

PHYSICS & SOCIETY

A Publication of The Forum on Physics and Society A Forum of The American Physical Society

Note from the Editor

Happy New Year! It is a pleasure to welcome you to the first issue of Physics and Society in 2015.

We start off with news from the Forum, including the results from our recent election of officers, a call to nominate our members to APS Fellowship, and a list of upcoming FPS-sponsored sessions at both the March and April meetings. Our representative to the APS Panel on Public Affairs (POPA), Phil Taylor, reports on the latest news concerning the APS statement on Climate Change. I am pleased to include a fascinating article on nuclear waste storage by Robert and Susanne Vandenbosch and a wonderful obituary of Martin Perl, a Nobel

Prize winner and the first Editor of this Newsletter, written by Brian Schwartz. Our Books Editor, Art Hobson ends this issue with two reviews, one on the history of German environmentalism, the other on marketing the Apollo program.

As always, we are looking for people that would like to publish articles of interest to our readership. Please let me know if you or one of your colleagues would like to submit an article for an upcoming newsletter.

*Andrew Zwicker
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Nomination of FPS members to APS Fellowship

We want to exhort our membership to nominate FPS members for consideration to be APS fellows. Now is the time to do it. There is a formal process through the APS website (<http://www.aps.org/programs/honors/fellowships/index.cfm>), but names of suggested nominees can also be sent

to Micah Lowenthal, FPS Chair, (mloenthal@nas.edu) who will explain the process and direct the nominator to the right people. We know that there are deserving FPS members out there, but we need the members to nominate them.

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Below you will find the FPS-sponsored sessions for both the March and April meetings. The sessions should be of interest to FPS members and the speakers are not typical fare for physics meetings, so we want to encourage you to attend the sessions. At the April meeting, there will also be an FPS executive committee meeting and an FPS business meeting on Sunday morning, April 12 before the FPS/FIP awards session that morning. We also want to urge the members to start thinking about what sessions they would like to see (organized by the member or by someone else) at future meetings. Any suggestions can be sent to Ruth Howes (rhowes@bsu.edu), who will be the FPS program chair for the March and April 2016 meetings.

APS 2015 March Meeting • Forum on Physics & Society • March 2-6 San Antonio, TX

WEDNESDAY, MARCH 4 • 8:00 AM *(with History of Physics)*

Physics at the Intersection of History, Tech, and Society

Chair: Joe Martin

This session will investigate the relationship physics has maintained with society in the last century and a half, particularly in relation to technological change.

Speakers: Spencer Weart
 Bruce Hunt (University of Texas at Austin)
 Cyrus Mody (Rice University)
 Bob Crease (Stony Brook University)
 Aimee Slaughter

WEDNESDAY, MARCH 4 • 11:15 AM

Artificial Intelligence: Existential Risk or Boon to Humanity?

Chair: Arian Pregenzer

Artificial intelligence is progressing rapidly: robotic surgical assistance, self-driving cars, and smart security systems. Future possibilities include robot/human hybrids and autonomous weapon systems. How to balance benefits and risks?

Speakers: Stuart Russell (UC Berkeley)
 Guruduth Banavar (IBM)
 Gill Pratt (DARPA)
 Benja Fallenstein (Machine Intelligence Research Institute)

THURSDAY, MARCH 5 • 8:00 AM *(with FIAP)*

Additive Manufacturing: Societal Impacts

Chair: Arian Pregenzer

Additive manufacturing (3-D printing) promises to revolutionize how companies design and make complex components from jet engines to medical implants. But, some raise concerns about management of intellectual property and potential security risks.

Speakers: Michael Cima (MIT)
 David Keicher (Sandia)
 Prabhjot Singh (GE)
 Bruce Goodwin (LLNL)
 Katherine Vorvolakos (FDA)

THURSDAY, MARCH 5 • 11:15 AM

Network and Grid Resilience

Chair: Micah Lowenthal

Much attention has been given to reducing vulnerabilities and enhancing resilience of electrical grids and information networks. Speakers will address technical issues associated with each of these, and concerns and strategies that link them.

Speakers: Dan T. Ton (DOE)
 Scott Bachhaus (LANL)
 Chen-Ching Liu (Washington State University)
 Chuanyi Ji (Georgia Tech)

SATURDAY, APRIL 11 • 10:45 AM (with GERA)

Energy / ARPA E

Chair: Valerie Thomas

The Advanced Research Projects Agency-Energy supports high-potential, high-impact energy technologies. Solar energy advances and other technologies are discussed, as well as the challenge of developing transformational energy technologies.

Speakers: Ellen Williams, Director, ARPA-E
Howard Branz, Program Director, ARPA-E

SATURDAY, APRIL 11 • 1:30 PM (Coordinated with morning plenary)

Big Science and Challenges

Chair: Pushpa Bhat

Exploring the nature of our universe at very small and very large scales requires Big Science projects with huge challenges. This session will focus on funding and competitiveness in the fields of space and accelerator-based high energy physics.

Invited Speakers: John Mather (NASA)
Rolf Heuer (CERN DG)
André Rubbia (ETH, Zurich)
John Grunsfeld (NASA)

SATURDAY, APRIL 11 • 3:30 PM

Exploration for Life in the Universe: Implications for Society

Chair: Arian Pregenzer

Astrobiology explores the origins and distribution of life in the universe. In this session we will discuss the search for extra-terrestrial life, the impacts its discovery might have on society, and implications for life on earth and elsewhere.

Speakers: Chris Impey, University Distinguished Professor, Department of Astronomy, University of Arizona
David Grinspoon, Senior Scientist, Planetary Science Institute
Mary Voytek Senior Scientist for Astrobiology, NASA

SUNDAY, APRIL 12 • 8:00 AM

FPS Executive Committee Meeting

SUNDAY, APRIL 12 • 9:15 AM

FPS Business Meeting

FPS ELECTION RESULTS

Vice-Chair:

ALLEN SESSOMS, Distinguished Professor, Georgetown University School of Continuing Studies

At-Large Members of Executive Committee:

ANNA M QUIDER, Director of Federal Relations at Northern Illinois University

ELIZABETH BEISE, Professor of Physics at the University of Maryland College Park

We want to congratulate the winners, thank heartily the candidates who did not win this time, and encourage FPS members (including those who have stood for election before) to consider being a candidate next time. We also want to offer our thanks to Treasurer/Secretary Tina Kaarsberg's efforts, we had the best ever electronic participation at 19.4% of membership. This is nearly twice what we've seen in the worst years.

Report from the FPS Representative on the Panel on Public Affairs of the APS

Philip Taylor

Now that the APS has finished its actions on corporate reform, and its new Board of Directors and Council of Representatives are in place, the most significant issue on the APS agenda is the reconsideration of the 2007 APS statement on climate change. Readers of this newsletter will recall that POPA is the unit charged with reviewing the 2007 statement, and, if necessary, recommending updates to it. Those same readers may be wondering why they have not seen any recent reports from their FPS-elected member of POPA on how this operation is progressing. Is he asleep at the switch?

I hope that I can reassure you with an emphatic and wide-awake denial of any tendency to drowse during POPA proceedings (although some of my co-panelists might have wished I had taken a nap or two as the discussions became more pointed). The reason for my silence lies in the familiar sausage-factory analogy: if you want to have confidence in the final product, it is best not to observe the manufacturing process too closely. We were enjoined to silence on the minutiae of the discussions. My lips are thus sealed as far as describing the contents of successive drafts and iterations, and what relation they bear to the 2007 statement.

On the topic of the process by which our work advanced, however, mouths have not been so firmly zippered. There is much information to be gleaned in the public press and the blogosphere, as well as on the APS web site itself. In 2013 a subcommittee of POPA was formed to review the 2007 statement. As stated on an APS web page, “As part of the POPA-approved process, on January 8, 2014, the subcommittee convened a workshop with six climate experts.”

It is at this point that events took an unexpected turn. As reported in *Physics Today*, “When Steven E. Koonin welcomed participants to the Climate Change Statement Review Workshop that he was chairing for the American Physical Society, he made a point of acknowledging ‘experts who credibly take significant issue with several aspects of the consensus picture.’” “This set the tone for much of what was to follow. Under the headline “American Physical Society sees the light: will it be the first major scientific institution to reject the global warming ‘consensus’?”, James Delingpole wrote “The American Physical Society (APS) has signaled a dramatic turnabout in its position on ‘climate change’ by appointing three notorious climate skeptics to its panel on public affairs (POPA).” This was not quite correct, as those three merely made presentations to a sub-group of POPA, but the comment was not a good portent.

Shortly after this, the *Investors Business Daily* put out an editorial under the banner “Mythical Climate Change Consensus Hits An Iceberg” in which they said “Climate change ‘de-

niers,’ as global warm-mongers call those who think empirical evidence is more reliable than computer models, may soon count among their number a 50,000-strong body of physicists. At the risk of being accused of embracing what alarmists call the flat-earth view of climate change, the American Physical Society has appointed a balanced, six-person committee to review its stance on so-called climate change....” Again, not a completely accurate statement, but an indication of the political problem that the APS faces in tackling this issue. Even now, in January 2015, a Google search on “American Physical Society” brings up as its third entry the unflattering portrait presented in the Delingpole article.

This rumbling drumbeat of public commentary continued through the summer, as an enlarged subgroup of POPA continued its efforts. An impartial observer with no inside knowledge of the inner workings of POPA might conclude that matters came to a head in September with the publication in the *Wall Street Journal* of an Op-Ed piece by no other than Steve Koonin himself. It was entitled “Climate Science Is Not Settled.” This was met with a forceful rebuttal from Raymond Pierrehumbert, a professor in geophysical sciences at the University of Chicago, who then commented on the procedures that the APS had adopted for reviewing the 2007 statement. He opined that “The choice of its drafting committee indicates some serious problems with the APS process for its climate change statement, as the committee did not include a single physicist who was actually doing work in the area of climate science. Given that, one might think the committee would avail itself of the opportunity to become better educated through hearing from the best and most representative experts the field has to offer.” Eli Rabett, following an earlier post in which he says that the APS “might as well have picked a bunch of squeegee guys from off the street” for its review subcommittee, makes some even more forceful but less reprintable comments, and includes rumors of Steve Koonin’s resignation from POPA, a conjecture confirmable by the disappearance of his name from the APS POPA web site.

And so where do we stand now? The revised statement is bouncing around between POPA and the Council, and will then be sent to the brand new APS Board of Directors. If they like what they see, then you, dear rank and file APS member, will get a chance to comment on it. I can’t wait to find out whether you, in turn, will like what you see, whatever that turns out to be.

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<http://www.aps.org/policy/statements/climate-review.cfm>
<http://scitation.aip.org/content/aip/magazine/physicstoday/news/10.1063/PT.5.8071>
<http://www.breitbart.com/Breitbart-London/2014/03/20/American-Physical-Society-Sees-The-Light-Will-It-Be-The-First-Major-Scientific-Institution-To-Reject-The-Global-Warming-Consensus>
<http://www.wsj.com/articles/climate-science-is-not-settled-1411143565>

http://www.slate.com/articles/health_and_science/science/2014/10/the_wall_street_journal_and_steve_koonin_the_new_face_of_climate_change.html
http://news.investors.com/ibd-editorials/032114-694249-american-physical-society-reviews-climate-change.htm?ven=rss&utm_source=dlvr.it&utm_medium=twitter
<http://rabett.blogspot.com/2014/02/like-lambs-to-slaughter.html>
<http://rabett.blogspot.com/2014/09/a-dogs-dinner.html>

Nuclear Waste Confidence: Is Indefinite Storage Safe?

Robert Vandenbosch and Susanne E. Vandenbosch

On Aug 26, 2014 the waste confidence rule was updated and the name changed. Waste Confidence refers to a finding by the Nuclear Regulatory Commission that spent fuel¹ from nuclear reactors can be safely isolated from the environment, either until a final disposal repository becomes available or in the new ruling for an indefinite period of time. Its main effect is to allow resumption of licensing of new reactors and extension of the licenses of currently operating reactors. Like the first waste confidence rule of 1984, the 2014 rule was passed in response to a court order.² This latter court order came in the context of the failure of the United States to complete licensing activities for a repository at Yucca Mountain in Nevada.³ The Nuclear Regulatory Commission was ordered to develop a waste confidence rule that included the possibility there would never be a repository.⁴ The court ruled that the need for updating the waste confidence rule was the failure of the previous rule to satisfy all the provisions of the National Environmental Protection Act.⁵ This led the Nuclear Regulatory Commission to evaluate various environmental impacts⁶ for three time frames.⁷

The Nuclear Energy Institute (NEI), the nuclear power industry's trade association, was pleased with the issuance of the new rule. Ellen Ginsburg, NEI's Vice President, said "the completion of this rulemaking is an important step that will facilitate final agency decisions on pending industry licensing actions such as license renewals of operating reactors and early site permitting for new reactors."⁸ In contrast, Geoffrey Fettus, lead counsel for the Natural Resources Defense Council, one of the petitioners in the Court case, issued the following statement: "The Nuclear Regulatory Commission failed to analyze the long-term environmental consequences of indefinite storage of highly toxic and radioactive nuclear waste; the risks of which are apparent to any observer of history over the past 50 years. The Commission failed to follow the express directions of the Court."⁹

The origin of this action so soon after the establishment of the 2010 rule (which in turn dates back to the first waste confidence decision in 1984) was a lawsuit challenging the 2010 rule filed by several eastern states, several public interest groups and the Prairie Island Indian Community. The

suit, *New York v. NRC*, claimed that the Nuclear Regulatory Commission failed to comply with NEPA, the National Environmental Protection Act. The Court ruled that the rulemaking in fact did not fully comply with the Act, and vacated the 2010 rule and Decision.¹⁰ The Court identified two kinds of deficiencies in the Nuclear Regulatory Commission's analysis. The first has to do with the assumption regarding the eventual final disposal of spent fuel in a repository. The 2010 rule had stated that "the Commission believes there is a reasonable assurance that sufficient mined geologic repository capacity will be available to dispose of the commercial high-level radioactive waste and spent fuel.....when necessary."¹¹ The Court held that the Commission needed to examine the environmental effect of failing to ever establish a repository. The second kind of deficiency is related to inadequate examination of the risk of spent fuel pool leaks and fires. We will be focusing on the repository availability issue in the present discussion. First we will review the origin of a nuclear waste confidence decision.

The general context of a waste confidence decision has to do with whether it is proper to license reactors that will produce waste that could provide a long-lasting threat to the health and safety of the public. The supporting document for the 2014 rule and decision update, "Generic Environmental Impact Statement of Continued Storage of Spent Nuclear Fuel" (NUREG-2157)¹², gives a brief history of waste confidence rulemaking. Like the present update, this issue came to a head as a result of a Court of Appeals remand to the Commission, in this case in response to a suit *Minnesota v. NRC* decided in 1979.

In response to the 1979 remand, the Commission issued its first Waste Confidence Decision in 1984. It found "reasonable assurance that safe disposal of high level radioactive waste and spent fuel in a mined geologic repository is technically feasible" and that "one or more mined geologic repositories.... will be available by the years 2007-09, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license...". It furthermore found "reasonable assurance that...spent fuel generated in any reactor... can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that reactor's operating licenses..."¹³

In 1990 the Commission revisited the waste confidence issue, and in the light of the slow progress on developing a repository issued a revised finding that they had reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twentieth century. They also broadened their reassurance about safe storage for thirty years beyond the original licensed life to include that of renewed or revised licenses.¹⁴

By the time of the 2010 revision the Obama administration had declared Yucca Mountain “not workable” and any prospect for a geological repository seemed remote. As mentioned above, the response of the Commission was to say that it “believes there is reasonable assurance that sufficient mined geologic repository capacity will be available when necessary”. It also made a generic determination that spent fuel can be stored safely for at least 60 years beyond the licensed life of a reactor. In 2013 Alley and Alley characterized the approach to waste confidence as one that “looks like shooting an arrow at a wall, drawing a bulls-eye around it, and proclaiming yourself an excellent marksman.”¹⁵ The 2014 version, no longer with the title “Waste Confidence”, fits in with this progression. Pressed by the Court, it considers three time frames including the possibility that a repository never becomes available. The 2014 rule no longer contains a statement corresponding to the 2010 statement “...spent fuel can be stored safely and without environmental impacts for at least 60 years beyond the licensed life for operation”, but rather simply states that the “Commission has generically determined that the environmental impacts of continued storage of spent nuclear fuel . . . are those impacts identified in NUREG-2157, ‘Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel.’”¹⁶ This generic environmental impact statement, (GEIS) is 1300 pages long and difficult to summarize.

The GEIS breaks the environmental impacts considered into 20 categories, from Land Use to Public and Occupational Health, Accidents, and Sabotage or Terrorism. Each of these categories are evaluated for three assumed timeframes for storage before availability of a repository. The short term time frame assumes a repository will be available within 60 years after termination of a reactor’s operating lifetime, the long-term 160 years, and an indefinite timeframe which assumes that a repository never becomes available. The Commission considers the short-term timeframe to be the most likely scenario.¹⁷ The indefinite timeframe was included in response to the Court order.

For each category and for each timeframe the GEIS rates the impacts as small, moderate or large. The general definitions of significance levels are:¹⁸

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded

that radiological impacts that do not exceed permissible levels in the Commission’s regulations are considered small.

MODERATE: The environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

For most categories the impacts were declared to be small for all three timeframes. Exceptions included Air Quality for short timeframes, Historic and Cultural Resources and Aesthetics for all timeframes, and Traffic for away-from-reactor storage for long and indefinite timeframes.

The most important issue is the question of when or if a geological repository will become available for final disposal. The NRC believes that a repository is “most likely” to become available during the shortest of the three time frames considered.¹⁹ Commission Chairman Allison Macfarlane in her notational vote²⁰ questioned that conclusion and asked that statements in the GEIS and Federal Register notice be revised to characterize repository availability in the near-term as “one reasonable scenario” rather than the “most likely scenario.”²¹ This request was apparently not accepted by the majority of the Commissioners and the original language remained in the final GEIS and Federal Register notice. A related issue is whether institutional control will be exercised over the long term. In evaluating the environmental impacts for this timeframe it was assumed that institutional control would remain throughout the indefinite timeframe.²² But the GEIS goes on to acknowledge that “although too remote to calculate meaningfully, a permanent loss of institutional controls would likely have ‘catastrophic consequences,’” (Commissioner Magwood objected to this wording, but it was not changed in the final GEIS). It is important to remember that there is a long-standing international consensus that deep geological final disposal of nuclear waste is required. This consensus is partly in response to concerns that it is impossible to assure indefinite institutional controls on surface storage facilities. US policy to provide for permanent disposal in a geological repository was formalized by passage of the Nuclear Waste Policy Act of 1982.

With the assumption that institutional controls will remain indefinitely, and that canisters and casks would be replaced about every 100 years, the GEIS concludes that environmental effects on public and occupational health (including radiological effects) would be SMALL (capitalization in GEIS). This is a rather remarkable assumption and conclusion for the Nuclear Regulatory Commission to incorporate into a Rule. It is based on a much more limited analysis and much less restrictive radiation standards than are in place for a deep geological disposal facility such as are applicable to the pending Yucca Mountain repository. Chairman Macfarlane hinted at this in a statement in her notational vote: “if the environmental

impacts of storing waste indefinitely on the surface are essentially small, then is it necessary to have a deep geologic disposal option?"²³ However her request that the staff should fully evaluate the potential range of environmental impacts for indefinite, no-repository storage under two scenarios-keeping and losing institutional control, was not accepted by the Commission.

The public may not share the confidence of the Nuclear Regulatory Commission about nuclear waste confidence. There is also concern that the Commission's action in approving this rule and supporting Generic Environmental Impact Statement may undermine the already precarious governmental support for addressing properly the nation's nuclear waste problem. A Blue Ribbon Commission, established by the Obama Administration after their request to withdraw the Yucca Mountain repository license application, urged prompt action on their recommendations which require some congressional action. Among their recommendations was prompt action to develop another geological repository. A bill to implement their recommendations is languishing in a Senate committee.

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- 1 *Spent fuel is also referred to as radioactive waste, nuclear waste, and more recently used fuel. It includes fission products and actinide elements produced by fission and neutron capture.. Fission of Uranium-235 splits the nucleus into two unequal parts and fast neutrons. Some of the isotopes of these elements are radioactive. Some isotopes of particular concern are Iodine-131 with a 8 day half-life and Cesium-137 with a 30 year half-life. Some of the neutrons produced in the fission process are captured by Uranium-238 to form Neptunium-239 which undergoes beta decay to form Pu-239. Pu-239 after chemical separation from other elements in the irradiated nuclear fuel can be used to produce a bomb and therefore poses a proliferation risk. Neutrons also produce Neptunium-237, with a 2 million year half-life.*
- 2 *New York v. NRC, 681 F.3d 471 (D.C. Cir. 2012 (ADAMS Accession No. ML 12191A407)*
- 3 *This repository site was selected in 1987 with passage of the Nuclear Waste Policy Amendments Act by congressional conference committee. See Chpt. 5 in Vandenbosch, Robert, and Susanne E. Vandenbosch, "Nuclear Waste Stalemate: Political and Scientific Controversies", University of Utah Press, 2007.*
- 4 *Referring to a possible failure to ever establish a geologic repository, the Court said "The Commission can and must assess the potential environmental effects of such a failure." P. 13, New York v. NRC. To*

the average person and certainly the attentive public this may seem like a ludicrous assignment as well as unnecessary. A committee of the National Research Council has suggested evaluating the ability of a geological repository, the Yucca Mountain repository in Nevada, from the perspective of environmental impacts until the time of peak risk. For Yucca Mountain they suggested this would likely be longer than 10,000 years. This is a more manageable frame than the indefinite period suggested by the court. (See National Research Council, Technical Basis for Yucca Mountain Standards, 1995).

- 5 *Pp. 7, 21 of New York v. NRC.*
- 6 *These were land use, socioeconomics, environmental justice, air quality, climate change, geology and soils, surface water quality, surface water quality and consumptive use, groundwater quality and consumptive use, terrestrial resources, aquatic ecology, special status species and habitats, historic and cultural resources, noise, aesthetics, waste management of LLW, mixed waste and nonradioactive waste, transportation traffic and health impacts, public and occupational health, accidents, and sabotage or terrorism. The Nuclear Regulatory Commission estimated whether the impacts would be SMALL, MODERATE OR LARGE for each of these categories.*
- 7 *A short term time frame assumes a repository will be available within 60 years after termination of a reactor's operating lifetime, the long-term 160 years, and an indefinite timeframe which assumes that a repository never becomes available.*
- 8 *<http://www.nei.org/News-Media/Media-Room/News-Releases/Nuclear-Industry-Commends-NRC-for-Finalizing-Used>*
- 9 *<http://www.nrdc.org/media/2014/140826a.asp>*
- 10 *New York v. NRC, 681 F.3d 471 (D.C. Cir. 2012 (ADAMS Accession No. ML 12191A407)*
- 11 *Section 51.23(a), Federal Register 75 FR 81037, Dec. 23, 2010*
- 12 *<http://pbadupws.nrc.gov/docs/ML1423/ML14238A284.pdf>*
- 13 *Federal Register 49 FR 34658, August 31, 1984*
- 14 *Federal Register 55 FR 38472, September 18, 1990*
- 15 *"Too Hot to Touch: The Problem of High-Level Nuclear Waste" William M. Alley and Rosemarie Alley, Cambridge University Press, New York, 2013. p. 117.*
- 16 *Section 51.23(a), Federal Register 75 FR 81037, Dec. 23, 2010*
- 17 *Nuclear Regulatory Commission, Continued Storage of Spent Nuclear Fuel, 79FR 56245, September 19, 2014.*
- 18 *Nuclear Regulatory Commission, Continued Storage of Spent Nuclear Fuel, 79FR 56246, September 19, 2014.*
- 19 *P.xxx of Executive Summary, GEIS September, 2014 and in final Federal Register rule, Federal Register 79 FR 56245, Sept. 19, 2014*
- 20 *The Nuclear Regulatory Commission has a rather unique way of voting. Commissioner's record their vote, which may include partial as well as full approval of a proposal, and supporting documentation and specific suggestions for any requested changes. These are circulated among the Commissioners prior to a final vote.*
- 21 *P.3, "Chairman Macfarlane's Comments on SECY-14-0072 "Proposed Rule: Continued Storage of Spent Nuclear Fuel", Aug. 7, 2014, released as Commission Voting Record on Aug. 26, 2014. <http://www.nrc.gov/reading-rm/doc-collections/commission/cvr/2014/2014-0072vtr.pdf>*
- 22 *P. xxxi of Executive Summary, GEIS September, 2014*
- 23 *P.1, "Chairman Macfarlane's Comments on SECY-14-0072 "Proposed Rule: Continued Storage of Spent Nuclear Fuel", Aug. 7, 2014, released as Commission Voting Record on Aug. 26, 2014. <http://www.nrc.gov/reading-rm/doc-collections/commission/cvr/2014/2014-0072vtr.pdf>*

Obituary for Martin Perl

A personal memoir focused on Martin as an activist in the early days of the formation of the Forum on Physics and Society

Brian Schwartz

Martin Perl, a friend of mine, a first-rate scientist, an espouser of science policy and an activist in science education, died on September 30, 2014 at the age of 87. Physicists know Martin as a great scientist as evidenced by his being awarded the 1995 Nobel Prize in Physics for his discovery of the tau lepton. Less well known are his many contributions to science policy and education. This obituary will focus on the late 60's and early seventies when US science and physics found itself under great scrutiny and pressure for change by some of its practitioners.

I believe I first met Marty at an annual meeting in New York of the American Physical Society which took place in late January 1969. In those days a general annual meeting was held in New York City every January in which physicists from all disciplines participated. The meeting took place primarily at the New York Hilton and consisted almost entirely of physics research. The world outside the discipline of physics and what was going on in society at large had not played a role at the meetings of the professional societies. The "revolutions" of the 60s in terms of free speech, the women's movement, civil rights and equality issues, and the public's dissatisfaction with the war in Vietnam had not significantly impacted the APS meetings or the APS governance. Unlike the student protests at Berkeley and Columbia, protests specifically related to science had not yet made national news or produced changes in the operations of professional societies. It soon became clear that the science education enterprise and the science professional societies could no longer remain indifferent to the consequences of science research on the society and the careers of scientists.

In my opinion two major societal events were responsible for some early stirrings of activism in science. The first was the deleterious effects on American society by the war in Vietnam. The warning by President Eisenhower of the military-industrial complex and the role that science played



The picture in the lower left shows Marty Perl, Richard Lapidus (Stevens Institute of Technology), and David Wolfe (University of New Mexico) at the Penn State Conference on tradition and Change. The photo is part of a display developed for the 1999 APS Centennial celebration and appears under the title *Consciousness Raising*. <http://www.aps.org/publications/apsnews/200001/knowledge.cfm>

in that complex became more apparent. The second was the rapid leveling off of generous science funding evidenced in the post-Sputnik decade. This was due to the pressure on the budget caused by the Vietnam War, further exacerbated by the Senator Mansfield amendment requiring that funding by any US military agency be shown relevant to their military mission. This sharp unplanned curtailment of the growth in science funding had a severe detrimental effect on employment, particularly to the new and upcoming science Ph.D.s who had entered graduate school during the earlier period of plenty.

In 1968, Charles Schwartz, a physics faculty member at Berkeley, and a friend of Perl, petitioned the APS to amend the constitution to allow one percent of members to call for a vote on any social or scientific issue. The Council opposed this amendment. Charlie had previously extended the scope of the then photocopied camera-ready APS abstracts to include the peace symbol as an abstract in the Bulletin. In 1971, Robert March, University of Wisconsin, proposed a specific amendment to the APS constitution to change the Society's mission statement to include the phrase "The Society...shall shun those activities which are judged to contribute harmfully to the welfare of mankind." The amendment was defeated by a nearly 3 to 1 ratio.

At the January 1969 APS meeting Perl and Schwartz established the “radical” organization SESPA, Scientists and Engineers for Social and Political Action which later became Science for the People with an iconic clenched fist icon symbolizing power on its newsletters. To quote from an oral interview with Charlie Schwartz ... “We had sort of a group of people meet in a hotel room the night before and then leafleted the meeting and had a session in the hotel room, which was sort of inviting people to come and join this new organization. There was a lot of response to that; I mean a couple of hundred people come to this meeting and so they were interested in such an organization. I remember the most interesting part was trying to define more or less what the organization was. I remember Marty Perl giving the first speech in which he made it very clear that this was not going to be a radical organization. And then I gave the second speech in which I said in my opinion this was going to be a radical organization. You know, fine, just let that ambiguity sit out there. It was designed as very much an unorganized organization, encouraging local activity and organization and initiative. Marty undertook to keep a newsletter going for a while. So the organization came into existence.”

<http://www.aip.org/history/ohilist/5053.html>

At that time, I worked with Marty and some other APS activists, notably Barry Casper, Carlton College and Earl Callen, American University, to establish a Division on Physics and Society. The APS constitutional rule stated that a petition signed by at least one percent of the APS membership (then 20,000) could institute the establishment of a new division with all the rights of invited talks, contributed abstracts, fellowships and prizes. At that time, the APS had only two categories of an APS subunit, the Divisions and the Regional Sections. The APS under the leadership of William (Bill) Havens and the APS Council found itself in a constitutional bind and thus proposed the concept of a Forum subunit. A Forum, unlike a Division, which focuses on a subfield of Physics, is a unit with appeal to any APS member. Almost immediately, upon the establishment of the new Forum on Physics and Society as the first Forum, the Council repositioned the Division on the History of Physics as the Forum on the History of Physics. Currently there are seven Forum subunits which contribute to the wider scope of interests of the APS membership and meeting participants. We have Marty Perl and his colleagues to thank for this major improvement in the role of the professional society in the development of the complete scientist-citizen. Marty was the first editor of the Forum on Physics and Society newsletter.

The late sixties were when many social responsibilities movements related to science were established. On March 4, 1969, students and professors at MIT organized a “Research Stoppage” and proposed an all-day symposium on the dangerous use of research and scientific technologies. The day

was set aside to discuss and criticize the cooperation of MIT and other research institutions with the US Department of Defense. An outgrowth of that symposium was the Science Action Coordinating Committee (SACC), a group of graduate students at MIT concerned with social responsibility of scientists. Another outgrowth of that period was the Union of Concerned Scientists founded by MIT faculty and students to “initiate a critical and continuing examination of governmental policy in areas where science and technology are of actual or potential significance” and to “devise means for turning research applications away from the present emphasis on military technology toward the solution of pressing environmental and social problems.”

In the area of science careers and education, Perl was the co-organizer with Roland Good, Penn State, of a conference titled, Tradition and Change in Physics Graduate Education held at Penn State. It was the first major physics graduate education conference, hosted under the auspices of the APS Forum on Physics and Society and the AAPT, which dealt in a comprehensive and fair way with the crisis students, faculty and departments in Physics were experiencing with respect to education, employment and funding. A brief compilation of the papers presented at the conference plus an overview of the conference by Perl and Roland Good appear in the 1975 edition of the FPS newsletter. <http://www.aps.org/units/fps/newsletters/upload/february75.pdf>

What is so surprising and unique about Martin Perl’s involvement with the social and educational challenges of the late 60’s and early seventies was that he was conducting his Nobel Prize winning research at the same time.

I had the opportunity to frequently meet with Marty when I was on the West coast and some of the times when he was in New York. He grew up in Brooklyn, New York as I did and thus we had a lot in common. Once, while visiting New York, he mentioned he was there for a Brooklyn Day to celebrate major achievers from Brooklyn. As a Nobel Laureate, he was high on their list.

I always enjoyed his discussion on creativity and his unbounded views of controversial ideas and experiments he wanted to do on the sign of the mass of some elementary particles. He was quite modest, outgoing, enthusiastic and very easy to get along with. He was always interested in the opinions of others, and valued them. I regret not spending even more time with him.

For more information on the Forum and the period between the late 60’s and mid-70s see: <http://www.aip.org/history/ead/20010001.html> and <http://www.aps.org/units/fps/newsletters/upload/february75.pdf>

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The Greenest Nation? A New History of German Environmentalism

Frank Uekötter (MIT Press, Cambridge 2014), 233 pp., \$28.00, ISBN 9780262027328 (hardcover)

Author Frank Uekötter is now a reader in Environmental Humanities at the University of Birmingham (UK). In Germany he became an expert for history and environmentalism. For example he is the author of the book “The Green and the Brown: A History of Conservation in Nazi Germany” and of “The Age of Smoke: Environmental Policy in Germany and in the United States, 1880-1980.” This illuminates the broad background of the author.

Besides his profound knowledge Uekötter declares his personal engagement for a sustainable future. He confessed “I usually buy organic food and pay climate compensation for my air travel“. He writes that his concern for environmentalism results from two insights: “That it is a necessity in our age and that it is fun (at times).”

In his book he wants “to identify the main factors and forms in the development of German environmentalism while keeping its distance from intellectual monoculture.” His goal is “to give non-German readers a general idea of the path of German environmentalism, providing them with a road map that may stimulate more in-depth inquiries.” He supports additional readings by listing four pages of significant literature at the end of the book. Also, more than 20 pages of footnotes give the engaged reader a lot of study material.

Following the renowned French sociologist, philosopher, and public intellectual Pierre Bourdieu he looks on environmentalism from three frames of reference: “a field of civic activism, a field of government policy, and a field of cultural and life (Lebenswelt).” This is a broader-than-usual starting point for an ecological topic and justifies the word “New” in the subtitle.

The book’s five chapters are: (1) Environmentalism and Environmental History in the Twenty-First Century; (2) Creating a Tradition: German Environmentalism, 1900 to 1945; (3) Getting in Motion: German Environmentalism, 1945 to 1980; Interim Remarks: Explaining the Rise of Environmentalism; (4) The Green Enigma: German Environmentalism, 1980 to 2013; (5) German Environmentalism in Mid Passage; How Green After All? An Epilogue.

This gives a first idea of the content. To be more specific, the five chapters are structured by helpful section headings. For example the two sections of Chapter 2 are titled: Defining Decades: The Early 1900s; Times of Crisis: World Wars, Weimar Years, and the Nazis. And the six sections of Chapter 4 give a good overview how the author handled the central chapter: Ecological 1980s—A West German Sonderweg; Globalizing Environmentalism II—The Green Ending of the

Cold War; GDR Tradition—Ephemeral Environmentalism; Sleeping through the 1990s; The Red-Green Coalition, the End of Nuclear Dreams, and a Can Deposit—1998 to 2005; German Environmentalism after Fukushima.

The history starts at the end of the nineteenth-century with problems resulting from rapid industrialization and urbanization, i.e. air pollution, urban sanitation, national parks or natural monuments. But in Germany the fight against these problems was not guided by “a general, authoritative idea of nature in need for protection.”

Uekötter describes in detail the diversity of the important initiatives and organizations. The issues were: endangered species, power plant projects, dams, observation towers, etc. However, in comparison to other nations, air pollution was not recognized by the active conservationists. The movements of imperial Germany can be characterized as individual actions without a common identity.

Despite his enumeration of the important initiatives, local actions, and facts, Uekötter makes an effort to summarize and generalize his presentation. This summary sheds light on the German situation when he compares it to the development in other countries, namely the United States or in Great Britain.

The section about environmentalism during the Nazi period is interesting and surprising. The “Reich conservation law” of 1935 “offered nearly every thing that the movement had been demanding for decades. For a few years, conservationists could take decisive action in a way that was surely impossible in a democratic state under the full rule of the law.” But this had made them complicit in a criminal and genocidal regime.

After the Second World War, environmentalism in Germany was more a cozy duty concentrating on deforestation, dirty water and air pollution. But the environmental problems helped to transform “the German Untertan [a citizen of imperial Germany who accepts the hierarchical structure, and the title of a famous novel by Heinrich Mann] into a self-conscious, active citizen.” In the election of 1961 Willy Brandt declared: “The sky over the Ruhr region must become blue again.”

Reform was not the task of the broad population but of the political elite. Especially “the third field of environmentalism, culture and life, was bleak. Most people were happy to enjoy the pleasures of mass consumption.”

In the sixties “a new type of threat emerged: The new dangers are global not local.” The book “Silent Spring“ by Rachel Carlson, “Limits of Growth“ from the Club of Rome, and the first oil shock characterized the new situation. Even the dynamic of public debates fostered a consensus, namely that environmental issues were the key challenge for modern societies. “Indeed the greatest challenge of all: the survival of humankind and of the biosphere.”

At the end of the 1970s, there were encouraging signs in all three fields of environmentalism. The author identified nine driving forces in explaining the rise of the Green movement, including changing values from material to post-material, transforming Marxist concepts to ecology, environmental fears, growing importance of the service sector, Germany as a deeply insecure nation, etc.

The ecological movements during the 1990s was stagnating despite the fact that in 1998 the Green Party became a part of the Red-Green Coalition. In concluding, Uekötter is convinced that “for the foreseeable future, Germany will

remain a green country” despite his conclusion that German environmentalism is in a crisis at the moment.

Uekötter has written a fascinating, concise, and convincing small book about Germany’s path to becoming a green nation and about actual and future problems of environmentalism. I recommend his work to readers who want to become acquainted with the history of this complex development.

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Marketing the Moon: The Selling of the Apollo Lunar Program

David Meerman Scott and Richard Jurek, The MIT Press, Cambridge, Massachusetts, 130 pages. ISBN 978-0-262-02696-3. Hardback.

David Scott and Richard Jurek, authors of “Marketing the Moon: The Selling of the Apollo Lunar Program,” are professional marketing experts, with a serious side-interest in NASA history and memorabilia. They intentionally shape their book to present an amazing amount of historical information in a style that is both visually and intellectually appealing to a wide range of readers, especially anyone with a modicum of interest in America’s Space Program. The book makes extensive use of original photographs from the Apollo Program, and of tone boxes interspersed throughout the text, to keep the reader’s interest and provide additional information on topics peripheral to the main theme. This theme is the uniqueness of the NASA Public Affairs/Information Offices during Apollo in terms of (1) providing open and honest reports on program status, (2) translating complex technical information into layman’s language, and (3) exciting and sustaining the public’s interest in space exploration (at least the Moon visits) without being overtly partisan about it.

The authors’ stated goal is “to examine the inner workings and public perceptions of the Apollo lunar program through the lens of practicing PR and marketing professionals,” and to analyze “what was done (by the NASA Public Affairs Officers [PAO]), and what worked and what did not.” They succeed admirably, particularly in showing that with a relatively small PAO staff at NASA Headquarters and the Manned Flight Centers (Marshall, Canaveral and Houston), NASA tried hard not to “spin” or “sell” the space program, but report it accurately and openly in as near real-time as the technology of the day would allow. The authors point out how different this approach was from what Americans were used to in the 1950s and 1960s from military programs and many other government activities. And, of course, it was the exact

opposite of the Soviet approach, which was to say nothing until a space feat was completed, and known to be successful. Also, the book documents the unique partnership NASA and private industry enjoyed in the Apollo program, focusing on how the PAOs at NASA and their industry counterparts helped each other present the program to the world in layman’s terms. All of these NASA PAOs came from a hard news reporting background, as opposed to being publicity hacks, so the factual nature of Apollo news releases was assured, given the Headquarters policy.

The book extensively surveys the history of science fiction that set the mood for much of the public to be receptive to a real space program, even quoting astronomical artist Ron Miller (no relation to this reviewer) as saying “Astronautics is unique among all the sciences because it owes its origins to an art form.” The advent of radio and (later) television helped expand the popularity of various space-travel-themed science fiction serials throughout the nineteen- thirties, forties and fifties. Then in the fifties, the teaming of Walt Disney with Werner von Braun and the presentation of their collaborative vision on TV and in print media (notably Collier’s magazine) began to convince much of the public that real human space travel, at least as far as the moon, was possible in the near future. These linkages between science fiction, entertainment media and von Braun as the ultimate “space salesman” have been made before, but Scott and Jurek’s book tells this story with the fresh feel of marketing experts.

Of course, none of this background would provide public support for a program as massive (in money and manpower) as Apollo without the impetus of the Cold War, and the general feeling in the fifties that the Soviets were ahead of the U.S. in space launch capability. Scott and Jurek document the well-known history that led to President Kennedy’s challenge to put men on the moon before 1970, then show the role the NASA PAOs played in keeping that goal alive after Kennedy’s assassination. They report the ups and downs (such as the Apollo 1 fire) and the learning experiences of the PAOs as the Apollo program matures. The book becomes more of a history text as

it presents detailed analyses of the PAO efforts carried out for each of the 11 Apollo missions (6 moon landings, one aborted moon mission, and 4 Earth-orbit or Moon-orbit development missions). It does this in the context of the television coverage of each mission, having previously established that TV was almost left out of the Apollo program altogether. It seems that the scientists, engineers and astronauts were happy with still photography, and thought that TV cameras would be too heavy for launch in the spacecraft and that astronauts shooting video of mission activities would be detrimental to the mission time-line. From our present historical perspective, we cannot imagine the Apollo missions without live TV images from the moon, but it almost didn't happen. Only a few visionary leaders at NASA and the TV networks pushed for the TV cameras to be on the spacecraft. The book does an excellent job of showing how the need for small, lightweight cameras on the Apollo missions pushed the technology of TV cameras that in turn revolutionized commercial (and ultimately consumer) TV cameras. This is shown to be part of the general synergism of solid state devices, missile and spacecraft design requirements and computer technology being pushed by the Apollo program

(and Department of Defense missions as well) to evolve from 1950s technology to 1970s technology and beyond.

Other issues addressed by this book include: media coverage of the astronauts as celebrities; NASA PAO efforts to share the results of Apollo space missions with all citizens of the U.S.; reasons for the U.S. public's decline in interest in space exploration after Apollo; ways Apollo technology formed the basis for the digital revolution of the past 30 years; how various companies associated with Apollo tried to commercialize on that association; and philosophical impacts the Space Program has had on American (and world) culture, especially environmental awareness through photographs of Earth made from the moon and in transit. All of these are handled concisely and expertly by the authors. I noticed only a few errors, and these appeared to be typographical in nature. This book may not be a history text per se, but is definitely a fine reference book for those studying marketing and public affairs, and for anyone with interest in the history of our Space Program.

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Physics and Society is the non-peer-reviewed quarterly newsletter of the Forum on Physics and Society, a division of the American Physical Society. It presents letters, commentary, book reviews and articles on the relations of physics and the physics community to government and society. It also carries news of the Forum and provides a medium for Forum members to exchange ideas. **Opinions expressed are those of the authors alone and do not necessarily reflect the views of the APS or of the Forum.** Contributed articles (up to 2500 words), letters (500 words), commentary (1000 words), reviews (1000 words) and brief news articles are welcome. Send them to the relevant editor by e-mail (preferred) or regular mail.

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