

Regarding the Department of Energy-Sponsored Comments by Kirk Shanahan

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This is a response to a 15-page (8,000-word) set of comments submitted by Kirk L. Shanahan, of the U.S. Department of Energy's national laboratory at Savannah River,¹ to the 15-page paper by Jan Marwan and me, "A New Look at Low-Energy Nuclear Reaction Research,"² in the *Journal of Environmental Monitoring*.

[Shanahan's Wikipedia talk page](#) includes 67,000 words of debate on "cold fusion," and he has devoted [six hundred edits](#) on Wikipedia to attacking "cold fusion."

After Harpal Minhas, the editor of *Journal of Environmental Monitoring*, and I made several attempts to agree on the parameters for my response to Shanahan's comment, I gave up and decided to publish a version independently.

Responsibility of Scientific Skepticism

Critical and honest scientific skepticism is essential to the scientific method and to the advancement of scientific progress. Pathological skepticism, however, is used to suppress and discredit competitive ideas, be they ideological, technological or scientific.

In his comments, Shanahan employs a three-pronged attack. He chooses to ignore the preponderance of reliable scientific evidence for nuclear effects in LENR that has accumulated in the past 21 years. He applies highly selective criteria to cherry-pick certain experimental data with potential deficiencies which are vulnerable to attack. He uses these as distractions to cast doubt on the entire large body^{3,4,5} of credible LENR data that lies outside the very limited subset on which he focuses his narrow lens.

Science asks but does not require its participants to accept or reject claims; the choice of accepting or rejecting reported results, given accurate information and meaningful analysis, is personal to each individual. Similarly, demand for proof or claim of proof is not a scientific requirement for either skeptic or claimant. Every participant in science has a personal responsibility to directly examine reported claims and data and come to his/her own independent conclusions about its truth and utility.

Our review of LENR was intended to provide readers with a much-needed update to the field. Thus, this response to Shanahan will make no attempt to argue any absolute proof or disproof of LENR claims. That important judgment is the responsibility, as always, of readers.

Specific Remarks About Shanahan's Lengthy Comments

Throughout his comments, Shanahan makes erroneous, sweeping generalizations about LENR researchers. In doing so, he glosses over and ignores wide variances in the quality and thoroughness of reported experimental results among LENR researchers. He ignores the better results and expertise in LENR research. Some of that research is excellent, some is average, and some is inferior and erroneous.

LENR researchers make the best of the limited funding and related resources available to them; the field's longstanding funding problems have imposed particularly severe constraints on access to sophisticated analytical techniques. Ironically, despite the fact that the Department of Energy has spent virtually nothing to support LENR research for 20 years, the department has paid for Shanahan's extensive comments to our paper (under Contract No. DE-AC09-08SR22470).

No single LENR experiment likely will be perfect and definitive in every respect. Calorimetry in one experiment may be weak, but characterization of materials, such as anomalous isotopic changes from that experiment, may be strong. Familiar points of reference, obvious choices for controls and distinct criteria on which to evaluate success or failure do not exist.

Shanahan's method of skepticism is to speculate or propagate insinuations by third parties of things that could have occurred to explain LENR phenomena as ordinary physical processes.

For example, Shanahan tries to persuade the reader that all transmutation products and/or isotopic shifts reported from LENR experiments analyzed with mass spectroscopy or neutron activation analysis are erroneously attributed to LENR, when they are simply the result of some type of contamination.

Shanahan does this with a reference to a conference presentation by David Kidwell⁶ (Shanahan ref. 19) of the U.S. Naval Research Laboratory in which Kidwell insinuates that a researcher at Mitsubishi Heavy Industries used "lucky tweezers" contaminated with praseodymium, which, according to Kidwell, accounts for the LENR transmutation results reported by Iwamura.

Shanahan does a tremendous disservice to readers by omitting to mention Iwamura's rebuttal to Kidwell, which immediately followed Kidwell's presentation.⁷ The Iwamura presentation reveals that Kidwell's speculations defy logic and show Kidwell's (and Shanahan's) comments for what they are: pathological skepticism.

Anyone who takes the time to carefully examine all of the field's voluminous experimental data on LENR transmutations should conclude that Shanahan's implication that all such claims are mere "contamination" is patently false.^{8,9}

Readers should consider the potential magnitude of low-energy nuclear transmutation research. The implications may be far-reaching as well as a potential embarrassment to federal institutions, such as the Department of Energy, should LENR become a new source of clean nuclear energy and a key national defense application.

Shanahan also wants readers to believe that all excess-heat results in the LENR field are errors. He is correct in saying that some heat measurements in the field may contain large errors. However, that assertion does not hold true for all such data.^{10,11,12,13,14,15}

Consider the measurements of excess heat reported by a team led by Michael McKubre at SRI International. In 1993, skeptics visited SRI and carefully audited all the relevant experiments and data. They confirmed, in a written report to the Pentagon, strong evidence of excess heat that "could not possibly be of chemical origin." They considered possible ordinary explanations for the data and found none that was reasonable.¹⁶

The audit team comprised two of the most outspoken "cold fusion" skeptics ever: well-known nuclear physicist Richard Garwin of IBM (who played a key role in the design and development of the first U.S. hydrogen bomb in the 1950s) and Caltech electrochemist Nathan Lewis. Clearly, if those men had thought the SRI team's excess-heat measurements were erroneous, they would have said so in their report. Given Lewis' long experience, he knows vastly more about electrochemistry and calorimetry issues than Shanahan does.

Shanahan's specious approach is common among pathological skeptics, though in recent years people have been less likely to attempt to cast doubt and uncertainty on the entire set of claims of observed LENR phenomena. Even Bob Park, the previous "arch-enemy" of "cold fusion," has seen the wisdom of treating LENR with more circumspection.

Shanahan imaginatively speculates (or uses citations to third-party speculations) or creatively theorizes about things that could have or might have occurred during an experiment. He then simply asserts with minimal factual justification that the claimed results are better explained by ordinary phenomena and/or are simply a product of compounded experimental errors.

To create a stronger foundation for his comments, Shanahan should first have interacted directly with the principal researchers, discussed his concerns with them, and determined whether his points could be or had been addressed.

A similar responsibility lies with the claimants; if they do not disclose sufficiently detailed background information to provide unambiguous support for their claims, an interested reader is in no position to make an accurate assessment of truth.

Even McKubre, who has a large collection of published reports and data on LENR to his credit, is not exempt from this requirement. A 2000 paper of his that claimed a measurement equating to 24.75 MeV heat per 4He atom without rigorous supporting information does not qualify as a well-substantiated, carefully documented experimental claim.¹⁷

Concluding Comments

Regrettably, the difference between "cold fusion" and LENR outlined in our article was apparently lost on Shanahan despite our best efforts, although a recent peer-reviewed encyclopedia article¹⁸, presentation to the American Chemical Society¹⁹, and a brief video clip²⁰ may help clarify this crucial distinction.

The difference is far from semantic; "cold fusion" implies an as-yet-mythical process in which like-charged atomic nuclei overcome the Coulomb barrier at room temperature to produce nuclear energy, products and effects. LENR implies the reality of the same nuclear effects without the presumption of such an as-yet-mythical process.

The credibility of Shanahan's criticisms is further weakened by his citation of and reliance on four references from a single source of allegedly scientific research that are neither peer-reviewed nor published. For 21 years, this shadowy source of private remarks about LENR — Earth Tech International, Inc. of Austin, Texas — has made strenuous efforts²¹ to experimentally discredit new-energy technologies and does not publicly disclose its source of funding.²²

For the most part, Shanahan's blanket criticisms of the field of LENRs are akin to what he asserts about excess-heat measurements: noise, in this case sponsored by the U.S. Department of Energy.

Clever skeptics can always find ways to theorize and imagine alternate explanations for anomalies in controversial science. For other people, who have taken the time to examine the accumulated body of anomalous experimental data with an open mind, the preponderance of evidence that energetic nuclear phenomena are truly occurring in LENR experiments is abundant and clear. These people will lead science and technology to provide solutions for society.

¹ Kirk L. Shanahan, "Comments on 'A New Look at Low-Energy Nuclear Reaction Research'," *Journal of Environmental Monitoring*, (in press)

² Krivit, S. and Marwan, J., "A New Look at Low-Energy Nuclear Reaction Research," *Journal of Environmental Monitoring*, **Vol. 11**, p. 1731-1746, 2009, DOI:10.1039/B915458M

³ <http://newenergytimes.com/v2/reports/SelectedPapers.shtml>

⁴ <http://www.lenr-canr.org/>

⁵ <http://www.dieterbritz.dk/>

⁶ K. Grabowsky, D.A. Kidwell, C. Cetina, and C. Carosella, "Evaluation of the Claim of Transmutation of Cesium to Praseodymium with the MHI Structure," Proceedings of 15th International Conference on Condensed Matter Nuclear Science, Rome, Italy, Oct. 5-9, 2009, (in press)
http://www.newenergytimes.com/v2/conferences/2009/ICCF15/Pres/b24-S3_06_Kidwell-EvaluationClaimTransmutation.pdf

⁷ Iwamura, Yasuhiro, Comments on Evaluation of the Claim of Transmutation of Cesium to Praseodymium with the MHI Structure, Proceedings of 15th International Conference on Condensed Matter Nuclear Science, Rome, Italy, Oct. 5-9, 2009, (in press)
<http://www.newenergytimes.com/v2/conferences/2009/ICCF15/Pres/b25-Iwamura-CommentsOnNRL.pdf>

⁸ Bush, Ben F. and Lagowski, J.J., "[Trace Elements Added to Palladium by Electrolysis in Heavy Water](#)," (Albert Machiels, Thomas Passell, Project Managers) EPRI TP-108743, November 1999

⁹ Miley, G., Narne, G., Woo, T., "[Use of Combined NAA and SIMS Analyses for Impurity Level Isotope Detection](#)," *Journal of Radiological and Nuclear Chemistry*, Vol. 263(3), p. 691 (2005)

¹⁰ Fleischmann M., Pons, S., Anderson, M. W., Li, L. J., Hawkins, M., "[Calorimetry of the Palladium-Deuterium-Heavy Water System](#)," *Journal of Electroanalytical Chemistry*, Vol. 287, p. 293-351, (July 1990)

¹¹ Wilson, R.H. et al., "Analysis of Experiments on the Calorimetry of LiOD-D2O Electrochemical Cells," *Journal of Electroanalytical Chemistry*, Vol. 332, p. 1-31, (1992)

¹² Fleischmann, M. and S. Pons, "[Some Comments on The Paper 'Analysis of Experiments on The Calorimetry of LiOD-D2O Electrochemical Cells,'](#) R.H. Wilson et al., *Journal of Electroanalytical Chemistry*, Vol. 332, (1992)," *Journal of Electroanalytical Chemistry*, Vol. 332, p. 33 (1992)

¹³ Li, X.Z., et al., "[Correlation Between Abnormal Deuterium Flux and Heat Flow in a D/Pd System](#)," *Journal of Physics D: Applied Physics*, Vol. 36, p. 3095, (2003)

¹⁴ Kainthla, R. C., Velev, O., Kaba, L., Lin, G. H., Packham, N. J. C. Szklarczyk, M. Wass, J. and Bockris J. O'M., "[Sporadic Observation of the Fleischmann-Pons Heat Effect](#)," *Electrochimica Acta*, Vol. 34(9), p. 1315-1318, Sept. 1989 [doi : 10.1016/0013-4686\(89\)85026-1](https://doi.org/10.1016/0013-4686(89)85026-1)

¹⁵ Oriani, R.A., et al., "[Calorimetric Measurements of Excess Power Output During the Cathodic Charging of Deuterium Into Palladium](#)," *Fusion Technology*, Vol. 18, p. 652, (1990)

¹⁶ <http://www.newenergytimes.com/v2/reports/GarwinLewisReport/garwin.shtml>

¹⁷ McKubre, Michael, Tanzella, Francis, Tripodi, Paolo and Hagelstein, Peter, "The Emergence of a Coherent Explanation for Anomalies Observed in D/Pd and H/Pd Systems; Evidence for 4He and 3He Production," Proceedings of 8th

International Conference on Cold Fusion. 2000. Lerici (La Spezia), Italy: Italian Physical Society, Bologna, Italy.

¹⁸ Krivit, S.B, "Cold Fusion - Precursor to Low-Energy Nuclear Reactions, " *Encyclopedia of Electrochemical Power Sources*, Vol 2, Juergen Garche, Chris Dyer, Patrick Moseley, Zempachi Ogumi, David Rand and Bruno Scrosati, eds, Amsterdam: Elsevier; Dec. 2009. p. 255–270, ISBN 9780444520937

¹⁹ Krivit, S., "Low-Energy Nuclear Reaction Research – 2008 Update," American Chemical Society, Philadelphia, PA, Aug. 20 2008

<http://newenergytimes.com/v2/library/2008/2008-Krivit-ACS.pdf>

²⁰ <http://www.youtube.com/watch?v=7i5MXRitINU>

²¹ Little, Scott, "Null Tests of Breakthrough Energy Claims, " Proceedings of 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference, AIAA 2006-4909 (2006)

²² <http://www.newenergytimes.com/v2/news/2007/NET22.shtml#earthtech>