

Research Article

LENR Research Documentation Initiative: What Have We Learned So Far?

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Abstract

Humankind desperately needs new sources of energy. Global climate change and the environmental damage caused by fossil fuels threaten the very habitability of the earth. Cold fusion (LENR) has the potential to address these issues and improve the prospects of humanity. The potential energy benefits of LENR were well understood when it was announced in 1989. Although the field was rejected by mainstream science, many capable researchers worldwide continue to pursue it to realize its potential benefits. Because many of them are now retired or dead, the LENR Research Documentation Initiative (LRDI) is underway to preserve their records while they are still available. LENR researchers and collaborators are participating in the LRDI. A site visit is usually made to survey and document records and to conduct interviews. When possible, a timeline of research activity is developed. A report is prepared, and arrangements are made for preserving and archiving records. Much has been learned in several categories in the four years since the initiative was started: 1) the participants and their LRDI projects; 2) the nature and content of the LENR records; 3) interviews and transcriptions; 4) the reports prepared for each project; and 5) the arrangements for preserving and archiving the records. The effects of continued LENR rejection have also been documented in the LRDI projects. The LRDI has many opportunities for future progress, such as expansion with new projects, extension of the findings of previous projects, and LENR advocacy through demonstration of the high quality and very large amount of research. The LRDI's ultimate objective is to advance the cause of LENR to realize its energy potential for the benefit of humankind.

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1. Introduction

Humanity's dependence on fossil fuels for energy has resulted in profound threats to the habitability of the earth. Major efforts and resources have been expended for over 50 years to deal with near-surface effects of energy production and use, such as smog, acid rain, water pollution, and radiation hazards. In more recent decades, global climate change – caused primarily by use of fossil fuels – has emerged as an even greater threat to our existence. It is clear that the future of humankind depends on finding new more suitable sources of energy. Alternative sources to fossil fuels, such as solar- and wind-produced energy, are helpful for addressing these critical issues.

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Cold fusion (CF) has major potential not only to displace fossil fuels, but also to provide energy in applications and areas where energy is not currently available. CF (now also called low energy nuclear reactions, LENR) was announced by Fleischman and Pons in 1989, only to be rejected by mainstream science within a year or so. People understood the immense potential energy benefit of LENR when it was announced. Despite the rejection, LENR has continued to be researched by many capable scientists around the world, and a massive amount of evidence for the reality of LENR has been accumulated.

Many of the investigators who have pursued LENR despite the rejection began their work in the early years after the announcement, and now, more than 30 years later, many are leaving the field because of old age or death. In large part because of the rejection, the researchers' records have not been systematically recorded and preserved. Because these records may eventually help understand LENR and achieve its benefits, their loss would be a tragedy not only for the field, but also for all of humankind. The LENR Research Documentation Initiative (LRDI) has been undertaken to help mitigate this loss [1], [2]. Much has been learned in the more than four years since the initiative was started.

2. Overview: What Kinds of Lessons Have Been Learned in the LRDI?

The LRDI works with investigators to document and preserve their research records and to understand their pursuit of LENR through interviews. An overall procedure [3] has been developed as shown in Figure 1.

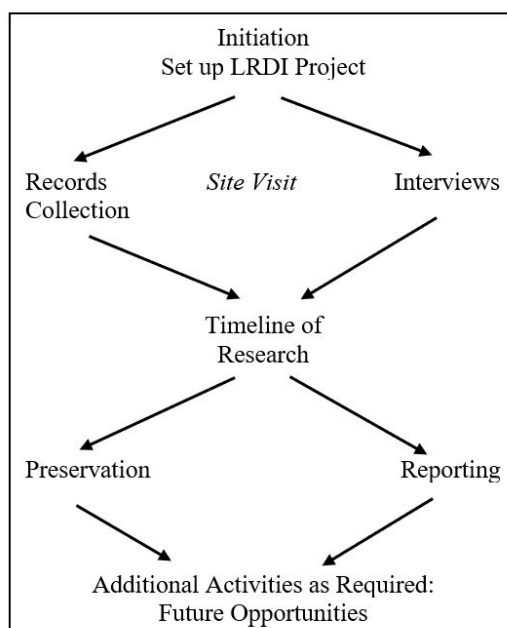


Figure 1. LRDI Procedure.

In summary, when agreement is reached with a researcher, a visit is usually made to survey and document the records and to conduct one or more interviews. Where possible, a timeline of LENR activities is developed. Interviews are usually conducted in person during the site visit. A report is prepared, and arrangements are made for preserving

and archiving the records. Information that could be added after the project is completed is identified and included in the report as “future opportunities”.

The procedure was developed in a pilot project with Dr. Edmund Storms in Santa Fe, New Mexico. The initiative began in 2018 as a poster on Dr. Storms’ LENR records presented at ICCF-21 [4]. Much has been learned in several categories as the LRDI has proceeded:

- Participants
- Projects
- Records
- Interviews
- Reports
- Preservation and Archiving
- Overall Status of the LENR Field

2.1. Participants

The current and previous participants are listed in Table 1. Some projects have more than one participant, such as where the researchers are collaborating. Four of the participants, Charles Beaudette, Mahadeva Srinivasan, Peter Gluck and Ludwik Kowalski, have died since their documentation projects were completed. Hal Fox and Stan Szpak had died before their projects were performed.

Table 1. LRDI Participants and Collaborators.

Beaudette, Charles*	Gordon, Frank*	Miley, George
Biberian, Jean-Paul	Hagelstein, Peter	Mossier-Boss, Pam*
Carat, Ruby*	Hubler, Graham*	Nagel, Dave
Celani, Francesco	Kowalski, Ludwik*	Passell, Tom
Claytor, Tom	Letts, Dennis	Pease, Dennis
Dolan, Tom*	Little, Scott	Rothwell, Jed*
El-Boher, Arik	Little, Marissa	Srinivasan, Mahadeva*
Forsley, Larry*	Lomax, Abd	Storms, Ed
Fowler, Malcolm	Marriott Library**	Szpak, Stan*
Fox, Hal*	Miles, Mel	Tanzella, Fran
Gluck, Peter*		

* Site visit not available or not required

** University of Utah

The interactions with the LRDI participants have resulted in many favorable subjective opinions on the part of the author. As researchers, the participants have been found to be competent, creative, conscientious, highly experienced, dedicated and driven in their work. As human beings, the strong impression is that they are professional, honest, articulate, competitive, original, opinionated, hard-working, and personable. Regarding their projects, the participants are supportive, open, cooperative, receptive, engaging, and enjoyable to work with. The overall observation is that the participants are very capable scientists are doing highly sophisticated experiments to solve the LENR riddles.

Many of the participants have laboratories for their LENR research (Figure 2). Different methods (e.g., electrolytic, gas loading), signatures (e.g., excess heat, very low levels of radiation), and facilities (ranging from small backyard labs to major university buildings) are utilized.



Figure 2. Francesco Celani (Left) and Tom Grimshaw during a Site Visit at Celani’s LENR Laboratory on the INFN Campus, Frascati, Italy, September 2022.

2.2. Projects

The LRDI functions as a program with individual projects for participants. The projects are conducted in accordance with standard project management procedures. Approximately 21 projects have been performed or are ongoing under the LRDI umbrella as shown in Figure 3, where the projects are shown generally in order of initiation from left to right.

The LRDI procedure has been found to be effective in practice, but flexibility is required to meet the specific needs of each participant. It has also been found that the site visit to the participant is important to conduct a hands-on review of the records and conduct the interviews. Some projects are undertaken where the participant is no longer available, but the records are nevertheless important to the LENR field. So far, these “legacy” projects have been for describing websites or utilizing hard copy or electronic files from sources other than the author.

Relatively modest resources are needed for LRDI projects. A major cost element is the travel for site visits and to present results at conferences. The need for equipment portability for site visits is an important LRDI lesson. Several types of equipment are utilized:

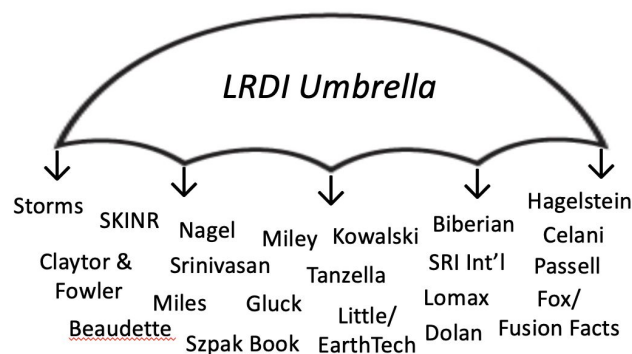


Figure 3. The LRDI Umbrella of Projects.

- Laptop computer
- External electronic files storage, such as USB flash drives and stand-alone hard disks
- Sheet-feed scanner for hardcopy files
- Printers for site visits and report preparation
- Multi-function phone for communication, taking photos, recording interviews, and hardcopy scanning (for materials not suitable for the sheet-feed scanner)

2.3. Records

A major observation in the LRDI is the very large amount of LENR records that are available. Many participants have kept the results of their investigations and activities going back to their original entry into the field. The records comprise both hardcopy and electronic files.

In general, the records fall into two categories – documents, such as publications and reports, and electronic data. Several variables determine the extent and type of records held by an LRDI participant:

- Original type of information collected – documents vs. data
- Methods of collecting and recording the information
- Completeness of the original records
- Methods and results of data analysis
- Storage media used, such as file cabinets and hard disks
- Retention and preservation

When an LRDI site visit is made, the search for records encompasses several categories:

- Publications and presentations
- Unpublished reports
- Hardcopy records in boxes and file cabinets
- Electronic files in current and legacy media
- LENR laboratory, if present, including methods, signatures, and facilities and equipment
- Lab notebooks
- LENR library, including ICCF conference proceedings, collections of books in the field, copies of journals and magazines, and virtual media (e.g., photos, tapes, DVDs)

Each time a component of the records – such as hardcopy files – is found, a memo is prepared with details of the record. The development of the digital age in the same timeframe as LENR research and other activities since 1989 has had a major impact on the participants’ storage of information. Many of the electronic records have been found in legacy media, such as floppy disks (Figure 4) and obsolete stand-alone hard disks.



Figure 4. Carousel of 3 1/2-Inch Floppy Disks Containing Edmund Storms’ Early Electronic Files.

2.4. Interviews

The interviews of the participants have been found to be almost as important as the records documented. They serve as a complement to the documentation and are necessary for developing a timeline of research and other LENR activities. The interviews serve as the “glue” for the records information in LRDI reports. Questions that are typically asked include:

- What were you doing at the time of the 1989 announcement?
- How did you learn about it? What was your initial reaction?
- When did you first become involved in the field?
- What have you been doing since then, and what are you doing now?
- Are you convinced that LENR is a real phenomenon? If so, what do you think is the best evidence for its existence?
- Tell me a little about yourself. Where were you born? Where did you go to school? What are your other professional interests besides LENR?

With the concurrence of the participant, the interviews are recorded using a cell phone app, and the audio files are transcribed. As noted, the interviews are normally done during the site visit. When in-person exchanges are not

feasible, the interviews are accomplished with another cell phone app for recording phone conversations. However, experience has shown that in-person interviews are superior to phone interviews because of the personal connection, lively back and forth interactions, and contributions of body language. When possible, more than one interview is conducted – separated by an significant length of time – because different events and results are recalled in each one.

Whether conducted in person or on the phone, interview audio files are submitted to an online service for transcription. Apps and services that have been found to be effective (although others may qualify also) are SmartRecorder [5] for in-person recordings; TapeACall for telephone interviews [6]; and REV.com [7] for transcription of audio files from both sources.

2.5. Reports

The memos describing the components of the records serve as the principal source for the project report. Confidentiality of the findings of the projects is required – nothing is released to others without the consent of the individuals, although some participants are willing to have their reports made public “after the fact”. A consistent format of the project reports has been found to be an effective presentation of project results.

Introduction. Provides background on LENR and its rejection. Includes introduction of the participant and his or her LENR contributions. Normally includes a photo of the participant.

Research and Other Records. Generally, a section or subsection on each component of the record. Derived from memos prepared for the records. Includes lists of publications and reports.

Interviews. Recorded as audio files that are then converted to transcripts of the interviews. May also be annotated to help develop a timeline.

Timeline of LENR Activities. Prepared when sufficient information is found in the records and interviews.

Future Opportunities. Delineates findings that were uncovered but could not be included in the scope of the project. Provides framework for future additional investigations.

Project Methods. Describes the LRDI procedure used in conducting the project. Often includes a list of the memos documenting the interviews and components of the records.

Appendix. Provided as backup or extension of findings in the various sections of the report. May require a second volume of the report when voluminous.

2.6. Preservation and Archiving

Much has been learned in the LRDI about securing records and arranging for long-term archiving. The methods are quite different for hardcopy and electronic files. Fortunately, the Marriott Library at the University of Utah (Figure 5) has expressed strong interest in receiving hardcopy LENR files. A visit has been made to Special Collections at the library [8], and contact was made with the manager. A substantial LENR collection was found to already exist at the library, and arrangements were made for additional contributions from LRDI participants. So far, Edmund Storms and Tom Passell have contributed extensive materials from their research.

A solution is also being developed for long-term archiving of LENR electronic files. Currently, the files from participants are backed up on two large-capacity stand-alone hard drives. A central repository in the Cloud is being pursued to provide ready access to the files by the participants and other interested (and authorized) parties. The central issues appear to be access and security. The files must be immune from sabotage and available only to those approved by the participant. Searchability may become necessary for reanalysis of the records to help solve LENR’s riddles of inadequate reproducibility and insufficient theoretical understanding.

An account has been established with Amazon Web Services (AWS) [9] for very large capacity storage at a reasonable rate. It is being used in a pilot project for storing large volumes of files from LRDI participants.



Figure 5. Reading Room of the Marriott Library Special Collections.

3. Status of the LENR Field

What has been learned in the LRDI about the status of the field is primarily verification of what is already known. LENR's rejection by mainstream science has become almost a hallmark of the field, with a multitude of adverse effects, such as highly restricted funding for research, damage to the careers of investigators, failure of mainstream journals to publish LENR papers, and barriers to younger scientists wanting to join the field. Certainly, these constraints have contributed to the lack of success in achieving reliable reproducibility and an acceptable explanation, as well as a new source of energy.

The "common cause" among the researchers of a rejected field has resulted in a strong sense of community. Although the community is held together loosely, and is often quite fractious, the sense of camaraderie persists to this day. The community has developed a separate but parallel set of practices and outlets for sharing research results. Examples of the separately developed LENR venues and outlets are shown in Table 2. (Incidentally, these sources are prime information resources for LRDI projects.)

4. Future LRDI Opportunities

A major LRDI lesson learned is the potentially very large quantity of available LENR records. The accomplishments so far seem to be "just scratching the surface". There are numerous researchers and other interested parties in the LENR field who are candidates for future projects. Also, nearly all projects completed or underway have potential for additional documentation in the future. Thus, the program can progress both by expansion with new projects and by extension with more efforts on previous projects.

Another area of opportunity is refinement of long-term arrangements for preservation and archiving, possibly beyond the Marriott Library for the hardcopy files and AWS for the electronic files. An integrated LRDI report is being prepared to describe the general characteristics of the researchers and their records, and to make observations and draw conclusions about the nature and scope of the LENR field. The ultimate objective of the report is to provide information to help understand the LENR phenomenon and secure its benefits.

Table 2. Examples of LENR Scientific Processes and Tools.

Professional Society and Awards	International Condensed Matter Nuclear Society (ISCMNS) [10]. International nonprofit organization. Preparata award.
Publications	Journal of Condensed Matter Nuclear Science (JCMNS) [11]. Issued approximately quarterly.
Magazine	Infinite Energy [12]. Published bi-monthly by the New Energy Foundation. Includes topics besides cold fusion.
Conferences	International Conferences on Cold Fusion (ICCFs). Held every one to two years. 24 meetings held since 1989.
Online Library	LENR-CANR.org [13]. Thorough collection of LENR papers going back to 1989. Easily searchable by author, title or date.
Website	LENR Forum [14]. Provides venue for communication among researchers and other interested parties.
Online Chat	CMNS Google group. Set up for posts by individuals on a full range of LENR topics. Membership is by invitation.

Another LRDI goal is to help make the case for LENR so that it will be reestablished in mainstream science, and major resources will be devoted to pursuing it. LRDI plans call for continued – or possibly expanded – communication of the positive findings of the program to persons both within and outside the current LENR field.

5. Conclusions and Acknowledgments

With the threats of current energy sources to the habitability of the earth, humankind desperately needs to pursue LENR for its energy benefits. It has been clear since the 1989 announcement that LENR is a potential source of abundant, safe, clean, and inexpensive energy. The LRDI seeks to document and preserve the LENR researcher records while they are still available. Much has been learned about the participants and their records in the four years since the initiative was started.

The LRDI is being conducted at the firm LENRGY, LLC in Austin, Texas [15]. Gratitude is expressed in particular to the participants for being willing to give interviews and grant access to their records (and in several cases also to their spouses). Thanks go to Carl Page and the Anthropocene Institute [16] for providing financial support for travel and other expenses. Gratitude is expressed to Christy Frazier of the New Energy Foundation and Infinite Energy magazine not only for providing a venue for LRDI articles [17, 18, 19] but also for assistance with tax considerations in LRDI funding. Rob Christian has provided the insight and information for setting up large-capacity storage at AWS for archiving electronic files securely.

Liz Rogers of Special Collections at the University of Utah’s Marriott Library has been instrumental in arranging to receive LENR materials from LRDI participants. Jed Rothwell’s LENR-CANR.org online library of LENR publications and related materials has been a great benefit as the “first stopping point” at the beginning of new projects. Finally, thanks are given to Edmund Storms, not only for serving as the pilot for LRDI projects and as the first to donate his hardcopy materials to the Marriott library, but also for being an informative and fun mentor to the author.

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