basis that could pose a challenge, to wit: "'1. Generally, reactor sites were not required and did not implement mitigating actions to cope with an SBO [station blackout conditions resulting from a loss of all alternating current power] in conjunction with a seismic event; and 2. During beyond design basis events, in which the SAMGs [Severe Accident Management Guidelines] direct depressurizing the PWR containment, conditions could exist in which mitigation equipment is damaged due to elevated containment pressures and potentially prevent containment depressurization and/or isolation.'" (p 11)

"During its 40 years of operation, Indian Point has had many incidents, reactor scrams, operational errors and equipment malfunctions. … As Indian Point ages and components degrade, additional events may occur. Given to its history of equipment problems, its proximity to the world's financial center and the severe consequences of a major accident on public health, the environment and the economy, Indian Point is a nuclear facility that remains a coastal concern." (pp 19-20, {*pages list some of the emergency shutdowns and radioactive leak events}*)

Indian Point makes no unique contribution to providing low cost energy. "Indian Point is a 'price taker,' accepting the hourly market price for the electricity it injects into the electric grid. … Rather than setting the clearing price, Entergy is paid the price offered by the highest cost generator of electricity chosen by NYISO." (p 24) Due to plentiful supply and projected low prices, natural gas remains the standard low cost fuel.

Initiates are being undertaken to ensure there will be adequate resources available to replace Indian Point's electricity by summer 2016. (pp 24 & 25). Infrastructure improvement projects, for the most part upgrades of or additions to existing transmission facilities, as well as demand-side measure, energy efficiency, and combined heat and power sources will lower the peak load on the Con Ed transmission system and increase transfer capability into Southeast New York.

The combined effect of these projects is to relieve reliability concerns by some combination of increasing capacity resources, reducing load, and allowing existing capacity resources to be better utilized through the presence of additional transmission system infrastructure. “For these reasons, the New York electric power system can be expected to operate reliably without Indian Point Unit 2 and Unit 3 at the time or soon after their licenses expire.” (p 27)]

NEW YORK TIMES: Wines, Michael, Toxic Algae Outbreak Overwhelms a Polluted Ohio River, New York Times, Oct 1, 2015. http://www.nytimes.com/2015/10/01/us/toxic-algae-outbreak-overwhelms-a-polluted-ohio-river.html.

[The Ohio River, the nation’s most polluted major waterway, is covered by carpets of poisonous blue-green algae called microcystis. The toxic algae covered nearly two-thirds of the 981-mile river in late August through September, 2015. Water utilities are on alert. The toxin in the algae – called microcystin – cause diarrhea vomiting and liver damage, and has been known to kill animals unlucky enough to drink water tainted with it.

The Ohio RIver bloom stretches 636 miles from Wheeling, West Virginia, to Cannelton, Indiana. Traces of algae have appeared as far west as Illinois. In 2008, a toxic algae bloom in the Ohio River spanned some 40 miles.

“The poisonous alga, called microcystis, increasingly plagues polluted waters across the country.” The problem has been persistent in Lake Erie. In 2014, the algae infected the municipal water intake for Toledo, forcing the city to shut off drinking water supplies to 400,000 residents for days in August. An outbreak in western Lake Erie in September 2015 grew to near-record proportions.

The algae flourish in hot sunny weather. And experts think changing weather patterns in the region are supporting infestations. Not just because of warming temperatures, but because increasing heavy rains in the Ohio River basin wash fertilizer off farmlands and overwhelm sewage systems along the river’s course. Richard Stumpf, an oceanographer at the National Oceanic and Atmospheric Administration, is leading an effort to forecast algae infestations. “‘These climate phenomena are consistent with our understanding of how these things work,” he said of the blooms. ‘We do expect them to be more common when you have wet springs followed by long, warm summers.’”]

NEW YORK TIMES: Wines, Michael, Mighty Rio Grande Now a trickle Under Siege, New York Times, Apr 13, 2015. http://www.nytimes.com/2015/04/13/us/mighty-rio-grande-now-a-trickle-under-siege.html.

[“From Texas to Arizona to Colorado, the entire West is under siege by changing weather patterns that have shrunk snowpacks, raised temperatures, spurred evaporation and reduced reservoirs to record lows.”

As drought worsens, dust and soot from forest fires and parched soil additionally coat snow cover, absorbing sunlight and accelerating snow melt.

A long drought around the 1,900 mile Rio Grande River has dried reservoirs throughout the region. Lake Mead, the Colorado River's main reservoir, is at a historic low.

Drought can spur water-rights disputes between different user groups and states. Experts advise water users to start collaboratively preparing for a much drier future.]

NORWEGIAN SCHOOL OF ECONOMICS: Folkestad, Sigrid and Øyvind Lothe, Too warm for power plants, Norges Handelshøyskole (Norweigian School of Economics, NHH Paraplyen, August 5, 2015. http://paraplyen.nhh.no/paraplyen/arkiv/2015/mai/too-warm-for-power-plants/.

[Recent heatwaves have resulted in debate concerning vulnerability and dependency linked to electricity production in thermic power plants, and in particular nuclear power plants. These require cooling water to operate. During periods when temperatures are extremely high, these power plants experience problems relating to their access and use of cooling water.]

SCIENCE ADVANCES: Cook BI, Ault TR, and Smerdon JE, Unprecedented 21st century drought risk in the American Southwest and Central Plains, Science Advances (2015); http://advances.sciencemag.org/content/1/1/e1400082.

[Authors are from NASA Goddard Institute for Space Studies; Ocean and Climate Physics, Lamont-Doherty Earth Observatory of Columbia University; and Earth and Atmospheric Sciences, Cornell University.

"In the Southwest and Central Plains of Western North America, climate change is expected to increase drought severity in the coming decades." The long historical record shows extended "megadrought" events which had "profound impacts on regional societies and ecosystems." These megadroughts provide crucial evidence in the paleoclimate record for benchmarking the severity of future drought risks.

Empirical drought reconstruction, moisture metrics, and state-of-the-art general circulation models project significantly drier conditions in the latter half of the 21st century compared to the 20th century and earlier paleoclimatic intervals. Future drought risk will likely exceed even the driest centuries of the Medieval Climate Anomaly (1100–1300 AD).

The findings, the authors state, "point to a remarkably drier future that falls far outside the contemporary experience of natural and human systems in Western North America, conditions that may present a substantial challenge to adaptation. Human populations in this region, and their associated water resources demands, have been increasing rapidly in recent decades, and these trends are expected to continue for years to come. Future droughts will occur in a significantly warmer world with higher temperatures than recent historical events, conditions that are likely to be a major added stress on both natural ecosystems and agriculture. And, perhaps most importantly for adaptation, recent years have witnessed the widespread depletion of nonrenewable groundwater reservoirs, resources that have allowed people to mitigate the impacts of naturally occurring droughts. …Combined with the likelihood of a much drier future and increased demand, the loss of groundwater and higher temperatures will likely exacerbate

the impacts of future droughts, presenting a major adaptation challenge for managing ecological and anthropogenic water needs in the region."]

UNIVERSITY OF RICHMOND: Sovacool BK and Gilbert A, Developing Adaptive and Integrated Strategies for Managing the Electricity-Water Nexus, University of Richmond Education Law Review (2015); 48: 997-1032. http://lawreview.richmond.edu/wp/wp-content/uploads/2015/01/SovacoolGilbert-483-master.pdf.

[Benjamin K. Sovacool, PhD, is with the Institute for Energy and the Environment, Vermont Law School. Alex Gilbert is an energy analyst with Haynes and Boone, LLP.

Thermoelectric power plants – nuclear power plants, fossil fuel burning plants and facilities that burn biomass – heavily exploit and rely on water resources.

"The most water intensive energy source by far is nuclear power." (p 1003)

Nuclear reactors require massive supplies of water to cool reactor cores and spent nuclear fuel rods. But water is also needed to cool equipment and buildings used to provide the core's heat removal. "Service water must lubricate oil coolers for the main turbine and chillers for air conditioning – in essence cooling the equipment that in turn cools the reactor." (p 1000) Much of water is turned to steam, "meaning substantial amounts are lost from the local water cycle entirely." (p 1000) Even when plants are not producing electricity, service water needs by nuclear plants can be quite high.

The amount of water consumed by nuclear is more than that consumed by coal and substantially more than the amount used by any other form of power production. For example nuclear consumes/withdraws over 3 X the water used by natural gas, 145 X the amount used by solar PV, and more than 217 X the amount used by wind. {*Figures derived from Table 1, p 999*.}

Thermoelectric power plants consume water in many ways and electric production via these plants is often tightly coupled with water use. The most water intensive phase is on site, but water resources are impacted at multiple points in the fuel cycles of these industries, including upstream at mines and downstream through pollution.

"The U.S. Geological survey reports that thermoelectric power plants – including coal, nuclear, and natural gas power plants – withdraw more fresh water than any other economic sector and they are the fastest growing users of fresh water resources in the country." (p 998) The U.S. Geological Survey further reported that 53% of all of the fresh, surface water withdrawn from the environment for human use in 2005 went to operating the nation's heavily water-reliant electricity industry.

Considering the massive water needs of thermoelectric power plants, minimizing the water intensity of the electrical generation sector – especially in the face of climate change, with drought and changing patterns of precipitation – mandates rethinking outdated assumptions of wide-spread abundant water resources.

Understanding water use is critical for assessing water vulnerability as well as long term viability. An imperative is to improve data collection and coordination. Despite the reality that water needs place a major constraint on thermoelectrical generation, the quality and availability

of data on consumption is insufficient. Energy policy and energy data gathering fails to adequately account for the use/pollution of water. While the Energy Policy Act of 2005 mentions the importance of water, it does not provide any funding for research and development and budget constraints have led to reduced data acquisition/analysis by the US Department of Energy (DOE). “In other words, planners and regulators could measure water use by thermal plants, but are choosing not to, crippling the ability to prepare for drought and other disruptions. … Understanding the water consumption patterns at power plants is particularly important when trying to plan for climate change. Precipitation patterns and water availability are projected to change significantly.” (p 1006)

There is particularly impressive potential to achieve water conservation through energy efficiency and demand-side management (DSM) programs. The National Association of Regulatory Utility Commissioners (NARUC) found cost effective energy efficiency potential in all regions of the US, with the most untapped potential in the Northeast and South. In situations where efficiency and DSM programs cannot completely offset the need for new power, utilities could rely on wind turbines and solar panels “these two technologies use almost no water to generate electricity, and need only a very small amount for cleaning and maintenance.” (p 1027)

Solar and wind power are viable and growing as renewable energy technologies expand into new markets. The cost of solar PV and wind have steadily decreased over the years and are expected to decrease further thanks to economies of scale, technology advances and other factors. Moreover, as water is not priced according to its economic value, the higher water needs of nuclear coal and gas have not been reflected in cost analyses. Proper pricing would incorporate the true value of water and make renewable effectively even more cost competitive. Pricing electricity more accurately would also greatly improve the efficiency of the electrical industry, give customers proper signals, and discourage wasteful energy use.

“Under the current system for pricing electricity, customers are often unaware that they are causing environmental impacts and rarely do they have to pay for them. If utilities instituted more accurate electricity pricing, altered electricity billing practices, and increased consumer education efforts, many of the worst water impacts could be avoided.” (p 1029)

Despite the seriousness of the electricity-water challenges, there are many technologies and mechanisms available to reduce the risk. A combination of these six would be most effective: “(1) improving data collection and monitoring, (2) decreasing the water intensity of thermoelectric generation through technology, (3) placing a moratorium on new thermoelectric power generation, (4) strongly promoting energy efficiency and demand-side management, (5) rapidly deploying wind turbines and solar photovoltaic panels, and (6) changing electricity prices so that electricity customers receive more feedback and information.” (pp 1004-1005)]

USA TODAY and DESERT SUN: James, Ian and Steve Reilly, Our Water Is Running Out; Many U.S. Aquifers In Decline, The Desert Sun and USA Today Investigative Report, Dec 10, 2015. http://www.desertsun.com/story/news/environment/2015/12/10/pumped-beyond-limits-many-us-aquifers-decline/76570380/.

[“Since the beginning of the 20th century, the United States is estimated to have lost more than 1,000 cubic kilometers from the nation’s aquifers – about 28 times the amount of water that can be held in Lake Mead, the country’s largest reservoir.”]

2014

Buesseler, Ken, New York Times letter, Aug 3, 2014. http://www.nytimes.com/2014/08/03/opinion/ocean-radioactivity.html.

[Ken Buesseler, PhD, Director of the Center for Marine and Environmental Radioactivity at the Woods Hole Oceanographic Institution, points out that discussion of ocean contamination is missing from news coverage.

"Fukushima constituted the largest unintentional release of radioactivity into the ocean in history." There is growing public concern over the safety of seafood and the marine environment and ocean currents are predicted to be bringing low-level contamination from Fukushima to the US West Coast in 2014. Yet the US government fails to monitor radiation along the West Coast. Dr. Buesseler writes: "As a marine radiochemist, I have relied on private foundations and even crowdsourcing (ourradioactiveocean.org) to track Fukushima radiation arriving on our shores."

He adds: "With more than 20 nuclear reactors near American coasts and many more around the world's oceans, surely one of the key lessons is the need to expand our understanding of what constitutes an appropriate level of both preparedness and response, including studies of ocean radioactivity."]

INSTITUTE FOR PUBLIC RESEARCH AT CNA: Faeth P, The Impacts of EPA's Clean Power Plan on Electricity Generation and Water Use in Texas, Institute for Public Research at CNA report, Nov 2014. http://www.cna.org/sites/default/files/research/IRM-2014-U-009083.pdf. & Faeth, Paul, In drought-prone Texas, a threat to the energy supply, Dallas Morning News Op-Ed, Dec 20, 2013. http://www.dallasnews.com/opinion/sunday-commentary/20131220-in-drought-prone-texas-a-threat-to-the-energy-supply.ece.

[Author, Paul Faeth, is the Director of Energy, Water and Climate at the Institute for Public Research at CNA, a national not-for-profit research and analysis organization.

The electric power sector is responsible for half of all water use across the US, but how power plants use water varies greatly. Nuclear, coal-fired and natural gas-fired plants are all thermal and require cooling – with water run through the power plants and returned to the surface water. If – as for example in 2011 – too little water is available or the available water is too warm, the plants can't be cooled and cannot operate. "There are numerous examples every year of shutdowns from water problems where there are droughts in the U.S."

Nuclear plants use the most water, followed by coal, then gas plants. Wind and solar photovoltaic power require virtually no water.]

NEW YORK TIMES: Wines, Michael, Behind Toledo's Water Crisis, a Long-Troubled Lake Erie, New York Times, Aug 5, 2014. http://www.nytimes.com/2014/08/05/us/lifting-ban-toledo-says-its-water-is-safe-to-drink-again.html.

["Lake Erie is in trouble, and getting worse by the year … the most intensely developed of the Great Lakes is increasingly being choked each summer by thick mats of algae, much of it poisonous. What plagues Toledo and, experts say, potentially all 11 million lakeside residents, is increasingly a serious problem across the United States." The problem is not restricted to the Great Lakes. Poisonous algae are found in polluted inland lakes from Minnesota to Nebraska to California, and even in ponds of Cape Cod in Massachusetts. Algae helped create an oxygen-free dead zone in the Gulf of Mexico during the summer of 2013 nearly as big as New Jersey. A 120 mile microcystin algae bloom in Lake Ohio stretched from Toledo to Cleveland in 2011.]

2013

ENERGY AND WATER IN A WARMING WORLD INITIATIVE (EW3): Rogers J, Averyt K, Clemmer S, Davis M, Flores-Lopez F, Kenney D, Macknick J, Madden N, Meldrum J, Sattler S, Spanger-Siegfried E, Yates D, and EW3 Scientific Advisory Committee (Frumhoff P, Hornberger G, Jackson R, Newmark R, Overpeck J, Udall B, and Webber M), Water-Smart Power: Strengthening the U.S. Electricity System In A Warming World, Energy and Water in a Warming Word Initiative report, Jul 2013. http://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_energy/Water-Smart-Power-Full-Report.pdf.

[The Energy and Water in a Warming Word Initiative (EW3) is a collaborative effort between the Union of Concerned Scientists (UCS) and independent experts to build and synthesize policy-relevant research on water demands of energy production in the context of climate variability and change. Authors of this report are from UCS; University of Colorado, Boulder; Stockholm Environment Institute; National Renewable Energy Laboratory; National Center for Atmospheric Research; Vanderbilt University; Duke University; University of Arizona, Tucson; and University of Texas.]

ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY: Hooper MJ, Ankley GT, Cristol DA, Maryoung LA, Noyes PD, and Pinkerton KE, Interactions between chemical and climate stressors: A role for mechanistic toxicology in assessing climate change risks, Environmental Toxicology and Chemistry (2013); 32 (1): 32–48. http://onlinelibrary.wiley.com/doi/10.1002/etc.2043/full

[Research group from the U.S. Geological Survey, Columbia Environmental Research Center; U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory; College of William and Mary; University of California, Riverside; Duke University; and University of California at Davis.

Chemicals can stress aquatic ecosystems and toxicokinetic modifications can lead to organism-level responses and eventually produce population-level impacts. "Some broad observations can be made regarding potential climate effects on the uptake and disposition of chemical contaminants. For example, it has generally been observed that uptake and elimination of toxicants increase as temperature increases." (pp 10-11)

"Many aquatic environments are subjected to widespread hypoxia (i.e., low dissolved oxygen [DO]) and anoxia (i.e., absence of DO]. It is an increasingly urgent global problem that has caused species declines and major ecosystem changes." (p 20) Hypoxia alone has been shown to act like an endocrine disruptor.]

NEW YORK: Comments Submitted by the Attorneys General of the States of New York, Vermont, Connecticut, and the Commonwealth of Massachusetts, the Vermont Department of Public Service, and the Prairie Island Indian Community on the Nuclear Regulatory Commission's Draft Waste Confidence Generic Environmental Impact Statement and Proposed Rule, In the Matter of: Consideration of Environmental Impacts of Temporary Storage of Spent Fuel After Cessation of Reactor Operations, RIN 3150-AJ20; NRC-2012-0246, Dec 20, 2013.

[This filing by the Attorneys General of NY, VT, CT, MA, the Prairie Island Indian Community, et al, (134 pp, plus exhibits) challenges conclusions of the NRC Draft Waste Confidence Generic Environmental Impact Statement and Proposed Rule (DGEIS). The filing argues that the NRC's treatment of severe accident impacts is internally inconsistent and arbitrary.

The filing expresses strong concern over radioactive leaks and extensively elucidates the plethora of risks that would be imposed on states and indigenous peoples by extended storage and increased build-up of nuclear waste from nuclear power plants.

Between the Indian Point, FitzPatrick, Nine Mile Point and Gina nuclear power plants, New York State is housing more than 3,700 metric tons of spent fuel, over 3,000 tons of which may remain in densely packed spent fuel pools subject to risk of fire upon loss of coolant. "The groundwater beneath Indian Point is also contaminated with radionuclides stemming from long-undetected leaks from a spent fuel pool and transfer canal." (p 2)

A major flaw of the DGEIS, the filing states, is the NRC's complete failure to assess the different impacts – economic, environmental, health, etc – of nuclear waste at sites near large populations or in areas with high population density.

In addition high burnup fuel presents the potential of additional and significant problems at spent fuel pools. Starting in 2008, the NRC has allowed reactors using uranium fuel to operate at the highest burnup rates of any country in the world but has failed to properly assess the risk. High burnup fuel contains much more radioactivity and produces increased decay heat. These factors both increase the likelihood of damage to spent fuel pool structures and the risk of an exothermic zirconium fire. These risks are elevated even further by age-related spent fuel pool degradation. (pp 95-100)

The NRC also ignores "the unique, site-specific consequences that would occur as a result of a severe accident at Indian Point." (p 87) The population within 50 miles of Indian Point is 17 million and a plume blowing South – a predominant wind direction – would affect the New York City metropolitan area, one of the most populous areas in the US.

"Aqueous releases following a severe accident would be of particular concern at Indian Point, which sits on the Hudson River. Aqueous releases have the potential to contaminate the Hudson River's waterways, riverbanks, riverbed and sediment, adjacent freshwater tidal wetlands, and fish and other aquatic organisms, and impacts to the environment and human

health could exceed the impacts flowing from the aqueous releases into the Pacific Ocean at Fukushima." (p 94)

NRC has not undertaken a real evaluation of past accidental radiation leaks. "For example, if the root cause of the leaks is the aging of the spent fuel pools, which were never meant to be long-term solutions, then the prospect for even greater and more damaging leaks in the future is far more serious than the DGEIS's optimistic assumption." (p 106) Nor has the NRC articulated what emergency actions might be taken by EPA should a future leak contaminate groundwater, depriving the affected population of potable water or depriving agricultural areas of safe irrigation. (p 107) The NRC also "fails to examine the combined impact of a leak and effluent discharges on sensitive surface waters, including whether state or federal water quality standards could be violated." (p 108)]

NEW YORK TIMES: Foderaro, Lisa W, Cleaning Up Radiation In Park May Take Years, New York Times, Nov 26, 2013. **http://www.nytimes.com/2013/11/26/nyregion/radiation-cleanup-at-staten-island-park-to-take-years.html**.

[In Nov 2013, officials said that the level of radioactive contamination is more extensive than previously thought. Cleanup likely to take years. Garbage with trace amounts of radium was dumped into the wetlands at Great Kills Park on Staten Island in the 1940s and 1950s. Contamination was first detected in 2005 when a police flyover of New York City detected a positive reading for radioactive material. In the years since, investigations by the city's Department of Health and Mental Hygiene, the EPA and the United States Army Corps of Engineers turned up more hot spots and a more disturbing picture.

"'As we're getting through this tough job, we're finding that the contamination is not only in these discrete pockets, but is dispersed in the soil and also at the surface,'" said Kathleen Cuzzolino, an environmental protection specialist for the Park Service." In late 2013, after another flyover and years of excavations, "the Park Service acknowledged that the contamination was more extensive than had originally been believed. Indeed, more than half of the park has shown some degree of radioactivity — virtually the entire area containing the historic fill."

Park officials have fenced off 260 acres and started the lengthy process of mapping the contamination and devising a cleanup plan. "[T]he National Park Service, with help from the Army Corps of Engineers, is now surveying every square foot of the 260 acres. Radiation technicians have so far scanned three-fourths of the park with detectors, a painstaking job that entailed clearing vegetation in the survey area so that the detectors could come within six inches of the ground…the Park Service will remove at least 30 hot spots with the highest levels of radiation in the coming months. …The federal government will also undertake a 'human health and ecological risk assessment,' in which soil and ground water samples will be analyzed. Then comes the eventual cleanup, which will involve a feasibility study and a public comment period. 'It's going to be several years,' [the Park Service's Kathleen] Cuzzolino said. 'It's not going to be an easy task to remediate contamination across 260 acres.'"]

U.S. DEPARTMENT OF ENERGY (DOE): U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather, U.S. Department of Energy, DOE/PI-0013, Jul 2013. http://energy.gov/sites/prod/files/2013/07/f2/20130716-Energy%20Sector%20Vulnerabilities%20Report.pdf.

[The US Department of Energy report assesses the vulnerability of U.S. critical energy and electricity infrastructure to the impacts of climate change. In recent years, widespread and long droughts, extreme heat waves, more severe and prevalent wildfires, and intense storms that caused power and fuel disruptions for millions have occurred and these trends are expected to continue.

Increasing risks include temporary partial or full shutdowns at nuclear power plants because of decreased water availability for cooling and higher ambient and air water temperatures.

Risk to infrastructure located along the coast is increasing due to sea level rise, increasing intensity of storms, and higher storm surge and flooding. Water levels of rivers may be affected by both drought and flooding. Distribution systems for gasoline may be disrupted. Climate change, additionally, poses increasing risk of physical damage to power lines, transformers and electricity distribution systems from hurricanes, storms and wildfires that are growing more intense and more frequent.]

U.S. DEPARTMENT OF INTERIOR: Llewellyn D and Vaddey S, Reclamation: Managing Water in the West – West-Wide Climate Risk Assessment: Upper Rio Grande Impact Assessment, U.S. Department of the Interior, Bureau of Reclamation study, Dec 2013. http://www.usbr.gov/WaterSMART/wcra/docs/urgia/URGIAMainReport.pdf. {More at: http://www.usbr.gov/WaterSMART/wcra/.}

[Study by the U.S. Department of the Interior, Bureau of Reclamation projecting the impacts of climate change on water systems in the Upper Rio Grande Basin of Colorado and New Mexico. The study includes a detailed evaluation of the climate, hydrology and water operations, but does not attempt to project population growth, power generation evolution, or agricultural and other land use changes. Projections based on 2013 climate models.

From 1971 through 2011, average temperatures in the Upper Rio Grande Basin rose at a rate ~double the global rate of temperature rise. Such rates of warming are unprecedented over the last 11,300 years. “This rate of warming has the potential to cause significant environmental harm and change the region’s hydrology.” (p S-iii) Projections indicate temperatures in the region will rise by 4° to 6°F by the end of the 21st Century. (pp 1 & 117.)

“Overall, climate change is projected to significantly decrease available water supplies in the Upper Rio Grande Basis.” (p 40) Average supplies of native water sources to the Rio Grande are projected to decrease by about one third over the course of the 21st Century. (pp 40 & 117.) Changes relate to the type (rain rather than snow), magnitude, timing (snowpack decreases), and variability of inflows (both more drought and more flooding) to the water system. The “usable, manageable water supply is expected to decline.” (p 118)

Water management challenges posed by a highly variable and extremely limited water supply are exacerbated by prolonged drought, and – with climate change – the frequency, intensity,

and duration of droughts are projected to increase. (pp S-i–S-iv) Rising temperature will also increase rates of evaporation.

All projections show an increase in variability in meteorological conditions (temperature and precipitation) and increases in the variability of runoff volume from month to month and year to year. (p 118) The frequency, intensity, and duration of floods are projected to increase. (p S-iv) Flooding will become more frequent, even as average supplies of water decrease and "extreme flows are projected to become more extreme with climate change". (p 102)

While the region's aquifer has a depth of several thousand feet, groundwater level declines represent the removal of the highest quality water because salinity increases with depth. (p 17) Removal of water from the groundwater also decreases river flows. "The growing imbalance between supply and demand would likely lead to a greater reliance on non-renewable groundwater resources." (p 118)

Less water can mean less water quality. "Concentrations of nitrogen, phosphorous, suspended solids, and salt in surface waters throughout the system are projected to increase in the future due to higher evaporation rates for surface water." (p 119) In addition, runoff from the projected higher intensity precipitation could wash a greater volume of pollutants from land into the river. (pp 103 & 120)

All demands of water – agricultural, riparian, and urban landscaping – would be expected to increase due solely to the projected rise in temperature. Decrease of snow means a decrease in the storage of water available for use during the summer irrigation season. Reduction in water is expected to reduce both river flows and available shallow groundwater. Both impacts could alter habitat conditions for fish and wildlife, including endangered species.

"Ecological thresholds are transition points in which a small change in a physical or chemical parameter or a component of a system elicits a large, or non-linear, response of a natural or social-ecological system." (p 111) A threshold represents the endpoint of ecological resilience. In the Upper Rio grande Basin, the available water supply is low relative to the demand. "Ecological and human systems within the basin already operate close to thresholds related to available water supply." (p 111) Some ecosystems may have already crossed thresholds. For example, in the Jemez mountain forest of New Mexico, dry conditions have stressed trees, leading to bark beetle infestations and forest fires.

"Feedbacks can lead to cascading impacts. For example, more intense droughts and higher temperatures recently led to a greater moisture deficit in the region's forests in New Mexico. Trees that aren't getting enough water are more susceptible to beetle infestations, and infected weakened and dead trees are more susceptible to catastrophic wildfires. Thunderstorms tend to build over fire scars because heat builds up over the blackened ground, and intense thunderstorms on the fire scars lead to the washing of ash into rivers, and to debris flows. Ash in the rivers can lead to decreased oxygen in the water and cause fish kills. Debris flows can lead to sediment accumulation in our reservoirs, and sediment accumulation in our reservoirs can lead to less flood protection for downstream human infrastructure, and so on." (p 119)]

VERMONT DIGGER: Galloway, Anne, Entergy Replaces Radiation Monitors; State Asks the NRC to Investigate "Spurious" Radiation Spikes at Vermont Yankee, Vermont Digger,

Jul 28, 2013. http://vtdigger.org/2013/07/28/entergy-replaces-radiation-monitors-state-asks-the-nrc-to-investigate-spurious-radiation-spikes-at-vermont-yankee/.

[Radiation monitors at Entergy's Vermont Yankee nuclear plant recorded "spurious spikes" in radiation levels on June 14, July 11, July 23 and July 24, 2013. Entergy first blamed a loose electrical connection, then ultimately determined the monitor equipment was faulty and did not indicate actual increases in radiation in the spent fuel pool building.

Entergy notified State officials 41 days after the first spike reading. Under NRC rules, a nuclear plant operator has 60 days to file a report with the NRC.

Vermont Department of Public Service Commissioner Chris Recchia said monitor malfunctions were alarming because they are the fundamental warning system for the plant, asking: "'What happens if there was actually a radiation leak and the equipment didn't register anything or didn't register the proper amount?'" Recchia also expressed concern about the integrity of the aging nuclear power plant, built more than 40 years ago: "'It feels like these systems need to perform accurately, as intended, and we feel like all the systems are aging'." Vermont Yankee has had operational and physical plant problems over the last decade, including tritium leaks, a water tower collapse, condenser problems, fuel rod location issues, and a transformer fire.]

2012

ENERGY: Dittmar M, Nuclear energy: Status and future limitations, Energy (2012); 37 (1): 35-40. http://www.sciencedirect.com/science/article/pii/S0360544211003653. *{See also paper at http://www.societalmetabolism.org/aes2010/Proceeds/DIGITAL%20PROCEEDINGS_files/PAPERS/O_118_Michael_Dittmar.pdf.}*

[Nuclear energy is plagued by a long list of unsolved problems. Without solution, despite decades of research, is the problem of final safe storage of already accumulated highly radioactive nuclear waste.

A less known problem is that nuclear power plants cannot provide power according to need. Because they must be continuously operated, nuclear power plants cannot power down during times of less demand. Nuclear power plants also need large contributions of water resources. And uranium is a limited non-renewable fuel.

Finally, the focus on nuclear power has wasted resources urgently needed to move down the path of a low energy future. Thus, nuclear energy is not a solution to our energy worries but part of the problem.]

INSIDE CLIMATE NEWS: Krier, Robert, Extreme Heat, Drought Show Vulnerability of Nuclear Power Plants, Inside Climate News, Aug 15, 2012.

http://insideclimatenews.org/news/20120815/nuclear-power-plants-energy-nrc-drought-weather-heat-water?page=show.

[Nuclear plants can be forced into shutdown or became too inefficient because of global warming conditions.

A study by Dennis Lettenmaier, a researcher at the University of Washington, estimates that nuclear and other power plants that need cooling will have a 4 - 16 % drop in production between 2031 and 2060 due to climate change-induced drought and heat.

Both drought and heat conditions affect the water needed to cool nuclear plants.

Drought causes lowered water levels in rivers and lakes. But nuclear plants depend on water for cooling. When water levels drop below the plants' intake pipes, they can't suck in the water. While pipes can sometimes be lowered, the modification is expensive and also risks pulling in sediment that could damage the plant.

Lake or river water that becomes warm can also become too warm to properly cool the reactor fuel. Other times, the warm water can be used, but the plants operate inefficiently.

Another problem is thermal pollution. Hot outflow water from the plant raises the river or lake temperatures above ecological tolerance. That has happened repeatedly in both the US and Europe. If a plant is not shutdown, the hot discharge can cause algae blooms, reduce dissolved oxygen, and threaten aquatic life.

"'From our perspective, this has been a problem for years, and it's only getting worse,' said Wendy Wilson, director of rivers, energy and climate for the River Network, which aims to protect the nation's freshwater resources. 'It gets worse every time we have a drought like this. We have terrible thermal pollution problems in this country, and the result is dead and dying rivers. Nobody's managing the system.'"

About 40 % of the nation's fresh water use goes toward energy generation, with nuclear being a particularly water-intensive industrial operation. Large water consumption also raises questions about how freshwater supplies should be managed as climate change and population growth increased competition for drinking water and agriculture.

Examples of nuclear plant shutdowns or power generation reductions:

Millstone nuclear plant (CT) shutdown of a reactor in Aug 2012 because Long Island Sound water was too warm for cooling use

Vermont Yankee had to limit output four times in Jul 2012 because of low river flow and heat. At one point, production was reduced to 83 % of capacity.

Perry 1 (OH) had to drop production in late Jul 2012 to 95 % of capacity because of hot temperatures.

Braidwood (IL) needed an EPA waiver to raise the temperature of a cooling pond to 102° F.

Browns Ferry (TN) reduced power in Aug 2011 to stay within discharge limits. At one point, all three of the reactors cut output to about 50 % to avoid heating of Tennessee River waters to 90°

Donald C. Cook reactors (MI) shutdown during a severe heat wave because temperatures in a containment building exceeded the regulatory limit of 120° F.

The Tennessee Valley Authority lost a third of nuclear capacity in Aug 2008 due to drought conditions. All three Browns Ferry reactors in Alabama were idled to prevent overheating of the Tennessee River.

In Europe: France had to get power from England in Jul 2009 because almost a third of its nuclear generating capacity was lost when it had to cut production to avoid exceeding thermal discharge limits. A heat wave during the summer of 2003 forced countries in Europe France, Germany and Spain to choose between shutting down reactors or allowing them to exceed design standards and thermal discharge limits. France and Germany allowed some to operate and shutdown others. Spain shutdown its reactors.]

NATIONAL RESOURCES DEFENSE COUNCIL (NRDC): Fettus GH and McKinzie MG, Nuclear Fuel's Dirty Beginnings: Environmental Damage and Public Health Risks From Uranium Mining in the American West, National Resources Defense Council report, Mar 2012. http://www.nrdc.org/nuclear/files/uranium-mining-report.pdf.

[Detailed review of the literature on damage inflicted upon the environment, aquifers and other waters as a result of uranium extraction, milling and processing activities. (Includes lists of radioactive spills.) Describes why future uranium mining projects will continue to pose a threat to human health and the environment, even under improved regulatory conditions.

Uranium mining – particular in situ leaching (ISL) mining– alone and in concert with other resource extraction activities contaminates groundwater. Mining operations in the US have repeatedly failed to restore aquifers, "often leaving them unusable for any alternative future use." (p 40) EPA and NRC regimes fail to reflect the best available data on what is required to protect the public and environment from the contamination inflicted by all types of uranium recovery. This failure also puts at risk scarce western groundwater. The EPA, which is required by law to set standards for the protection of public health and the environment, should promulgate regulations that prohibit ISL mining in underground sources of drinking water and pay increased attention to the complexity of underground aquifers and potential drinking water sources. The EPA should also mandate groundwater restoration that addresses both the contaminated ore zone and any near areas affected by the mining. "Importantly, EPA's restoration standards must be keyed to the overall water quality throughout the aquifer, not just an arbitrarily limited mining site presented by the applicant." (p 41) Appropriate environmental review needs to consider the cumulative impacts of mining and analyze the issue in its totality.]

2011

ENERGY AND WATER IN A WARMING WORLD INITIATIVE: Averyt K, Fisher J, Huber-Lee A, Lewis A, Macknick J, MaddenN, Rogers J, Tellinghuisen S, and EW3 Scientific

Advisory Committee (Frumhoff P, Hornberger G, Jackson R, Newmark R, Overpeck J, Udall B, and Webber M), Freshwater Use by U.S. Power Plants Electricity's Thirst For a Precious Resource, Report of the Energy and Water in a Warming Word Initiative, Nov 2011. https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR953.pdf

[Authors are from the University of Colorado-Boulder, NOAA Western Water Assessment; Synapse Energy Economics; Tufts University; Duke University; the National Renewable Energy Laboratory; Union of Concerned Scientists; Western Resource Advocates; Vanderbilt University; University of Arizona and University of Texas, Austin.

Nuclear, coal and gas-fired power plants are the largest users of water resources in the US and contribute to water and ecosystem stress.

Many factors influence the amount of water used by individual coal, nuclear and natural gas plants but averaging reveals nuclear reactors to be the most water-intensive form of power generation. Among power plants using freshwater for cooling in 2008, nuclear plants used nearly 8 X more freshwater than natural gas plants per unit of electricity generated, and about 11% more than coal plants. Nuclear plants also consumed 3X as much freshwater as natural gas per unit of electricity produced and ~4% more freshwater than coal plants. (p 17) Moreover, data on the true volume of water used by thermoelectric power plants has significant gaps. Many power plants fail to report water use and discrepancies are widespread. Further, nuclear power plants were made exempt from reporting under US Energy Information Administration (EIA) policy. In 2002, the agency stopped requiring owners of nuclear plants to report on their cooling technology and water use due to EIA budget limitations. "Yet that left 6.3 trillion to 16.7 trillion gallons (19 million to 51 million acre-feet) of freshwater withdrawals and 280 billion to 460 billion gallons (870,000 to 1.4 million acre-feet) of freshwater consumption unaccounted for, representing 27 percent of all freshwater withdrawals, and 24 percent of all freshwater consumption."

"The lack of high-quality federal data on water use by thermoelectric power plants also has serious consequences. At the national level, low-quality data hinder the creation of well-informed federal policies to guide the sustainable development of water and energy resources (GAO 2009)." (p 23)

Aside from damage to ecosystems via the mechanical impacts of sucking in vast quantities of water via cooling system intakes and output of heated water, warming waters decrease the efficiency of power plants. The pressures of high water temperatures, declining water levels, warmer air temperature can negatively affect grid reliability. During heat waves nuclear plants in the US have been forced to power down or cut power output. (pp 30-31) "Such events now endemic in the United States" have forced rolling blackouts in Europe. (p 31)

"Electricity's thirst for water, along with pressure from growing populations, is putting freshwater resources and the reliability of our energy supply in jeopardy. From Arizona to Alabama, from North Carolina to New York, the use of water to cool many of today's power plants is contributing to the stress we are placing on water resources." (p 35)

Climate change with fluctuation of freshwater supplies, higher water temperatures and water stress is anticipated to exacerbate the problem. Decision makers and utilities would be well advised to prioritize low or no-water cooling options. "Averting energy-water collisions means taking a long view." (p 37)]

Hong GH, Hamilton TF, Baskaran M, and Kenna TC, Applications of Anthropogenic Radionuclides as Tracers to Investigate Marine Environmental Processes, Chapter 19, "Handbook of Environmental Isotope Geochemistry," Springer Berlin Heidelberg (2011): 367-394.
http://scholar.google.com/citations?view_op=view_citation&hl=en&user=DFxeUYYAAAAJ&citation_for_view=DFxeUYYAAAAJ:zYLM7Y9cAGgC.

[Authors are from Lawrence Livermore National Laboratory; Lamont-Doherty Earth Observatory of Columbia University; Wayne State University (US); and Korea Ocean Research and Development Institute (South Korea).

Anthropogenic radionuclides are "ubiquitous global contaminants". (p 369) Man-made radiation has been intentionally and accidentally introduced into the environment since the 1940s through a number of activities including those relating to nuclear weapons and nuclear power. Attributes of the isotopes are varied and include a range of different geochemical characteristics such as different half-lives and particle affinities.

The transuranic composition of fission products depends, in part, upon the isotopic composition of the initial material. The more intense the neutron flux (e.g., high versus low burnup fuels), the higher proportion of heavier transuranic isotopes and the higher the yield of fission products.

A "secondary pathway for global fallout nuclides reaching the oceans, such as continental run-off, release of anthropogenic radionuclides from estuarine processes, and atmospheric deposition of continental dust of previously deposited debris, becomes important in some ocean regions." (p 369)

As anthropogenic radionuclides are introduced into the sea, they behave almost identically to their stable counterpart – although plutonium does not have a stable nuclide form. Distribution depends, in part, upon the "dynamics of water mass movement, biological particle formation, sorption-desorption reactions and decomposition processes, settling rates of particulate matter through the water column, and ultimate deposition of radionuclides onto the seafloor in various ocean basins". (p 370) The carrier phase of each radionuclide is affected by the chemistry of prevailing redox and acid-base conditions in situ. Chemical forms of radionuclides influence their solubility, cell-membrane transport and bioavailability, adsorptive behavior, water residence times. The daughter products of some radionuclides have different particle-affinity than their parents. (p 371)

Radionuclides released from nuclear power plants include: Ag-110m; Ba-139; Ba-140; Ce-141; Ce-143; Ce-144; Co-57; Co-58; Co-60; Cr-51; Cs-134; Cs-136; Cs-137; Cs-138; Fe-55; Fe-59; H-3; I-131; I-132; I-133; I-134; I-135; Mo-99; Mn-54; Mn-56; Na-24; Nb-95; Nb-97; Np-239; Pa-140; Ru-103; Ru-106; Sb-122; Sb-124; Sr-89; Sr-90; Sr-92; Tc—99m; Te-132; W-187; Zn-65; Zr-95; and Zr-97. (p 369, Table 19.1, data from UNSCEAR 2000.) {*NOTE: Co-14 is missing from this list*.}

Radionuclides released from nuclear power plants additionally include the noble gases: Ar-41; Kr-85; Kr-85m; Kr-87; Xe-131m; Xe-133; Xe-133m; and Xe-138.

C-14, with a mean lifetime of 8,200 years, can penetrate the active carbon reservoirs through chemical reactions of carbonic acid formation and plant photosynthesis. It is difficult to measure

absolute C-14 concentrations. “Living organisms take up radiocarbon through the food chain and via metabolic processes.” (p 377) This is what makes C-14 useful for age-dating organic material.

Mn-54 (Manganese), Co-58, Co-60, Cs-134 and Cs-137 are among the common beta/gamma emitting radionuclides discharged under normal operating conditions by nuclear plants. “For instance in 1995, these five isotopes accounted for about 68% of the non-tritium low-level radioactive liquid wastes from French 1,300 MW pressurized reactors. In addition to this radioecological aspect, the three elements selected present a special interest from a biological standpoint. Cs is biochemically analogous to K while Mn and Co are classified among the ten vital elements for life. Co is vital to many enzymatic systems and to the formation of noble molecules, such as vitamin B-12. Mn is a coactivator of such enzymes as transferases and decarboxylases, and is a constituent of several metalloenzymes, including pyruvate carboxylase and superoxide dismutase.” (p 378)

Fe-55 is of biological interest because iron is an essential element for plant growth and is absorbed by the red blood cells of animals. Studies indicate that particulate carrier phase may be specific to each metallic element. (For instance Fe-55 particles appear to sink faster tan Up isotopes.) (p 378)

Sr activity in rivers varies depending upon the watershed soil and denudation characteristics in the watershed. (p 381)

“In the terrestrial and marine environment, natural levels of ^{129}I (cosmogenic origin) have been overwhelmed by a build-up of ‘new’ ^{129}I, a product of the nuclear age. … During primary production, iodine is incorporated in marine organic matter and migrates through the food chain.” (p 382)

Although Cs-137 and Pu-239+240 were injected into the ocean surface by similar processes, their oceanic behavior differ. Most Cs-137 exists in a dissolved form and moves with water mass, whereas Pu-239+240 is controlled by water movement and adsorption onto particles formed in situ or introduced and subsequently sinks to deeper waters.

Given the long-lived nature of Sr-90 and Cs-137, these isotopes are good tracers for assessment of slow moving waters in the ocean.]

UNION OF CONCERNED SCIENTISTS: Koplow D, Nuclear Power: Still Not Viable without Subsidies, Report of the Union of Concerned Scientists, Feb 2011. http://www.ucsusa.org/assets/documents/nuclear_power/nuclear_subsidies_report.pdf. Summary at: http://www.psr.org/nuclear-bailout/resources/nuclear-power-still-not.pdf.

[Report (136 pp) for the Union of Concerned Scientists written by Doug Koplow, founder of Earth Track, Inc., an economic analysis firm which specializes in evaluation of energy market subsidies. Environmental damage done by nuclear plants is also a large hidden cost.

When existing plants were sited, little consideration was given to the economic or ecological impacts of’ massive withdrawals of cooling water. Nuclear power reactors are the most intense water users per kilowatt hour of electricity produced. (pp 72-77, 105) As pressure on resources grows, nuclear plants consumptive withdrawals put increasing pressure on waterways.]

U.S. GOVERNMENT ACCOUNTABILITY OFFICE (GAO): Nuclear Regulatory Commission Oversight of Underground Piping Systems Commensurate with Risk, but Proactive Measures Could Help Address Future Leaks, Report of the Government Accountability Office, Jun 2011, GAO-11-563. http://www.gao.gov/new.items/d11563.pdf.

[GAO investigation was initiated after revelations of recurrent leaks from America's aging nuclear plants. The GAO concludes: "The occurrence of leaks at nuclear power plants from underground piping systems is expected to continue as nuclear power plants age and their piping systems corrode." (p 22)

"As nuclear power plants age, their underground piping systems tend to corrode, but since these systems are largely inaccessible and difficult to inspect, the condition of many underground piping systems at plants across the country is unknown." (p 1)

NRC primarily began collecting data on "unplanned and uncontrolled releases of radioactive material" in 2008. (p 5)

The "NRC has concluded that all 65 reactor sites in the United States have experienced a leak or spill of radioactive material into groundwater." (p 5)

Common sources of leaks that have resulted in groundwater contamination include underground piping systems, spent fuel pools, storage tanks, including radioactive waste storage tanks, sumps and vaults.

The GAO finds that nuclear power plant operators have not figured out how to quickly detect leaks of radioactive water from aging pipes that snake underneath the sites. The leaks often remain undetected for years. Leaks from aging nuclear plants will likely continue.

Most of the structures, components and systems that discharge radioactive materials are not classified by the NRC as "safety-related" and while "nonsafety-related piping has been the source of many reported leaks that resulted in groundwater contamination," the NRC did not start focusing on unplanned releases until 2008 does not generally require inspections of such piping. (pp 6-7 & 20)

Original construction hydrogeology evaluations are outdated since any construction on-site can significantly modify how groundwater flows through the subsurface. "More specifically, experts noted that industry currently lacks standardized data across nuclear power plants to characterize the impacts of leaks and that data used to inform assessments of risk are limited to the locations where samples are collected." (p 11)

The NRC relies on plant operators to determine whether a leak presents a health risk. An expert observed that the groundwater reports prepared voluntarily by industry typically oversimplify presented data. In addition, experts expressed concern that there is no process for an agency or third party to review licensees' groundwater monitoring programs. "For example, one expert observed that licensees, with their consultants, independently develop their voluntary groundwater monitoring programs, collect the data and report the results without a formal

opportunity for NRC or others to comment on the specifics of the programs such as the number, location, and depth of monitoring wells." (p 12) In addition, the NRC relies on licensees to initially determine whether a leak presents a health risk

NRC does not generally require licensees to monitor on or off-site groundwater if it not used as a direct source of drinking water or irrigation. (pp 13-14)

After multiple leaks from nuclear plants were reported, heightening public concern, the Nuclear Energy Institute (NEI) announced voluntary initiatives to assess the condition of buried piping and groundwater under a "Groundwater Protection Initiative."

"However the NRC has no plans to evaluate the extent to which this initiative, as implemented, will promptly detect leaks and, as a result, has no assurance that the Groundwater Protection initiative will consistently help to promptly detect leaks as nuclear plants age. In addition, NRC officials have said ... that the agency is not going to incorporate the initiative into its requirements . ...Therefore, the public cannot be assured the initiative will remain in place in the future." (p 17; *see also* p 24)

"NRC officials and other stakeholders noted that the pressure and flow tests NRC currently requires do not provide information about the structural integrity of an underground pipe, such as whether the pipe has degraded to the point that the thickness of its wall could hinder the pipe's structural performance… the technology for such tests has not been sufficiently developed for, or adapted to, the nuclear industry site conditions. … NRC and licensees cannot be assured that underground safety-related pipes remain structurally sound without having information about degradation that has occurred. … the likelihood of future pipe failures cannot be as accurately assessed, and this increases the uncertainty surrounding the safety of the plants." (p 19)]

2010

ASSOCIATED PRESS: More than one quarter of U.S. nuclear plants have leaked tritium, Associated Press interactive diagram, 2010.
http://hosted.ap.org/specials/interactives/_national/leaking_nukes/index.html?SITE=AP.

[The diagram identifies nuclear sites which have leaked tritium with red dots and shows the vast majority of nuclear plant tritium leaks to be located in the Northeast/East coast.]

BEYOND NUCLEAR: Gunter P, Leak First, Fix Later: Uncontrolled and Unmonitored Radioactive Releases from Nuclear Power Plants, Report of Beyond Nuclear, Apr 2010. http://www.beyondnuclear.org/storage/documents/LeakFirst_FixLater_BeyondNuclear_April182010_FINAL.pdf.

[Report by Paul Gunter, Director of the Reactor Oversight Project at the nuclear watchdog group Beyond Nuclear, reviews the uncontrolled releases from nuclear power plants. The report observes:

"Water is necessary to sustain all life. Water is a natural cycle of vapor, liquid and solid. New water is not created; it is recycled. This continuous cycle takes each water molecule through the processes of evaporation, condensation, precipitation and collection. Clouds, rain, snow, ice, fog and water vapor all converge into the collection of surface water in streams, rivers, lakes, and oceans, as well as within the movement of groundwater in deep and shallow aquifers to begin the cycle anew. Today's groundwater is tomorrow's drinking water. It is a vital resource for sustaining habitats, food and agriculture and recreation.

"However, long-lived manmade radioactive toxins are being deliberately and accidentally released from nuclear power plants and are incrementally poisoning this natural water cycle." (p 5)]

BLACKSMITH INSTITUTE: McCartor A, Becker B, Hanrahan D, Ericson B, Thomen A, Fuller R, Jones D, May I, and Caravanos J, Top Six Toxic Threats: Six pollutants that jeopardize the health of tens of missions of people, Blacksmith Institute report produced in collaboration with Green Cross Switzerland, 2010.

["The global health impacts from toxic pollutants such as heavy metals, pesticides and radionuclides, are greater than previously thought. …. These pollutants exacerbate other health concerns by weakening the body's immune system, rendering it more susceptible to disease." (p 1) Some pollutants end up in food chains in oceans and distant countries.

The 6 toxic pollutants lead, mercury chromium arsenic, pesticides, and radionuclides were selected because extensive research conducted by the Blacksmith Institute demonstrates they have the greatest impact on public health and impact the greatest number of people. However, long-lived manmade radioactive toxins are being both deliberately and accidentally released.]

CERES: Leurig S, The Ripple Effect, Water Risk in the Municipal Bond Market, Ceres Report with Analysis by Water Asset Management, Oct 2010. http://www.ceres.org/resources/reports/water-bonds.

[In the context of financial assessment of the municipal bond market, this study warns the nation's water supply and water management systems are at risk, particularly from water shortages. Both quality and quantities of supply are at risk. These effects can impact bonds with investment in nuclear power plants which rely on access to water supply for cooling. Water shortages and droughts will especially impact water demand and supply.]

ESTUARY, ESTUARINE, COASTAL AND SHELF SCIENCE: Nitsche FO, Kenna TC, and Haberman M, Quantifying 20th century deposition in complex estuarine environment: An example from the Hudson River, Estuary, Estuarine, Coastal and Shelf Science (2010); 89 (2): 163-174. Abstract. http://www.sciencedirect.com/science/article/pii/S0272771410002313.

[Authors, scientists affiliated with the Lamont-Doherty Earth Observatory of Columbia University, observe: “Sediment processes in estuaries “are controlled by the interaction of factors that include tides, fresh water inputs, bed morphology, sediment supply, and hydrodynamics. The interaction of these factors strongly influences the pattern of sediment deposition.” Best management of estuarine systems requires the ability to quantify sediment deposition on a regional scale. The paper describes an approach for obtaining the deposition pattern and quantifying the amount of 20th century impacted sediments in the Haverstraw Bay section of the Hudson River Estuary. Authors estimate the site experiences average sediment accumulation rate of ~3 mm/y and that ~75,000 t/y or ~10% of the annual total sediment input measured at the Poughkeepsie, NY gauging station is stored in this reach of the Hudson River on ~100 y timescales. A detailed analysis of the depositional pattern indicates that the accumulation rate varies considerably throughout the study area ranging from non-depositional to >8 mm/y. The data collected by the Lamont-Doherty team also clearly indicate that the dredged channel in Haverstraw Bay is currently the primary focus of deposition in this area.]

2009

ASSOCIATED PRESS: Blaney, Betsy, Critics: Burial site for Hudson River PCBs is inadequate, Associated Press, Jun 22, 2009. http://lubbockonline.com/stories/062209/sta_453317901.shtml#.VipnYv-FMuU.

[A stretch of West Texas, bordering New Mexico, has become a dumping ground for radioactive waste – including 45,000 tons of waste from a former uranium-processing plant – and carcinogenic PCB-tainted sludge dredged from the Hudson River.

Critics charge the dumping will only create a new toxic mess for future generations to clean up.

Waste Control Specialists (WCS), the Dallas-based company that operates a low level radioactive waste and PCB disposal site, stands to make tens of millions of dollars from the Hudson PCBs. Glenn Lewis, formerly with the Texas Commission of Environmental Quality said geologists studying the site found holes and fissures in the clay at the site. “The ‘geology is awful. It leaks,’ said Lewis, who compiled the geologists’ findings. He called the site ‘irredeemably inadequate’ for radioactive waste.” The Santa Rosa aquifer is near the site. The aquifer is not used for drinking water but it is used to water livestock which could transfer contaminants to the human food chain in the event of a leak Lewis said.

Neil Carman, an official with the Sierra Club in Texas charged: “‘There’s no cleanup. It’s just gone from the Hudson River,’” and called the {*WCS LLC site in Andrews County*} a “‘cheap pay toilet … the cheapest GE could find’.”]

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES; NATIONAL INSTITUTES OF HEALTH; NATIONAL CANCER INSTITUTE: President’s Cancer Panel Report. Reducing Environmental Cancer Risk: What We Can Do Now (2008-2009), Apr 2010. http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp08-09rpt/PCP_Report_08-09_508.pdf.

[Higher incidence of multiple myeloma has been documented at Hanford Nuclear Reservation in Washington and other DOE weapons production sites. “In addition to numerous gaseous

emissions of radioactive iodine [I-131] during its nearly 30 years of operation, the Hanford site, which covers nearly 600 square miles, discharged over 400 billion gallons of radioactive waste into the surrounding soil and the Columbia River. The plant ceased operations in 1972, but now is the largest nuclear waste storage site in the country. Nuclear waste at Hanford has an estimated 195 million curies of radioactivity." (pp 80-81) DOE acknowledges that ~60 underground plutonium waste storage tanks have leaked and others are suspected of leaking.

"An estimated one million gallons of high-level nuclear and chemical waste have leaked into the soil, contaminating 200 square miles of land under the Hanford facility. This radioactive waste continues to leach into the groundwater that empties into the Columbia River, the principal site of salmon spawning in the region and main water source for agriculture and recreation in most of southern Washington and Northern Oregon. The river also supplies drinking water for nearly a million people." (p 81)

The Hanford cleanup program is one of "the most complex, technically challenging, and costly hazard remediation projects ever attempted" with an annual budget greater than hundreds of other Superfund cleanups combined. (p 81) Cleanup was initiated in 1989 with the expectation the job would be completed in 30 years, but as of 2009, the job was less than half completed.

In a 2002 report the President's Cancer Panel described radiation exposures and health problems, including cancer, experienced by the Yakima Nation and other Northwest Native Americans who live in close proximity to Hanford. In addition, many uranium mining and milling operations have been located in or near Navajo tribal lands in New Mexico. The Navajo banned uranium mining and milling in 2005, but more than 1,000 contaminated sites exist in the region, some designated as Superfund sites. Many families still live near the sites where "they continually breathe uranium dust and drink uranium-contaminated water. Bothe the Navajo and Laguna tribes have experienced markedly higher than average rates of lung cancer, as well as kidney disease, birth defects, and other health problems." (p 81)

It may never be known how many hundreds of thousands – or millions – of people living near and downwind and/or downstream from atomic weapons activity sites, uranium mines and mills, nuclear power plants and nuclear waste storage sites have been exposed to significant radioactive contamination. (p 81) Though less documented than the Hanford complex radiation leaks, similar situations exist at numerous nuclear facilities across America. "People with multiple exposures (at different locations to multiple radionuclides, or both) have no measurement tool or mechanism that enables them to combine estimated doses to determine their cumulative radiation exposure and resultant health risks." (p 81)]

2008

ENERGY POLICY: Sovacool BK, Valuing the greenhouse gas emissions from nuclear power: A critical survey, Energy Policy (2008); 36: 2940-2953. http://www.nirs.org/climate/background/sovacool_nuclear_ghg.pdf.

GZA GEOENVIRONMENTAL: Hydrogeologic Site Investigation Report for the Indian Point Energy Center, Report of GZA GeoEnvironmental, Inc., Jan 7, 2008. http://pbadupws.nrc.gov/docs/ML0803/ML080320540.pdf.

[Report of hydrogeologic firm on mechanisms and pathways of years of radioactive leaks into the Hudson River and the soil at the site of the Indian Point nuclear plant in New York. Ultimately, because of site geology, waters at the location flow towards the Hudson River.]

WILLIAM & MARY ENVIRONMENTAL LAW AND POLICY REVIEW: Sovacool BK and Cooper C, Nuclear Nonsense: Why Nuclear Power is No Answer to Climate Change and the World's Post-Kyoto Energy Challenges, William & Mary Environmental Law and Policy Review (2008); 33 (1/2). http://scholarship.law.wm.edu/wmelpr/vol33/iss1/2.

2007

ESTUARY, ESTUARINE, COASTAL AND SHELF SCIENCE: Crusius J and Kenna TC, Ensuring confidence in radionuclide-based sediment chronologies and bioturbation rates, Estuarine, Coastal and Shelf Science (2007); 71 (3-4): 537-544. Abstract. http://www.sciencedirect.com/science/article/pii/S0272771406004082.

[Authors John Crusius, PhD of the U.S. Geological Survey, Woods Hole Science Center and Timothy C. Kenna, PhD, of the Lamont-Doherty Earth Observatory of Columbia University note that sedimentary records of radionuclides are widely used as tools for estimating the age of recent sediment and rates of sedimentation and bioturbation. Developing records to the point of data interpretation requires careful sample collection, processing, analysis and data modeling.

Paper addresses some potential pitfalls that can impact sediment core records and interpretation with emphasis on problems that are not well documented in the literature.]

ESTUARY, ESTUARINE, COASTAL AND SHELF SCIENCE: Nitsche FO, Ryan WBF, Carbotte SM, Bell RE, Slagle A, Bertinado C, Flood R, Kenna T, and McHugh C, Regional patterns and local variations of sediment distribution in the Hudson River, Estuarine, Coastal and Shelf Science (2007); 71 (1-2): 259-277. Abstract. http://www.sciencedirect.com/science/article/pii/S0272771406003428

[Authors are from the Lamont-Doherty Earth Observatory of Columbia University, Stony Brook University and McHugh Queens College. Data from the Hudson River Benthic Mapping Project, funded by the New York State Department of Environmental Conservation illuminates the regional pattern and the local variations of the sediment distribution in the 240-km long Hudson River Estuary. The Hudson River Estuary may be divided into 8 sections with distinct combinations of channel morphology, bedrock type, sediment texture, and sediment dynamics. The regional sediment distribution consists of marine sand-dominated sediments near the ocean end of the estuary, a large, mud-dominated central section, and fluvial sand-dominated sediments in the freshwater section of the Hudson River Estuary. This regional trend is highly modified by small-scale variations in the sediment distribution. These local variations are controlled by changes in morphology, bedrock, and tributary input, as well as by anthropogenic modifications of the estuary. In some areas these local variations are larger than the overall trend in sediment distribution and control the actual sediment type, as well as the condition of erosion and deposition in the estuary.]

2006

2005

GEOLOGICAL SOCIETY OF AMERICA: Kenna TC, Chillrud SN, Chanky DA, Simpson HJ, McHugh CM, Shuster EL, Bopp RF, Determining Sources and Transport of Nuclear Contamination in Hudson River Sediments with Plutonium, Neptunium, and Cesium isotope Ratios: Sources and Transport, Session on Chemistry and Transport of Particles and Particle-Associated Contaminants in Rivers and Estuaries, Geological Society of America Northeastern Section 40th Annual Meeting, Mar 14-16, 2005. Abstract. https://gsa.confex.com/gsa/2005NE/finalprogram/abstract_84081.htm.

[Scientists from Lamont-Doherty Earth Observatory of Columbia University and Rensselaer Polytechnic Institute note different sources of nuclear contaminants exhibit unique isotopic signatures which can be used to identify and resolve inputs from multiple sources. This approach can lead to a better understanding of the transport behavior, fate, and relative importance of particle reactive nuclear contaminants.

Here the scientists report on isotope ratios of Cs-137, Np-237, Pu-239, and Pu-240 measured in sediment cores from 5 locations in the Hudson River drainage basin.

The Hudson River radionuclide measurements "show clear evidence of input from non-fallout soruces," specifically, the Indian Point Nuclear Power Plant (IPNPP) and the Knolls Atomic Power Laboratory (KAPL), which lie within the drainage basin.

Authors' work to date indicates contamination derived from KAPL activities is present in Mohawk River sediments and is "a chronic source of contamination to sediments at all sites sampled in the Hudson River Estuary, indicating transport distances of greater than 200km."

"Non-fallout ^{137}Cs in effluent releases from IPNPP, identified by $^{137}Cs/^{239}Pu$ ratios significantly higher than average global fallout, is present in sediments collected in close proximity to the facility as well as those collected ~30km downstream."

An additional source of contamination has contributed excess Cs-137 to sediments in the Upper Hudson River – but the source of this contamination is unknown.]

PUBLIC CITIZEN: Nearly 300 Groups Reject Nuclear Energy as a Global Warming Solution: Groups Urge Congress to Choose Clean Energy Path, Not Embrace Dangerous and Dirty Nuclear Power, Public Citizen and Nuclear Information and Resource Service Press Release, Jun 16, 2005. http://www.citizen.org/cmep/article_redirect.cfm?ID=13563.

["In response to an industry campaign touting new nuclear reactors as a solution to global warming, nearly 300 international, national, regional and local environmental, consumer, and safe energy groups reiterated their substantial concerns today over nuclear energy and rejected

the argument that nuclear power can solve global warming. Rather, the groups urged a focus on clean and renewable sources of energy and energy efficiency and conservation."

"'Global warming is the most serious environmental problem facing us today and we should aggressively increase energy efficiency and renewable energy to reduce carbon dioxide pollution,' said Anna Aurilio, Legislative Director for the U.S. Public Interest Research Group. 'We're now one of nearly 300 public interest groups that say nuclear power is too dangerous and expensive and should not be part of a global warming solution,' she added."]

2004

AMERICAN GEOPHYSICAL UNION: Kenna TC, Chillrud SN, Chanky DA, Simpson HJ, McHugh CM, Shuster EL, Bopp RF, Determining Sources and Transport of Nuclear Contamination in Hudson River Sediments with Plutonium, Neptunium, and Cesium isotope ratios, The Smithsonian/NASA Astrophysics Data System (2004), American Geophysical Union, Fall Meeting 2004, Abstract #H41I-05. http://adsabs.harvard.edu/abs/2004AGUFM.H41I..05K.

[Study led by Timothy C. Kenna Lamont-Doherty Earth Observatory of Columbia University of radioactive sediment transport in the Hudson River, focusing on Pu-239, Pu-240, Np-237 and Cs-137, which are strongly bound to fine grained sediments.

The Hudson River drainage basin has received contamination from at least three separate sources: (1) global fallout from atmospheric testing of nuclear weapons, which contributed Pu, Np and Cs; (2) contamination resulting from reactor releases at the Indian Point Nuclear Power Plant (IPNPP) located on the Hudson River Estuary ˜70km north of New York Harbor, where records document releases of Cs-137; (3) contamination resulting from activities at the Knolls Atomic Power Laboratory (KAPL) located on the Mohawk River, where incomplete records document releases of Cs-137 (but no mention is made of Pu or Np).

Findings: Report of measurements of Pu isotopes, Np-237 and Cs-137 for a series of sediment cores collected from various locations within the drainage basin: the Mohawk River downstream of KAPL; the Hudson River upstream of its confluence with the Mohawk River, and the lower Hudson River at a location in close proximity to Indian Point. The scientists also collected and analyzed selected samples from a site ˜30km downstream of Indian Point, and another ˜30km upstream of Indian Point.

Different sources of radioactive contamination contain characteristic and identifiable isotopic signatures. Thus by comparing the isotopic ratios Pu-240/Pu-239, Np-237/Pu-239, and Cs-137/Pu-239, measured in fluvial sediments to mean global fallout values, it is possible to identify and resolve different sources of non-fallout contamination. Np-237 appears to originate from global fallout only.

Mohawk River sediments downstream of KAPL exhibit enrichments in Pu-239, Pu-240, and Cs-137 that are 7 to 20 times higher than levels expected from global fallout as indicated from Np-237. The elevated levels, non-fallout isotopic signatures, and core location are all consistent with KAPL being a source of Pu and Cs isotopes. By comparing KAPL-derived Pu-239 inventories measured in the Mohawk and Lower Hudson Rivers, the researchers estimate a dilution factor of ˜140.

Sediments from upper Hudson River and a section of the lower Hudson Estuary both contain Cs-137 levels that are more than twice that expected from global fallout.

Isotopic evidence of KAPL derived radionuclides was found in all the lower Hudson sediments analyzed. But the dilution factor – estimated as ˜140 – suggests that the primary source of Cs-137 contamination to lower Hudson River sediments is from Indian Point, not KAPL. Elevated levels of Cs-137 were observed in sediments collected in the vicinity of Indian Point as well as sediments collected 30km downstream of the nuclear power plant.

Conclusion: “We attribute the elevated Cs-137 levels in these Lower Hudson sediments to contamination originating from IPNPP {*Indian Point nuclear power plant*}.”]

2003

INSTITUTE FOR ENERGY AND ENVIRONMENTAL RESEARCH (IEER), 2013. Makhijani A, Transcript KUNM public radio commentary, Sep 2003. http://ieer.org/resource/commentary/drought-threatens-nukes/.

2002

2001

SAFE ENERGY COMMUNICATION COUNCIL (SECC); NUCLEAR INFORMATION AND RESOURCE SERVICE (NIRS); STANDING FOR TRUTH ABOUT RADIATION (STAR); AND NANCY BURTON, ESQ: Gunter L, Gunter P, Cullen S, and Burton N, Licensed to Kill: How the nuclear power industry destroys endangered marine wildlife and ocean habitat to save money, joint Report of the Safe Energy Communication Council (SECC); Nuclear Information and Resource Service (NIRS); Standing for Truth About Radiation (STAR); and Nancy Burton, Esq, 2001. http://static1.1.sqspcdn.com/static/f/356082/3590840/1247621149403/ltk_full.pdf?token=a1DMYa6noVeCWgy7ax3jx60SJBc%3D.

[Report details the ways routine operation of nuclear reactors injure and kill wildlife and harm riverine and marine habitats. Reactors can draw in and discharge (heated) as much as 3 billion gallons of water a day for cooling.]

2000

1990s

1980s

NEW YORK TIMES: Leaking Pipe Repaired At Indian Point 2 Plant, New York Times, Oct 23, 1980. http://query.nytimes.com/gst/abstract.html?res=9C03EEDD163AE732A25750C2A9669D94619FD6CF and http://timesmachine.nytimes.com/timesmachine/1980/10/23/111302960.html?pageNumber=31.

[Workmen have repaired a broken water pipe that forced the shutdown on October 17, 1980 of the Indian Point 2 nuclear power plant but a spokesman for the operator said on October 23,1980 that Con Edison could not say when the plant would resume operations.

"The pipe, used for the plant's cooling system, began leaking Friday at 4P.M. because of a crack in a joint, depositing 100,000 gallons of non radioactive water on the floor of the containment building ... tests will be made by Con Edison and the Nuclear Regulatory Commission to see if the salt water had corroded any of the equipment it came into contact with."]

APPENDIX C

HUMAN RIGHTS AND ENVIRONMENTAL JUSTICE

2016

CLEAN UP THE MINES: 'We are the Miner's Canary': Indigenous Organizations Call for Clean Up of 'Homegrown' Radioactive Pollution Crisis, Clean Up The Mines Press Release, Jan 29, 2016. http://www.cleanupthemines.org/press-release-we-are-the-miners-canary-indigenous-organizations-call-for-clean-up-of-homegrown-radioactive-pollution-crisis/.

CLEAN UP THE MINES: Press Release: Indigenous Delegation Sounds Alarm on Homegrown Radioactive Pollution Crisis Clean Up The Mines Press Release, Jan 23, 2016. http://www.cleanupthemines.org/press-release-indigenous-delegation-sounds-alarm-on-homegrown-radioactive-pollution-crisis/.

COUNTERPUNCH: Kamps, Kevin, After Flint, Don't Let Them Nuke the Great Lakes, Counterpunch, Jan 26, 2016. http://www.counterpunch.org/2016/01/26/after-flint-dont-let-them-nuke-the-great-lakes-next/.

ECOWATCH: Kamps, Kevin, The Great Lakes and a High-Level Radioactive Nuke Waste Dump Don't Mix, EcoWatch, Jan 28, 2016. http://ecowatch.com/2016/01/28/great-lakes-nuclear-waste-dump/.

2015

APPLIED NURSING RESEARCH: Adams N, A review of Yellow Dirt: A Poisoned Land and the Betrayal of the Navajos, Applied Nursing Research (2015); 28 (2): 114-115. Abstract. http://www.appliednursingresearch.org/article/S0897-1897(14)00113-X/abstract

[Author, a nurse affiliated with the University of Mexico, reviews the book "Yellow Dirt" by Judy Pasternak, emphasizing that knowledge of the impact of uranium mining on the environment and health of the Navajo people is something all nurses treating this population needs to be aware of and incorporate into their health care practice.]

Biguenet, John, The Water Receded. The Anger's Still Here, New York Times Op-Ed, Aug 30, 2015. http://www.nytimes.com/2015/08/30/opinion/sunday/new-orleans-the-big-uneasy.html.

[John Biguenet, author of "The Rising Water Trilogy: Plays" and a New Orleans resident, to explains the anger of so many New Orleanians is continuingly stoked by hardships like the inability to get from one end on your neighborhood to another because streets continue to collapse – even a decade after the deluge - because the saltwater which flooded the area for weeks eroded the buried infrastructure.

Reminders of the tragedy also abound.

Nearly 2 weeks after the levees collapsed, soldiers broke through the roof of Biguenet's parent's home searching for the dead. The water was still at least 10 feet deep. Still visible today on the home is a fading X spray painted by the soldiers. "A zero in one quadrant confirms that no bodies were found. In the top quadrant of the X is the date: 9/11."

Every day, a few blocks from his home, Biguenet passes houses where people drowned in their bedrooms or died of dehydration trapped in their attics.

Ten years after Katrina, 100,000 fewer African Americans live in New Orleans. For those who remain, poverty has worsened, with annual median household income 54% lower than those of white families and 20% lower than black households nationally.]

DATA CENTER: Plyer A, Shrinath N, and Mack V, The New Orleans Index at Ten: Measuring Greater New Orleans' Progress toward Prosperity, The Data Center, Independent Analysis for Informed Decisions in Southeast Louisiana report, Jul 31, 2015.

https://s3.amazonaws.com/gnocdc/reports/TheDataCenter_TheNewOrleansIndexatTen.pdf.

[Report derives from collaboration of the Greater New Orleans Community Data Center and the Brookings Institution. It provides data of New Orleans recovery process using 30 indicators as well as a series of essays by leading local scholars. Definition of resilience: "Regional resilience is composed of two related components; they are: (1) resilience performance, how well a region rebounds after a disaster and (2) resilience capacity, the region's ability to respond to any shock." (p 6)

More than one million people were displaced from their homes after Hurricane Katrina and the failure of the New Orleans levees. Damage to the region from Katrina is estimated at $151 billion. Katrina was just one of multiple shocks suffered by the region. Katrina was quickly followed by Hurricane Rita. Then, in subsequent years, extensive flooding and wind damage to the region was caused by Hurricanes Ike, Gustav, and Isaac. And, in 2010, the BP Deepwater Horizon disaster gushed millions of barrels of oil into the Gulf, fouling miles of Louisiana's delicate coastal wetlands – New Orleans' first line of defense against storm surge. "Since 1932, the New Orleans region has lost nearly 30 percent of the land that forms its protective buffer from hurricane storm surge, and saltwater is increasingly infiltrating groundwater within the levee walls." (p 9)

Despite extensive investment and economic and reform-driven progress and substantial rebounding in the ten years after Katrina, metro New Orleans performs worse on indicators of inclusion than the nation and other fast-growing Southern metros. Available data (2013 census figures): The median income for black households in metro New Orleans is 20% below that of black households nationwide (whereas that of white households is on par with white households nationally). Disparity between black and white incomes in metro New Orleans is 54% (compared to 40% nationwide). Just 57% of black men are employed, a figure significantly lower than other fast-growing Southern metros. "The share of the metro's poor that live outside the city continues to expand – growing from 46 percent in 1999 to 58 percent by 2013." (p 8)

GEOSCIENCES: Moore-Nall, A, The Legacy of Uranium Development on or Near Indian Reservations and Health Implications Rekindling Public Awareness, Geosciences (2015); 5 (1): 15-29. http://www.mdpi.com/2076-3263/5/1/15/htm.

[Author Anita Morre-Nall, of the Department of Earth Sciences at Montana State University, notes energy material from uranium mining and milling activity contains harmful chemical substances that – if mobilized into air, water, or soil – can adversely impact human health and environmental quality. The legacy of uranium procurement in the U.S. has left a legacy of long-lived health effects for many Native Americans. The largest population and some of the most impacted people are the tribes living in the Southwest, especially the Navajo, but also Sioux, Spokane Nation and many others.

"As a result of the mining activity much of the population of the Navajo Nation residing near the areas of mining or milling has had their health compromised. Most of the 1000 unsealed tunnels, unsealed pits and radioactive waste piles still remain on the Navajo reservation today, with Navajo families living within a hundred feet of the mine sites."

Uranium mining has also left a legacy of contaminated groundwater and tailings on the Wind River Reservation, Wyoming, home to Eastern Shoshone and Northern Arapaho Indians. “Increased incidences of cancers among its peoples are attributed to the old Susquehanna-Western uranium mill tailings site. The site is a few miles southwest of Riverton, the ninth most-populated city in Wyoming. In some areas of the Wind River Indian Reservation groundwater contamination is so bad that the Department of Energy (DOE) estimates drinking water from contaminated aquifers could make residents up to 10 times more likely to develop cancer than the general population.”

Pacific Northwest tribal groups on nine reservations in Washington, Idaho and Oregon have also been impacted by Hanford Nuclear reservation activities. The peoples of these reservations traditionally used and continue to use the lands and resources from the Columbia River Plateau region including land ceded to the government for which they retained hunting and gathering privileges. “Thus, they may have been exposed to more radiation and contaminants than the general public in practicing traditional lifestyles while fishing, hunting game, food gathering (berries, root plants, *etc.*) harvesting medicinal plants and traditional practices (*i.e.*, sweats), as well as social and spiritual interaction networks.”

The other four reservations, the Nez Perce, Confederated Tribes of the Umatilla, Confederated Tribes and Bands of the Warm Springs and the Yakama Nation are known to consume large quantities of fish and likely received higher doses of river borne releases which resulted from radiation releases into the Columbia River water. In addition, liquid waste that had been poured onto the ground or held in ponds or trenches at the Hanford reservation evaporated or soaked into the soil on the site. The contaminated areas are thought to have also created underground “plumes” of contaminants which could also affect native peoples who consume native food sources in the area.

A study in the Eastern Agency of the Navajo Nation, NM found that, despite decades of inactivity in the mines and mills investigated, environmental contamination was widespread, often near homes, livestock grazing areas, and locations frequented by children and families. “The uranium contamination in this area was predominantly in the highly soluble chemical forms that could be spread when disturbed or by the bursts of precipitation that occur in this semiarid region at certain times of the year.”]

INTERNATIONAL DISPLACEMENT MONITORING CENTRE (IDMC): Albuja S, Bilak A, Ginnetti J, Howard C, Kok F, McCallin B, Swain M, Turner W, and Walicki N, Global Estimates 2015: People displaced by disaster, International Displacement Monitoring Center (IDMC) report, with support from the Norwegian Refugee Council, July 2015. http://www.internal-displacement.org/assets/library/Media/201507-globalEstimates-2015/20150713-global-estimates-2015-en-v1.pdf. Sandy estimate recalibration: http://www.internal-displacement.org/publications/2015/global-estimates-2015-people-displaced-by-disasters.

[The Internal Displacement Monitoring Centre (IDMC) is the leading source of information and analysis on internal displacement – i.e., people worldwide displaced within their own country. This report draws on data from a wide range of sources, including the UN, governments, international organizations, NGOs and media. Analyses focus on displacement caused by disasters associated with rapid-onset geophysical and weather-related hazards.

In 2014 more than 19.3 million people in 100 different nations were forced to flee their homes – 17.5 because of weather-related hazards; 1.7 million due to geophysical hazards.

Since 2008 an average of 26.4 million people per year have been displaced from their homes by disasters brought on by natural hazards. This is equivalent to one person every second. While the number and scale of disasters creates significant fluctuation from year to year, the trend over decades is on the rise.

In addition, hundreds of thousands remain displaced following disasters of previous earlier years. This problem exists even in highly industrialized nations. In Japan, more than 230,000 people forced to flee the quake, tsunami and Fukushima disaster in 2011 remain displaced in 2015. In the United States, nearly 40,000 people still need housing assistance three years after Tropical Storm Sandy hit in 2012.]

INTERNATIONAL JOURNAL OF GYNECOLOGY AND OBSTETRICS: Di Renzo GC, Conry JA, Blake J, DeFrancesco MS, DeNicola N, Martin Jr JN, McCue KA, Richmond D, Shah A, Sutton Pm Woodruff TJ, van der Poel SZ, and Giudice LC, International Federation of Gynecology and Obstetrics opinion on reproductive health impacts of exposure to toxic environmental chemicals, International Journal of Gynecology and Obstetrics (2015); http://www.figo.org/sites/default/files/uploads/News/Final%20PDF_8462.pdf.

[Authors are from the International Federation of Gynecology and Obstetrics (UK); American College of Obstetricians and Gynecologists (US); Society of Obstetricians and Gynaecologists of Canada (CA); Royal College of Obstetricians and Gynecologists (UK); Program on Reproductive Health and the Environment, University of California (US); American Society for Reproductive Medicine (US); and the World Health Organization. Widespread exposure to environmental toxins, they warn, is threatening healthy human reproduction across the globe.

While exposure to toxins at any point in life is potentially harmful, “there are time-specific vulnerable windows of human development” when environmental factors and stressors can “dramatically alter developmental programming signals.” Even small exposures to toxic chemicals during pregnancy and breastfeeding can trigger adverse health consequences. Developmental neurotoxicity is an especial risk during these periods. Risk extends beyond cancer to cardiovascular disease, chronic respiratory disease, and diseases related to the endocrine system, including neurobehavioral disorders associated with thyroid disruption.

Policies that address toxins should not result in the transfer of harmful exposures between and among current and future populations. The health of all vulnerable populations must be protected.

Environmental contaminants cross borders through food, trade, wind and water. Reducing the disease burden of toxic environmental exposures from food, air, water, and other sources will make an important contribution towards human health, eradication of extreme poverty and environmental sustainability.

Exposure to toxic environmental chemicals and related health outcomes is a global phenomenon. However exposures are inequitably distributed within and between countries.

Universally, the consequences of exposure are disproportionately borne by people with low incomes. Economic, occupational and social factors add to the risk of exposure and harm.

Environmental factors harmful to reproductive health disproportionately affect vulnerable and underserved populations – this type of harm is often subsumed in other EJ issues.

The US Environmental Protection Agency (EPA) defines environmental justice as "'the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.'"

Authors urge all health care professionals to advocate prevention and champion policies and practices that secure environmental justice on a global scale.]

Millet, Lydia, Selling Off the Holy Land, New York Times Op-Ed, May 29, 2015. http://www.nytimes.com/2015/05/29/opinion/selling-off-apache-holy-land.html.

[An ancient sacred Native American land known as Oak Flat lies at the core of traditional Apache ceremonial and cultural activities. In 1955, President Dwight D. Eisenhower decreed it closed to mining. In 1971, President Richard M. Nixon's Interior Department renewed the ban. Under the multiple-use mandate of the Forest Service, the land belongs to the public.

In December 2014, Congress promised to give away title to the Apache holy land to Resolution Copper Mining, a foreign-owned subsidiary of Rio Tinto.

The giveaway was accomplished via a fine-print land swap rider slipped into the National Defense Authorization Act at the 11th hour by Senators John McCain (R-AZ) and Jeff Flake (R-AZ). Rio Tinto affiliates have been McCain campaign contributors. Before Flake went to Congress, he was a paid lobbyist for Rio Tinto Rössing Uranium (a huge uranium mine in Namibia). Another Congressman involved was Rick Renzi, a former Republican representative sent to federal prison in February 2015 for corruption connected to earlier versions of the land-transfer deal.

If the deal goes through, "[t]he site will doubtless be destroyed for any purpose other than mining; Resolution Copper Mining will hollow out a vast chamber that, when it caves in, will leave a two-mile-wide, 1,000-foot-deep pit. The company itself has likened the result of its planned mining at Oak Flat to that of a nearby meteor crater."

But the rider may be repealed. Hundreds of Apache traveled to occupy Oak Flat to protest what is, to them, a sacrilegious and craven sell-off of a place where, in the words of San Carlos Apache tribal chairman, Terry Rambler, "'Apaches go to pray'." Wendsler Nosie Sr., a former chairman of the San Carlos Apache, described the area's importance as "'No difference to Mount Sinai. How the holy spirit came to be.'"

Lydia Millet writes: "If Oak Flat were a Christian holy site, or for that matter Jewish or Muslim, no senator who wished to remain in office would dare to sneak a backdoor deal for its destruction into a spending bill — no matter what mining-company profits or jobs might result. But this is

Indian religion. Clearly the Arizona congressional delegation isn't afraid of a couple of million conquered natives."]

NEW YORK TIMES: Santos, Fernanda, On Parched Navajo Reservation, 'Water Lady' Brings Liquid Gold, New York Times, Jul 14, 2015. http://www.nytimes.com/2015/07/14/us/on-parched-navajo-reservation-water-lady-brings-liquid-gold.html.

[One-third of the roughly 50,000 households on the Navajo reservation face water shortages, "one of the highest concentrations of water-poor homes in the country. A multiyear drought has only made it worse."

Navajo land straddles the high desert across New Mexico, Arizona and Utah and Navajo elders have told scientists at the National Climate Assessment that they have seen a perceptible decline in snowfall over the years and the gradual disappearance of streams, lakes and shallow wells of the reservation.

"In Thoreau, residents said that the soil had become sandier, and that horses and cows had been dying of thirst by water holes that had gone dry. Some families have had to drink, bathe and cook with water they have hauled from livestock tanks, or use water pumped from aquifers poisoned by radioactive waste, a devastating legacy of decades of uranium mining on Navajo lands. Often, this is the only water they can find …."

Inadequacy of water for the reservation has continued despite $27 million spent by the EPA and other federal entities since 2008 on improvements to water delivery on the reservation. Many residents rely on Darlene Arviso, whom they call the "water lady," to bring them water from a water truck she drives for the St. Bonaventure Indian Mission. She can't leave the job she says, "'If I'm not here, who's going to bring these people their water? Right now, I'm all they've got.'"]

NEW YORK TIMES: Wines, Michael, Michty Rio Grande Now a trickle Under Siege, New York Times, Apr 13, 2015. http://www.nytimes.com/2015/04/13/us/mighty-rio-grande-now-a-trickle-under-siege.html.

["From Texas to Arizona to Colorado, the entire West is under siege by changing weather patterns that have shrunk snowpacks, raised temperatures, spurred evaporation and reduced reservoirs to record lows."

As drought worsens, dust and soot from forest fires and parched soil additionally coat snow cover, absorbing sunlight and accelerating snow melt.

A long drought around the 1,900 mile Rio Grande River has dried reservoirs throughout the region. Lake Mead, the Colorado River's main reservoir, is at a historic low.

Drought can spur water-rights disputes between different user groups and states. Experts advise water users to start collaboratively preparing for a much drier future.]

PRECIOUS DREAMS FOUNDATION: Russell, Nicole, email, Oct 2015.

[There are over 14,000 foster children and 23,000 homeless youth in New York City sleeping in unfamiliar and uncomfortable conditions.]

Rivlin, Gary, "Katrina: After the Flood," Simon & Schuster (2015)

[Gary Rivkin, a journalist, covered New Orleans on the ground following Katrina for the New York Times. He then spent much of the subsequent decade investigating the collective emergency response at all levels and the lasting effects of the disaster.

In the aftermath of the storm, 4 out of every 5 houses in New Orleans were flooded. The city's infrastructure – water, sewage, electricity, transportation, schools, municipal buildings – were decimated. Businesses and the city's tax base were shattered. Over 1 million people were displaced.

More lasting consequences were damage to the social fabric of the city. The disaster exacted the greatest and most lasting toll on poor and working-class minority communities.]

U.S. NUCLEAR REGULATORY COMMISSION (NRC): Nuclear Regulatory Commission, NRC Web Page (accessed April 15 2015). http://www.nrc.gov/info-finder/decommissioning/uranium/rio-grande-resources-corp.html.

[Chevron sold the facility to Rio Grande Resources Corporation (RGR), a subsidiary of General Atomics. The license was amended in May of 1997 to reflect the transfer of the facility to RGR. Rio Grande Resources Corporation completed decommissioning of the mill site. The tailings impoundment has been capped and a vegetative cover established. The tailings impoundment is still being monitored for performance.

3.0 Major Technical or Regulatory Issues: Groundwater remains an outstanding issue. The licensee has submitted an application for alternate concentration limits. The licensee has indicated a desire to amend the license to authorize an in situ leach uranium recovery processing facility. The expressed desire is to retain the current license number and have the tailings impoundment removed and transferred to the DOE, rather than terminate the license. The agency will need to work through this with the NRC.]

WORLD BANK: Hallegatte S, Bangalore M, Bonzanigo L, Fay M, Kane T, Narloch U, Rozenberg J, Treguer D, and Vogt-Schilb A, Shock Waves: Managing the Impacts of Climate Change on Poverty, World Bank Group report, Nov 8, 2015. Link at: http://www.worldbank.org/en/topic/climatechange/brief/shock-waves-managing-the-impacts-of-climate-change-on-poverty-background-papers.

[World Bank monograph of 14 papers in collaboration with research institutions across the globe examining the impacts of climate change on poverty through ecosystems, natural disasters, health and agriculture.

The objectives of stabilizing climate change, sustainable development and eradicating poverty must not be considered in isolation. They need to be jointly tacked through integrated strategies and creation of a "win-win" situation. Effort must be directed to climate change policies which also contribute to poverty reduction as well as to implementation of poverty-reduction policies help mitigate climate change and build resilience.]

2014

ENVIRONMETAL HEALTH PERSPECTIVES: Arnold C, Once Upon a Mine, Environmental Health Perspectives (2014); 122 (2): A44-A49. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3915248/.

NEW YORK TIMES: Frosch, Dan, Amid Toxic Waste, a Navajo Village Could Lose Its Land Forever, New York Times, Feb 20, 2014. http://www.nytimes.com/2014/02/20/us/nestled-amid-toxic-waste-a-navajo-village-faces-losing-its-land-forever.html.

REPUBLIC/AZ CENTRAL: Loomis, Brandon, Abandoned uranium mines continue to haunt Navajos on reservation, The Republic /AZ Central, Aug 4, 2014. http://www.azcentral.com/story/news/arizona/investigations/2014/08/04/uranium-mining-navajos-devastating-health-effects/13591333/.

[The Colorado Plateau is "scarred, poisoned and frightening a people who still live with the radioactive residue of 521 abandoned mines scattered across their reservation's 17.2 million acres." The Environmental Protection Agency (EPA) reached a $1 billion settlement with Anadarko Petroleum Co. for past mining by subsidiary Kerr-McGee Corp., which Anadarko acquired in 2006. The money is part of a record $5 billion nationwide settlement for a number of environmental violations. But the $1 billion for Navajo cleanup is only enough to cleanup a few dozen (49) abandoned uranium mines, and no company has accepted liability for the rest. The federal government has promised cleanup, but at current low funding levels that could take 100 years to complete.

Uranium ore and debris emits alpha particle radiation which does not penetrate skin, but can be ingested or breathed as dust. Much of the toxic material is expelled by the body within days, but with chronic exposure, it can accumulate in the bones and stress the kidneys as they work to expel it. Chronic exposure, the Environmental Protection Agency, says, is known to damage kidneys and increases risk of cancer and liver disease. At certain mine sites, gamma radiation – a high-frequency penetrating radiation – is also well above regulatory doses. EPA scans of 474 abandoned uranium mines on the Navajo reservation found that 403 had gamma radiation at 2 times the background level, and 226 showed radiation at 10 times background.

Church Rock, NM, has two massive uranium waste-rock piles. A 1979 dam break at the site unleashed one of the largest radioactive uranium contamination accident in US history. “Contamination flooded downstream to the Rio Puerco and Gallup, eventually disappearing out of sight and beyond tracking in the aquifer somewhere above the confluence with Arizona's Little Colorado.” While the companies mining at Church Rock ceased digging uranium in the 1980s, site cleanup remains to be done. In addition, a Texas-based corporation, Uranium Resources Inc., wants to use an in-ground leaching system to dissolve and extract uranium for nuclear power plants. Uranium Resources controls a private square of land surrounded by Navajo reservation land, and wants right of access.

A study published in the journal Health Physics in 2000 found Navajo uranium miners had a lung-cancer rate nearly 29 times that of Navajos who didn’t work in the mines. From 1969 to 1993, two-thirds of new lung cancers in Navajo men afflicted miners.

Pulmonary fibrosis, multiple-organ failure, and kidney disease also commonly afflicts miners, said Gary Foster, a visiting nurse who treats miners in Colorado. “‘If they don't lose their ability to breathe,’ he said, ‘they're all going to get cancer’. … ‘All of the patients I've dealt with, they've had to have it explained to them why they're sick…They don't understand the concept of it sitting in their lungs and staying there forever.’"

Now the children of old miners – who grew up drinking from contaminated wells – are falling ill even as their own children play around abandoned uranium pits and piles.

No funding has been made available to study the full effects of chronic uranium exposure in the Navajo population. Dr. Charles Wiggins, director of the New Mexico Tumor Registry notes: "We don't really have a lot of solid studies that document the effects of exposure."

However a study of health effects upon mothers and babies is being conducted by the University of New Mexico in collaboration with the Southwest Research and Information Center. University of New Mexico researcher Jennifer Ong reports early results show uranium is ubiquitous in blood and urine samples – including in babies. Virtually all of the first 208 samples had uranium levels above the 50th percentile for the US, and 15% spiked past the 95th percentile.]

2013

Farrell, Lindsay, Ann Nolan and Carole Morris, Cutting health center funds will cost Westchester in long run, Journal News Op-Ed, Jan 11, 2013. http://www.lohud.com/article/20130112/OPINION/301110113/.

[Lindsay Farrell is president/CEO of Open Door Family Medical Centers, Ann Nolon is president/CEO of Hudson River HealthCare; and Carole Morris is president/CEO of Mount Vernon Neighborhood Health Center Network.

The authors note that Westchester is a county with a significant income disparity and lament the decision of Westchester County Executive Rob Astorino and a coalition of legislators to eliminate contracts with neighborhood health centers that provide services to the poor, and screen and treat communicable diseases. This undermines the public health safety net that has

existed in Westchester for decades. Westchester's neighborhood health centers are operated by three nonprofit groups with locations in Peekskill, Ossining, and Mount Kisco. "Collectively, they are the family doctor and dentist for nearly 200,000 of Westchester's residents, the majority of whom have low incomes, are African American or Latino, and do not have employer-based health coverage or are covered by Medicaid.

"Health-center patients are commonly described as the working poor — and in Westchester this means people who live and work in areas where there are low-wage jobs in the service economy. Many of our patients are employed in landscaping, housecleaning, house painting or by restaurants, dry-cleaners, and the like."]

PRARIE ISLAND INDIAN COMMUNITY: Prairie Island Indian Community Responds to CNN Scheduled Airing of Pro-Nuclear Documentary, News Release, Prairie Island Indian Community's Tribal Council, Nov 7, 2013.
http://www.tulalipnews.com/wp/2013/11/07/prairie-island-indian-community-responds-to-cnn-scheduled-airing-of-pro-nuclear-documentary/.

[Press Release commenting on the pro-nuclear power film Pandora's Promise.

Two nuclear reactors sit near the reservation of the Prairie Island Indian Community, a Native American Nation in Minnesota. With no permanent nuclear waste storage site, 98 casks could be indefinitely stranded on Prairie Island.

Some 35 nuclear waste storage casks are just 600 yards from tribe member homes.

"The Prairie Island Indian Community knows a thing or two about promises. The thousands of pounds of radioactive nuclear waste stranded on our ancestral homeland provide a daily reminder of how easily promises can be broken.

"When onsite nuclear storage was first approved in our state of Minnesota 20 years ago, our Tribe and other concerned citizens were promised it would be temporary, and because the federal government was legally required to develop a national repository by 1998, we were also promised that only 17 spent fuel casks were needed on Prairie Island. Of course, those promises were broken."

Continuing to create more nuclear waste with no permanent solution puts reactor communities at "considerable risk". Keeping nuclear waste on site exposes communities to the vulnerabilities of aging facilities, human error, natural disasters and acts of terrorism.]

UNITED NATIONS (UN): Grover A, Report of the Special Rapporteur on the right of everyone to the enjoyment of the highest attainable standard of physical and mental health, Anand Grover to the United Nations Human Rights Council (23rd Session, May 2, 2013).
http://www.ohchr.org/Documents/HRBodies/HRCouncil/RegularSession/Session23/A-HRC-23-41-Add3_en.pdf

[Reporting on the Fukushima disaster: “Mandatory evacuation zones were periodically altered from a radius of three kilometers from the Daiichi plant to ten and later to 29km. Voluntary evacuation was eventually endorsed within a 20-30km radius area. Evacuation orders for some areas with high radiation doses were not issued until one month later. On 22 April 2011, the Government issued evacuation orders for areas up to 50km north-west of the plant, including Katsurao, Iitate, Namie, and parts of Minami-soma and Kawamata, due to high-dose radiation detected in the area brought by winds carrying radioactive material from the plant. People in these areas thus remained exposed to high-dose radiation for a significant period.”

“573 deaths have been certified by the Government as ‘nuclear disaster-related deaths.’” (p. 8)

Significantly, the report clarifies the inadequacy of international radiation safety standards which are based on the principles of optimization and justification: “Such a risk-benefit analysis is not in consonance with the right to health framework, as it gives precedence to collective interests over individual rights. Under the right to health, the right of every individual has to be protected. Moreover, such decisions, which have a long-term impact on the physical and mental health of people, should be taken with their active, direct and effective participation.” (p. 16) On cumulative risk, the report observes: “Furthermore, epidemiological studies monitoring the health effects of long-term exposure to low-iodinizing radiation conclude that there is no low-threshold limit for excess radiation risk to non-solid cancers such as leukaemia. The additive radiation risk for solid cancers continues to increase throughout life with a linear dose-response relationship.” (p. 16)]

2012

BEYOND NUCLEAR: PFS pulls the plug on parking lot dump targeted at Skull Valley Goshutes in Utah, Beyond Nuclear post, Dec 22, 2012. http://www.beyondnuclear.org/native-america/2012/12/22/pfs-pulls-the-plug-on-parking-lot-dump-targeted-at-skull-val.html.

[The Skull Valley Goshutes were first targeted by the nuclear power establishment more than 20 years ago. Altogether, 60-some tribes have been actively targeted as high-level radioactive waste dump sites.

The Nuclear Regulatory Commission (NRC) granted Private Fuel Storage (PFS) Limited Liability Corporation (LLC) license to turn the tiny Skull Valley Goshutes Indian Reservation in Utah into a "centralized interim storage facility" (a parking lot dump) for commercial high-level radioactive waste. (At one time, PFS was comprised of more than a dozen nuclear utilities, led by Xcel Energy, with Dairyland Power Co-Op as a front group.)

The waste dump was opposed by members of the Skull Valley band, nearly 500 environmental and environmental justice organizations, as well as the State of Utah. The plan was for 40,000 metric tons of irradiated nuclear fuel to be "temporarily stored" (for 20 to 40 years) in 4,000 dry casks on the Skull Valley reservation. Since plan was to later transfer the waste to the Yucca Mountain dump, but cancellation of Yucca in 2009, meant the wastes would have been stuck indefinitely at Skull Valley.

In 2006 a campaign waged by Mormon political leaders and wilderness advocates, succeeded in creating the first federal wilderness area in Utah in a generation. This created a "moat" around the Skull Valley reservation, blocking the railway needed to directly deliver the waste. PFS gave up on its Skull Valley plan in late 2012.]

CANCER: Field LA, Love B, Deyarmin B, Hooke JA, Shriver CD, and Ellsworth RE, Identification of differentially expressed genes in breast tumors from African American compared with Caucasian women, Cancer (2012); 118 (5): 1334-1344. Abstract. http://onlinelibrary.wiley.com/doi/10.1002/cncr.26405/abstract;jsessionid=4AC3732B16A34D2EC613C6C6D82FA8F2.f04t04.

[Researchers are from the Windber Research Institute; BioReka, LLC; Walter Reed Army Medical Center; Henry M. Jackson Foundation for the Advancement of Military Medicine.

Breast cancer tumors in African American women have less favorable pathological characteristics and African American women have higher mortality rates than Caucasian women. While socioeconomics may influence prognosis, biological factors appear to contribute to tumor behavior.

Here the researchers found that, despite matching of tumors by pathological characteristics, the molecular profiles of African American women and Caucasian women differed in both invasive tumors and benign breast tissues. The differentially expressed genes (including CRYBB2, PSPHL, and SOS1) identified, are involved in cellular growth and differentiation, invasion, metastasis, and immune response and thus may contribute to the poor outcome in African American women.]

CLEARWATER: Hudson River Sloop Clearwater, Inc., (Clearwater) Environmental Justice Contention Summary of Testimony at Indian Point Relicensing Hearings in front of Atomic Safety Licensing Board, Oct 23, 2012, Initial Statement of Position for Clearwater's Contention EC-3A Regarding Environmental Justice, orig sub Dec 22, 2011, revis. Jan 5, 2012, http://pbadupws.nrc.gov/docs/ML1233/ML12335A648.pdf; and Supporting Witness Statements – Prefiled Written Testimonies: Testimony of Dr. Michael Edelstein, http://www.clearwater.org/pdf/CLE000003%20Michael%20Edelstein%20Pre-Filed%20Testimony.pdf; Testimony of Stephen Filler, http://www.clearwater.org/pdf/CLE000009%20Stephen%20Filler%20Pre-Filed%20Testimony.pdf; Testimony of Manna Jo Green, http://www.clearwater.org/pdf/CLE000010%20Manna%20Jo%20Greene%20Prefiled%20Testimony.pdf; Testimony of Erik A. Larsen, FD, FACEP, http://www.clearwater.org/pdf/CLE000005%20Dr.%20Erik%20Larsen%20Pre-Filed%20Testimony.pdf; Testimony of Aaron Mair, http://www.clearwater.org/pdf/CLE000007%20Aaron%20Mair%20Pre-Filed%20Testimony.pdf; Testimony of Anthony Papa, http://www.clearwater.org/pdf/CLE000004%20ANTHONY%20PAPA%20PREFILED%20TESTIMONY.pdf; Testimony of John Simms, http://www.clearwater.org/pdf/CLE000006%20John%20Simms%20Pre-Filed%20Testimony.pdf. {*See ASLB webpage for testimonies of Dolores Guardado and Andrew Kanter, MD.*}

ENVIRONMENTAL HEALTH PERSPECTIVES: A Strategy for Comparing the Contributions of Environmental Chemicals and Other Risk Factors to Neurodevelopment of Children, Environmental Health Perspectives (2012); 120 (4): 501-507. http://ehp.niehs.nih.gov/1104170/.

[David C. Bellinger, MD, of Children's Hospital Boston, Harvard Medical School, observes: "The impact of environmental chemicals on children's neurodevelopment is sometimes dismissed as unimportant because the magnitude of the impairments are considered to be clinically insignificant. Such a judgment reflects a failure to distinguish between individual and population risk. The population impact of a risk factor depends on both its effect size and its distribution."

This article advocates a population-oriented approach to estimating environmental (and other) risk factor burden as an alternative to the typical disease-oriented approach because a disease-oriented approach can underestimate the contribution to neurodevelopmental morbidity. Notably the loss of Full-Scale IQ (FSIQ) points is not identified as a disease. Yet the effects can be considerable from the public health perspective.

The population approach is consistent with the strategy economists use to assign monetary value to changes in FSIQ, which does not focus solely on the extreme low tail of the distribution.

"Finally, it is likely that risk factors interact with one another to influence FSIQ of children. For example, not only do children living in poverty tend to experience greater exposures to environmental chemicals than do children living in advantaged circumstances, but increasing evidence also suggests that material hardship, increased stress, and lack of enrichment opportunities exacerbate chemical neurotoxicity."]

NATIONAL RESOURCES DEFENSE COUNCIL (NRDC): Fettus GH and McKinzie MG, Nuclear Fuel's Dirty Beginnings: Environmental Damage and Public Health Risks From Uranium Mining in the American West, National Resources Defense Council report, Mar 2012. http://www.nrdc.org/nuclear/files/uranium-mining-report.pdf.

[Detailed review of the literature on damage inflicted upon the environment, aquifers and other waters as a result of uranium extraction, milling and processing activities. (Includes lists of radioactive spills.) Describes why future uranium mining projects will continue to pose a threat to human health and the environment, even under improved regulatory conditions.

Uranium mining – particular in situ leaching (ISL) mining– alone and in concert with other resource extraction activities contaminates groundwater. Mining operations in the US have repeatedly failed to restore aquifers, "often leaving them unusable for any alternative future use." (p 40) EPA and NRC regimes fail to reflect the best available data on what is required to protect the public and environment from the contamination inflicted by all types of uranium recovery. This failure also puts at risk scarce western groundwater. The EPA, which is required by law to set standards for the protection of public health and the environment, should promulgate regulations that prohibit ISL mining in underground sources of drinking water and pay increased attention to the complexity of underground aquifers and potential drinking water sources. The EPA should also mandate groundwater restoration that addresses both the

contaminated ore zone and any near areas affected by the mining. “Importantly, EPA’s restoration standards must be keyed to the overall water quality throughout the aquifer, not just an arbitrarily limited mining site presented by the applicant.” (p 41) Appropriate environmental review needs to consider the cumulative impacts of mining and analyze the issue in its totality.]

2011

BREAST CANCER RESEARCH AND TREATMENT: Loo LWM, Wang Y, Flynn EM, Lund MJ, Aiello Bowles EJ, Buist DSM, Liff JM, Flagg EW, Coates RJ, Eley JW, Hsu L, and Po PL, M, Genome-wide copy number alterations in subtypes of invasive breast cancers in young white and African American women, Breast Cancer Research and Treatment (2011); 127 (1): 297-308. Abstract. http://link.springer.com/article/10.1007%2Fs10549-010-1297-x.

[Report on population study by researchers from Fred Hutchinson Cancer Research Center; Cancer Research Center of Hawaii, University of Hawaii; Rollins School of Public Health, Emory University and Emory University School of Medicine; the Group Health Research Institute, Group Health Cooperative; the CDC; and the Department of Pathology at the University of Washington.

The researchers note that genomic copy number alterations are common in breast cancer and identifying characteristic alterations associated with specific breast cancer subtypes is a critical step in defining potential mechanisms of disease initiation and progression. They thus used genome-wide array comparative genomic hybridization to identify distinctive genomic copy number alterations in different breast cancer subtypes of young women diagnosed with breast cancer prior to age 55 years.

Data showed that estrogen receptor negative (ER-) tumors had a higher average frequency of genome-wide gain and loss compared to estrogen receptor positive (ER+) tumors and triple-negative (TN) tumors had a higher average frequency of genome-wide gain and loss than non-TN tumors.

In addition, the authors report, copy number alterations differ in frequency between TN breast tumors of the African American and Caucasian American women. This is of particular relevance because TN breast cancer {*basal-type*} is associated with higher mortality and young African American women have higher rates of TN breast tumors compared to Caucasian women. The data suggests that higher overall frequency of genomic alteration events as well as specific focal copy number alterations in TN breast tumors may, in part, contribute in part to the poor breast cancer prognosis for young African American women.]

COLORLINES: Palmer, Brian, The Nuclear Industry’s Astroturf Movement in Communities of Color, Colorlines, May 26, 2011. http://www.colorlines.com/articles/nuclear-industrys-astroturf-movement-communities-color.

[A PR campaign waged by Entergy has aimed to convince communities of color that closing Indian Point would cause them detriment and lead to increased rates of asthma. In fact, there is

no evidence for this assertion. Raging asthma epidemics in New York's urban neighborhoods are due to a number of environmental hazards that disproportionately clump in places like Harlem (*eg*, air pollution from bus depots and truck exhaust). Yet "Entergy's assertions, misleading though they may be, have found support among some community leaders who have accepted the corporation's claims at face value."

Part of the corporation's PR effort has been manufacturing a "community-based" movement, and then luring minority leaders to join. One such front – or "astroturf" – group is Safe Healthy Affordable Reliable Energy, or SHARE, which " isn't so much a community group concerned about 125th Street as it is an arm of Entergy's PR department. … SHARE doesn't just have a relationship with Entergy; SHARE is Entergy. Documents the nonprofit filed with the IRS list Entergy executives as SHARE officers. Government affairs manager Joanne Fernandez is recorded as 'assistant treasurer.' Also in the lineup: the Vidal Group's head Alfredo Vidal, and Darren Peters, an officer at Entergy's political action committee."

"'You have entered a web in which corporations move money around to these front organizations,' says Susan Lerner, executive director of the watchdog group Common Cause. 'It makes it seem that these are community-based advocacy groups, when it's just the corporation in another guise.'"

In addition, through its political action committee, Enpac, Entergy runs public information campaigns and contributes generously to politicians and civic organizations, including those in communities of color. "But Entergy's information operations have a more insidious purpose than simply informing--or half-informing--the populace. Successful info ops divide and conquer one's opposition, and Entergy has been hard at work doing just that."]

EARTHWORKS: Kamptner E, Nuclear Power's Other Tragedy: Communities Living With Uranium Mining, Earthworks report, Jun 2011. http://www.earthworksaction.org/files/publications/Nuclear-Power-Other-Tragedy-low.pdf.

[Earthworks is a nonprofit focused on the protection of communities and the environment from adverse impacts of mineral and energy development and the promotion of sustainable solutions. This report details case studies of communities – especially Native American communities – impacted by conventional and *in situ* uranium mining, highlighting the more serious instances of contamination.

While *in situ* mining causes minimal land surface disturbance and doesn't produce tailings and waste rock, "groundwater contamination is inevitable and persists for decades." (p 7) The NRC has acknowledged that – although *in situ* mine permits call for complete restoration of groundwater conditions following mining operations, most baseline parameters have proved impossible to achieve. "Any *in situ* operation risks spreading uranium and its hazardous byproducts outside the mine, potentially contaminating nearby aquifers and drinking water sources. This has been a major problem with almost all *in situ* projects in the U.S." (p 7)]

NAVAJO TIMES: Bitsoi, Alastair Lee, The battle continues: 32 years after Rio Puerco uranium tailings spill, suit challenges new uranium mine, Navajo Times, Jul 22, 2011. http://navajotimes.com/news/2011/0711/072211uranium.php#.U1KMjFdUGdB

[Reporting on opposition of Navajo Diné against leach mining in New Mexico. Groundwater pollution is the top concern in leach mining. The process involves the injection of a chemical solution into an underground ore body. The chemical solution dissolves the uranium in the rock and is then pumped up to the surface, where the uranium is separated from the leachate in a second process. Mining requires a groundwater discharge permit, which Navajo fear can leak into aquifers that supply drinking water to Navajos communities in the Church Rock and Crownpoint areas.

On July 16, 1979, an earthen dam owned by the United Nuclear Corp. broke and released 1,100 tons of radioactive uranium tailings and 94 gallons of toxic wastewater into the Rio Puerco, contaminating the river for at least 80 miles. Chris Shuey, a researcher with the Southwest Research and Information Center in Albuquerque, said radioactive waste had burnt the feet of people crossing the river downstream as a result of pH levels being equal to battery acid levels.]

REVIEWS ON ENVIRONMETAL HEALTH: Brugge D and Buchner V, Health effects of uranium: new research findings, Reviews on Environmental Health (2011); 26 (4): 231–249. http://www.degruyter.com/view/j/reveh.2011.26.issue-4/reveh.2011.032/reveh.2011.032.xml.

[Authors from the Department of Public Health and Family Medicine at Tufts University School of Medicine and the Weizmann Institute of Science (Israel) present a review of the health effects of uranium mining, with an emphasis on newer findings (2005–2011). “Uranium mining can contaminate air, water, and soil. The chemical toxicity of the metal constitutes the primary environmental health hazard, with the radioactivity of uranium a secondary concern. The update of the toxicologic evidence on uranium adds to the established findings regarding nephrotoxicity, genotoxicity, and developmental defects. Additional novel toxicologic findings, including some at the molecular level, are now emerging that raise the biological plausibility of adverse effects on the brain, on reproduction, including estrogenic effects, on gene expression, and on uranium metabolism.”

Most epidemiology on uranium mining has focused on mine workers and radon exposure. An emerging literature has begun to investigate environmental exposure in residential areas near uranium mining and processing facilities and more epidemiologic research is clearly needed.

“As much damage is irreversible, and possibly cumulative, present efforts must be vigorous to limit environmental uranium contamination and exposure.”]

2010

Brown, Jovana J, PhD and Lori Lambert, PhD, Blowing in the Wind: The Navajo Nation and Uranium, Evergreen State College (2010). http://nativecases.evergreen.edu/collection/cases/blowing-in-the-wind.html.

[The material in the monograph was based upon work supported by the National Science Foundation under a grant. The following are two excerpts:

"On July 16, 2009 an early morning prayer walk was held in Church Rock, New Mexico on the Navajo Nation to remember the largest radioactive accident in the United States. This accident occurred thirty years earlier when a retaining dam at the United Nuclear Corporation's Church Rock Uranium Mill broke, spilling 90 million gallons of radioactive waste into the Rio Puerco. (Giusti, *Farmington Daily Times* 9/16/09) This disaster involved more radioactivity than Three Mile Island which occurred in March of 1979 and the ranks second only to the 1986 Chernobyl reactor meltdown in the amount of radiation released (SW Research & Information Center) The radioactive waste water flowed downstream ultimately killing entire herds of cattle and sheep. The Navajo people could not market their meat or wool after this disaster. (Yazzie-Lewis & Zion, p. 4 in Brugge et al). The spill flooded the alluvial water layer forcing contamination into the deeper aquifers. The groundwater was polluted for 70 miles. (Hugate, pp. 171-173) The spill deposited waste in nearby river and stream beds which is still present. (Giusti) Though there is a higher than usual cancer rate among the residents of the area, it is unclear if this has been caused by this horrendous spill or contamination from 1) working in the uranium mines and mills during the 1950's and 1960's, 2) contamination from abandoned mines and tailings and/or 3) contamination of the aquifers."

The Navajo Nation (NN) and other tribes have paid a terrible price for the uranium boom of the 1950's-1980's. Situated on the Colorado Plateau, the NN's 16 million acres of land are rich in mineral resources. The Colorado Plateau contains 55% of the uranium deposits in the western United States. During the period 1944 to 1986 nearly four million tons of uranium ore were extracted from Navajo Nation lands. (EPA, *Addressing uranium contamination in the NN*) This has resulted in tragedy for the people and the land of the Navajo Nation. Uranium miners, mill workers and their families have high rates of cancer. There are over 1,200 abandoned mines on NN land. Aquifers have been contaminated with radioactive waste and heavy metals. Some dwellings and other buildings constructed from mill tailings are contaminated."]

Pasternak, Judy, *Yellow Dirt: An American Story of a Poisoned Land and a People Betrayed,* Free Press (2010).

SOMACENT DEVELOPMENT RESEARCH FOUNDATION: Hussein, Bashir Mohamed, PhD, The Evidence of Toxic and Radioactive Wastes Dumping in Somalia and its Impact on the Enjoyment of Human Rights: A Case Study, Somacent Development Research Foundation presentation to United Nations forum panel on Toxic Wastes, Geneva, Jun 8, 2010. http://somalitalk.com/sun/toxic_waste_dumping_somalia.pdf.

[Many developing countries, especially African countries, have been the victim of the adverse effects of the dumping of highly toxic wastes from industrialized nations. The case of Somalia is particularly preoccupying. "The country has been subjected to extensive illegal dumping

operations of toxic and radioactive wastes since the 1980s." (p 2) Illegal dumping has become a rampant phenomenon after 1990 and has occurred on a large-scale both along the coast and the hinterland. The impact of the toxic wastes has been devastating. It has had an extremely adverse effect upon the health, livelihoods and environment. It further compromises the future prospect of water and food security, and the sustainable development of the local population. "And, consequently, it has denied the victims the enjoyment of their fundamental human rights including the right to life, healthy environment and food security." (p 3)

The toxic waste dumping "has contributed to the perpetuation and exacerbation of the deadly effects of the armed conflict which has been going on in Somalia for the last two decades. While Somalia itself has not yet an effective government, the international community has failed to tackle the toxic waste dumping issue and other closely related internationally-driven illegal activities in Somalia. In this respect, lack of 'sufficient evidence' of toxic waste dumping in Somalia is often advanced as an argument to justify the aforementioned inaction."

Rotting containers and leaking drums of previously dumped toxic wastes continue to wash up on shore following the Tsunami disaster which hit the Somali coast in December 2004, along with a dozen other countries. The poisonous content contaminated the water and air whereby adverse effects were felt mile away. Following this disaster, on February 22, 2005, the United Nations Environment Programme (UNEP) issued an official statement stating: "'Somalia's coastline has been used as a dumping ground for other countries' nuclear and hazardous wastes for many years as a result of the long civil war and, thus, the inability of the authorities to police shipments or handle the wastes."

Testimony of Marcello, Giannoni, a businessman who was active in the Italian "Special Wastes" sector, acknowledged being personally involved in toxic waste export to Somalia. He told Italian magistrates that "'the idea was to mix highly toxic waste imported from America (including radioactive waste) with Italian waste and send the whole thing to Somalia.'" (p 9)]

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES; NATIONAL INSTITUTES OF HEALTH; NATIONAL CANCER INSTITUTE: President's Cancer Panel Report. Reducing Environmental Cancer Risk: What We Can Do Now (2008-2009), Apr 2010. http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp08-09rpt/PCP_Report_08-09_508.pdf.

["In addition to numerous gaseous emissions of radioactive iodine [I-131] during its nearly 30 years of operation, the Hanford site, which covers nearly 600 square miles, discharged over 400 billion gallons of radioactive waste into the surrounding soil and the Columbia River. The plant ceased operations in 1972, but now is the largest nuclear waste storage site in the country. Nuclear waste at Hanford has an estimated 195 million curies of radioactivity." (pp 80-81) DOE acknowledges that ~60 underground plutonium waste storage tanks have leaked and others are suspected of leaking. "An estimated one million gallons of high-level nuclear and chemical waste have leaked into the soil, contaminating 200 square miles of land under the Hanford facility. This radioactive waste continues to leach into the groundwater that empties into the Columbia River.

In a 2002 report the President's Cancer Panel described radiation exposures and health problems, including cancer, experienced by the Yakima Nation and other Northwest Native Americans who live in close proximity to the Hanford Nuclear Reservation. In addition, many

uranium mining and milling operations have been located in or near Navajo tribal lands in New Mexico. The Navajo banned uranium mining and milling in 2005, but more than 1,000 contaminated sites exist in the region, some designated as Superfund sites. Many families still live near the sites where “they continually breathe uranium dust and drink uranium-contaminated water. Bothe the Navajo and Laguna tribes have experienced markedly higher than average rates of lung cancer, as well as kidney disease, birth defects, and other health problems.” (p 81)]

2009

ASSOCIATED PRESS: Blaney, Betsy, Critics: Burial site for Hudson river PCBs is inadequate, Associated Press, Jun 22, 2009. http://lubbockonline.com/stories/062209/sta_453317901.shtml#.VipnYv-FMuU.

[A stretch of West Texas, bordering New Mexico, has become a dumping ground for radioactive waste – including 45,000 tons of waste from a former uranium-processing plant – and carcinogenic PCB-tainted sludge dredged from the Hudson River.

Critics charge the dumping will only create a new toxic mess for future generations to clean up.

Waste Control Specialists (WCS), the Dallas-based company that operates a low level radioactive waste and PCB disposal site, stands to make tens of millions of dollars from the Hudson PCBs. Glenn Lewis, formerly with the Texas Commission of Environmental Quality said geologists studying the site found holes and fissures in the clay at the site. “The ‘geology is awful. It leaks,’ said Lewis, who compiled the geologists’ findings. He called the site ‘irredeemably inadequate’ for radioactive waste.” The Santa Rosa aquifer is near the site. The aquifer is not used for drinking water but it is used to water livestock which could transfer contaminants to the human food chain in the event of a leak Lewis said.

Neil Carman, an official with the Sierra Club in Texas charged: “‘There’s no cleanup. It’s just gone from the Hudson River,’” and called the {*WCS LLC site in Andrews County*} a “‘cheap pay toilet … the cheapest GE could find’.”]

DAILYTIMES: Giusti, Brendan, Radiation spill in Church Rock still haunts 30 years later, Daily-Times, Jul 15, 2009. http://www.daily-times.com/ci_12848333

[Reporting on the 30 year anniversary of the July 1979 accident in which an earthen dam owned by the United Nuclear Corp. broke and released large quantities of radioactive uranium tailings and toxic wastewater into the Rio Puerco River and nearby stream beds. Paul Robinson, research director at the Southwest Research and Information Center, said, at the time of the disaster, the mining company thought it was operating a state-of-the-art facility and the government thought it was exercising proper oversight: "‘Everyone thought they were doing a good job,’ Robinson said.” But the disaster is an example of the types of problems that occur at uranium mines and mills.

After the accident, only about 3,400 barrels of waste materials were cleaned up. Mines were abandoned. Three decades later, the contaminants remain, and citizen groups and Navajo

Nation leaders worry about the groundwater, which serves as the only drinking supply many members of the community members as well as livestock. Nadine Padilla, coordinator of Multicultural Alliance for a Safe Environment, a coalition of grassroots, said entire herds of cattle and sheep died in the wake of the disaster,

No human health studies were conducted in the area.]

LAKOTA COUNTRY TIMES: White, Deb, Uranium Mining Expert tours Pine Ridge, Lakota Country Times, Jan 9, 2009. http://www.lakotacountrytimes.com/news/2009-09-01/front_page/004.html.

[Gavin Mudd, PhD, of Australia, a world renowned uranium mining expert, spent several days toured the Pine Ridge Indian Reservation, located 30 miles from the nearest ISL uranium mine, at Crawford, Nebraska. Cameco, Inc. (a Canadian corporation) operates the Crow Butte uranium mine, and applied to the NRC for an expansion license to open another ISL uranium mine called the North Trend. During his trip, Dr. Mudd met with Lakota people and organizations affected by uranium mining. "'There has never been an In Situ Leach (ISL) uranium mine that has been able to return groundwater to its baseline (pre-mining) water quality,'" according to Dr. Mudd.

Groundwater contamination and other concerns led Owe Aku, Western Nebraska Resource Council, Joe American Horse Tiospaye, the Black Hills Sioux Nation Treaty Council, Beatrice Holy Dance, Debra White Plume, the Oglala Sioux Tribe, Bruce MacIntosh, and the Tom Cook Tiwahe to challenge Cameco's license renewal and expansion to the first of three more uranium mines in Nebraska's panhandle, where Pine Ridge's southern border meets Nebraska. Surface water from the mine area travels to the Pine Ridge, and studies show faults and fractures in the aquifer at the Cameco mine site connect to the drinking water aquifers of the Pine Ridge.

While in the US, Dr. Mudd also met with the Coloradoans Against Resource Destruction, which opposes Powertech, Inc.'s planned ISL uranium mine near Ft Collins.]

2008

2007

ABC NEWS: Jaffe, Matt, Nuclear Materials 'Poison' Navajo Land, ABC News, Oct 23, 2007. http://abcnews.go.com/Politics/story?id=3764417.

[Ray Manygoats testifies about the damage done to him and his family by uranium mining on Navajo lands before a House Oversight and Government Reform Committee:. "'Our land today is poisoned. Today I am a man who has lost his health, his family and his ancestral way of life because of uranium'."

No comprehensive study has ever been done on the health problems resulting from uranium mining in the Navajo nation. However researchers believe that exposure to mining almost certainly triggered a dramatic rise in cancer among the Navajo. Years after many mines have

been closed and abandoned, surface and groundwater contamination from the mines continues to plague the Navajo population. "'My family's land is poisoned,' says Manygoats. 'But no one helps us to remove the poison. I am here on behalf of my community to ask for your help.'"

George Arthur, representing the Navajo Nation government at the hearing, stated: "'Uranium mining and milling on and near the reservation has been a disaster for the Navajo people'."]

PUBLIC HEALTH: Brugge D, deLemos J, and Bui C, The Sequoyah Corporation Fuels Release and the Church Rock Spill: Unpublicized Nuclear Releases in American Indain Communities, American Journal of Public Health (2007); 97 (9): 1595-1600. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1963288/.

[Authors are from the Department of Public Health and Family Medicine at Tufts University School of Medicine; the Department of Civil and Environmental Engineering at Tufts University School of Engineering; and the Massachusetts College of Pharmacy.

Authors examined two large accidental releases of uranium. One release occurred on January 4, 1986, at Kerr McGee's Sequoyah Fuels Corporation in Oklahoma, located near a major interstate highway (I-40), at the confluence of the Illinois and Arkansas Rivers and upstream from a reservoir within the jurisdiction of the Cherokee Nation. The other release was from United Nuclear Corporation's Church Rock uranium mine and mill in New Mexico, located near the Puerco River, and nearly entirely on Navajo land, but also near Gallup, NM, which has a large Hispanic population.

Authors emphasize the dearth of health studies of the low-income and Native American communities exposed and urge exploration into the reasons for such inattention. Authors also state: "More attention should be given to the early stages of the nuclear cycle and their impacts on health and the environment."]

2006

BAYOU BUZZ: Tidmore, Chrisopher, Is Entergy New Orleans Out of Power? Bayou Buzz, Mar 23, 2006. http"//www.bayoubuzz.com/articles.aspx?aid=6576.

[After Katrina, Entergy reported to threaten walking away from its damaged New Orleans subsidiary if multi hundred million dollar federal bailout money was not given to the corporation.]

CORP WATCH: King, Rita, Entergy Holds New Orleans for Ransom, Special to Corp Watch, May 10, 2006. http://www.corpwatch.org/article.php?id=13569.

[Investigative report on how Entergy Corporation determined that its first duty was to its shareholders, not the devastated population of New Orleans following Katrina. The corporation demanded millions from the federal government to repair its utility. Taxpayer subsidies to the nuclear industry and corporate liability legal structures are also reviewed in the article.

Specifically, following Katrina, Entergy threatened to leave New Orleans "quite literally in the dark" unless the federal government granted Entergy $718 million to defray the cost of maintain and rebuild its storm-damaged infrastructure.

While the parent corporation Entergy Corp had prior year revenues of $10 billion and holds $29 billion in collective assets – which could comfortably cover storm losses and repairs – Entergy's subsidiary Entergy New Orleans LLC filed for bankruptcy weeks after the storm to protect its assets.

"According to a May 2004 report from the United States General Accounting Office (GAO), limited liability companies such as Entergy Corp resulted from the deregulation of the electricity industry in the 1990s. 'Like a partnership,' the report said, 'the profits are passed through and taxable to the owners ... like a corporation, it is a separate and distinct legal entity and the owners are insulated from personal liability for its debts and liabilities.'"

Entergy estimated its Katrina losses as over $1 billion and determined that its first duty was to protect its shareholders, not the population of New Orleans. Entergy spokesman {Morgan} "Stewart explained that each subsidiary is a 'separate business,' and that each company is 'protected from the burden' of picking up unexpected costs from the others."]

NATIONAL ACADEMY OF SCIENCES: Kates RW, Colten CE, Laska S, and Leatherman SP, Reconstruction of New Orleans after Hurricane Katrina: A research perspective, Proceedings of the National Academy of Sciences (PNAS), 2006; 103 (40). Abstract. http://www.pnas.org/content/103/40/14653.short.

[Researchers are from Popple Point (Trenton, ME); the Department of Geography and Anthropology at Louisiana state University; the Center for Hazards Assessment, Response, and Technology at the University of New Orleans; and the International Hurricane Research Center at Florida International University. This study was done under a grant from the National Science Foundation.

Sixty years of natural hazard and reconstruction research provide a comparative and historical perspective on the reconstruction of New Orleans after Hurricane Katrina. Four main conclusions may be derived.

The first is that decisions taken over New Orleans' 288-year history that made it so vulnerable to Katrina "reflect a long-term pattern of societal response to hazard events—reducing consequences to relatively frequent events, and increasing vulnerability to very large and rare events." Thus Katrina's consequences were catastrophic: an estimated 1,570 people died and there were $40–50 billion in monetary losses.

"Because disasters tend to accelerate existing economic, social, and political trends, the large losses in housing, population, and employment after Katrina are likely to persist and, at best, only partly recover."]

NEW YORK TIMES: Herbert, Bob, Poor, Black and Dumped On, New York Times Op-Ed, Oct 5, 2006. http://www.nytimes.com/2006/10/05/opinion/05herbert.html.

[Wildly disproportionate numbers of the most toxic industrial activities and the most hazardous waste dumps are systematically sited in disadvantaged communities of color. Agencies issue permits and then do little monitoring and enforcement.

“The evidence has been before us for decades that black people, other ethnic minorities and some poor whites have been getting sick and enduring horrible deaths from the filth that they breathe, eat, drink and otherwise ingest from the garbage dumps, landfills, incinerators, toxic waste sites, oil refineries, petrochemical plants and other world-class generators of pollution that have been deliberately and relentlessly installed in the neighborhoods where they live, work, worship and go to school.”]

2005

2004

AFRICAN AMERICAN ENIRONMENTAL ASSOCIATION (AAEA) NEWS: Environmental Justice Claims Rejected for New Nuke in Mississippi, African American Environmentalist Association (AAEA) News, Aug 2004. http://www.aaenvironment.com/News1.htm.

[The Nuclear Regulatory Commission’s (NRC) Atomic Safety Licensing Board denied a request by the Sierra Club, Public Citizen, Nuclear Information & Resource Service (NIRS), and the Clairborne County NAACP to participate in a licensing hearing on Entergy’s application to site a new nuclear reactor at its existing Grand Gulf site. The licensing board denied all the groups’ environmental justice contentions. Clairborne County is 84% African American with 32% of residents living at or below the poverty line.]

NUCLEAR INFORMATION AND RESOURCE SERVICE (NIRS); PUBLIC CITIZEN; and RIVERKEEPER: Indian Point’s Owner Played Role in Attacks on Environmental Justice, Nuclear Information and Resource Service (NIRS); Public Citizen; and Riverkeeper Press Release, Feb 25, 2004. http://www.nirs.org/press/02-25-2004/1.

[“Entergy, owner of the Indian Point nuclear power plant, has been part of an aggressive effort led by the Nuclear Energy Institute (NEI), the industry's leading lobbying arm and policy organization, to eviscerate the Nuclear Regulatory Commission's policy on environmental justice. The NEI, in which Entergy is a major player, is blaming the NRC's EJ policy for stalling proposed projects — a few of which involve Entergy. Meanwhile, in a strongly worded letter to the Entergy Corporation, the National Association for the Advancement of Colored People supported their Claiborne County, Mississippi Chapter's opposition to Entergy's bid for new reactors in Port Gibson, MS on the grounds that the proposal constitutes environmental racism. Finally, as has been discussed often, Indian Point's nuclear fuel cycle disproportionately affects low income communities and communities of color.”]

2003

Daitz, Ben, MD, A Doctor's Journal: Navajo Miners Battle a Deadly Legacy of Yellow Dust, New York Times Contributing Column, May 13, 2003. http://www.nytimes.com/2003/05/13/health/a-doctor-s-journal-navajo-miners-battle-a-deadly-legacy-of-yellow-dust.html.

[Ben Daitz, a physician and professor at the University of New Mexico School of Medicine describes his visit to a Navajo reservation and a clinic serving Navajo suffering from the ravages of uranium mining:

"The Diné (pronounced dee-NAY) or 'the People,' as the Navajo call themselves, have many stories about their origins. One says that as they emerged from the fourth world into the fifth and present world, they were given the choice of two yellow powders. One yellow powder was corn pollen, and that was the one they chose."

The other was the color of the yellowcake, uranium oxide.

"The Spirits said it had to be left alone. But from the late 1940's through the mid-80's, yellowcake was picked and shoveled and blasted and hauled in open-bed trucks, and then dried in mountainous piles at multiple sites in the American West. The Navajo, whose lands extend over western New Mexico, eastern Arizona and southern Utah, were at the epicenter of the uranium-mining boom, and thousands of Navajos worked in the mines. More than 1,000 abandoned mine shafts remain on Navajo land.

"The consequences are measured today, decades after the mines closed, in continuing health problems and degraded land.

Mitchell Capitan, a former mining technician president of the Crownpoint chapter of the Eastern Navajo Agency, founded Endaum, Eastern Navajo Diné Against Uranium Mining. The group was battling against a plan for uranium mining using a leeching using water from the Westwater Canyon Aquifer under Crownpoint, the sole source of drinking water for the Crownpoint area providing for 15,000 people. Capitan says: "'People come here from all over these parts, from 50 miles away, to truck this water back to their houses, to drink it, because it's the only pure supply. Their own water is bad -- contaminated….'This uranium impacts on our water, our air and our cultural identity,'" he said. "'We've already had enough uranium.'" At a gathering Mr. Capitan stood under an Endaum banner which said in Navajo and English: "One Mind, One Voice, One Prayer, One People."]

2002

ENVIRONMENTAL JUSTICE: Arquette M, Cole M, Cook K, LaFrance B, Peters M, Ransom J, Sargent E, Smoke V, and Stairs A, Holistic Risk-Based Environmental Decision Making: A Native Perspective, Environmental Justice (2002); 110 (Suppl 2): 259–264. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241171/pdf/ehp110s-000259.pdf.

[Risk assessment and management processes used by government agencies with respect to toxicants have many inadequacies and have not served Native American peoples well. In addition, resources to address the concerns of Native Nations have not always been adequate.

The definitions of health used by Native people are strikingly different from that of risk assessors. There is thus also a need to expand current definitions and incorporate traditional knowledge into decision making. Authors in this paper illuminate the problem by reviewing the findings of the First Environment Restoration Initiative, a project working to address toxicant issues facing the Mohawk territory of Akwesasne. The project is developing a community-defined model in which health is protected at the same time that traditional cultural practices, which have long been the key to individual and community health, are maintained and restored.]

2001

2000 and Prior

Kuletz, Valerie L, *The Tainted Desert: Environmental Ruin in the American West*, New York, Routledge (1998). http://www.sric.org/workbook/V24_1/tainted.php.

[Valerie L. Kuletz, PhD, is a professor. The daughter of a weapons scientist, Dr. Kuletz grew up near Department of Defense site in the Mojave Desert. The book describes the heavy environmental and health burden placed upon Native American communities in the Southwestern US as a combined result of uranium mining and processing, nuclear testing and waste dumping. Areas particularly affected are the Mojave and Four Corners (which include Navajo, Hopi, Zuni, Paiute, Uti, Havasupai, and Shoshone, among other tribes). Dr. Kuletz also delves into the eco-politics underlying the proposed Yucca Mountain high level nuclear waste depository.]