

*Los Alamos Critical Experiments Facility*

*1989 Program Review*

*E. M. Leonard*

*E. A. Plassmann*

*J. J. Malanify*

*G. D. Spriggs*

*R. E. Anderson*

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# **LOS ALAMOS CRITICAL EXPERIMENTS FACILITY 1989 Program Review**

by

E. M. Leonard, E. A. Plassmann, J. J. Malanify, G. D. Spriggs, and R. E. Anderson

## **ABSTRACT**

The Annual Program Review for the Los Alamos Critical Experiments Facility (LACEF) drew attendees from throughout the nuclear criticality community. They discussed the importance of the LACEF to their programs and stressed the uniqueness of the facilities available at the LACEF and the importance of doing numerous criticality experiments for a variety of programs. On-going and proposed activities were presented by the staff.

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## **I. INTRODUCTION**

The Los Alamos Critical Experiments Facility (LACEF) has been operating at Pajarito Site at Los Alamos National Laboratory (LANL) since 1948. Much of the original nuclear criticality research was performed at this site, and it continues to be a center for innovative activity. The site has always been, and will continue to be, home to a more diverse array of critical experiments than is available anywhere else in the world.

The annual program review, instituted in 1984, brings together the critical assemblies staff, the program sponsors both within the Lab and the DOE (Department of Energy), and interested members of the nuclear criticality community. During this review, the DOE sponsors and interested users of the facility presented their requirements for the future, and the staff of the LACEF reported the results of their research for the preceding year and their ideas for future projects. This year's participants are listed in Appendix A; an agenda is given in Appendix B.

## **II. PROGRAM OVERVIEWS**

The closures of critical facilities around the country, along with new requirements for critical experiments, has given an urgency to not only the continued operation, but also to the potential upgrading of the facility at Pajarito Site. The criticality community expressed its wholehearted support for the continued operation and expansion of the activities of the LACEF.

## **A. The DOE Criticality Safety Program**

Al Evans spoke for the DOE Criticality Safety Program Study Committee, (Appendix C lists its members). Their task includes

- evaluating criticality safety program/facility needs;
- evaluating available resources: facilities and personnel;
- matching resources to needs for experiments (known and anticipated), criticality safety training, and criticality safety career track;
- addressing specific issues such as long-term needs for LACEF and DOE management and support for LACEF and NCTSP (Nuclear Criticality Technology and Safety Project); and
- preparing recommendations for the Assistant Secretary for Defense Programs (ASDP).

These items will be addressed by the committee during the coming months, and a report will be issued that will be designed to give the LACEF some guidance in the indicated areas. Both Evans and Thomas expressed concern over the ever decreasing number of researchers involved in the discipline of nuclear criticality safety research. Since funding has decreased over the years, new researchers have not been attracted to the field, and others have left for more lucrative areas of endeavor. As a result, many of the experts in the field may retire before replacements can be trained.

## **B. Needs of the Nuclear Criticality Community**

Joe Thomas addressed the needs of the nuclear criticality community, particularly the need for a program that provides stable support in a number of areas relevant to nuclear criticality safety. He stressed the need to have experiments for benchmarking the codes that are currently in use. Research in basic critical and subcritical experiments as well as research, development, and maintenance of calculational methods are of the utmost importance. He recommended that Laboratory management address the following areas:

- establishing the LACEF as a center for nuclear criticality safety research;
- continuing support of the Oak Ridge National Laboratory (ORNL) training program for contractor personnel;
- creating a defined, coordinated program that addresses discrepancies between experiments and calculations; and
- developing a portable subcritical measurements capability for use by the safety community.

## **C. Office of Nuclear Materials Production (ONMP) Program**

Paul Cunningham, LANL Program Director of Nuclear Materials, put the program in perspective by comparing the LACEF funding to other Laboratory ONMP funding. The critical experiments funding of \$1.8M is only a small fraction of the total Lab budget in nuclear materials, which is ~\$100M and funds the following activities:

- Support for weapons program
- Development of plutonium processing
- Support for plutonium processing and production
- Closeout of the molecular laser isotope separation
- Development of nuclear fuels
- Support for critical experiments
- Construction of facilities

The nuclear materials program at Los Alamos provides flexibility in responding to an uncertain future and a unique integration of technical expertise in nuclear materials handling; processes RD&T (research, development, and testing) to improve efficiency and cost effectiveness; and addresses safety, security, and environmental problems for DP (Defense Programs) facilities.

#### **D. New Production Reactor Program**

Each of the new production reactor (NPR) concepts will require critical experiments to verify certain parameters. Experiments for both the heavy-water concept and the modular high-temperature gas-cooled-reactor (MHTGR) concept could easily be performed at the LACEF. Walt Kirchner, Program Manager for Defense Terrestrial Reactors, gave an overview of the NPR program and the potential for LACEF participation and pointed out ways that the existing CNPS (Compact Nuclear Power Source) critical experiment could be modified to accommodate the needs of the MHTGR.

### **III. ONMP Programs**

Solution critical experiments have always been important because of the many reprocessing activities in the DOE complex. As processes change and processing facilities are reconfigured, the need for more criticality information increases.

#### **A. WINCO and Subcriticality Measurements**

The Westinghouse-Idaho Nuclear Company (WINCO) requested that the Lab perform experiments to provide benchmark data for uranyl-nitrate solutions stored in thin rectangular (slab) tank arrays that are isolated from adjacent tanks by neutron moderator and absorber materials. Greg Spriggs, LACEF, discussed the status of this experiment. New tanks have been fabricated, filled with solution, and placed on the Planet machine in Kiva I. During 1988, a series of experiments that obtained 30 benchmark criticals were performed. These results were compiled and handed out at the meeting (see Fig. 1 for the reference case for these experiments).

John Schlessor, Los Alamos Criticality Safety Group, discussed a series of  $k_{eff}$  calculations that he did for the WINCO slab-tank experiment. He compared the MCNP code with the KENO code and  $S_N$  for a number of different cases.

Bob Wilson, WINCO, compared their Monte Carlo calculations with the results of LANL's subcritical measurements using the old slab tanks. The WINCO results show that KENO IV underestimates  $k$  by 1-2% at critical. As the measured  $k$  decreases to  $\sim 0.9$ , the

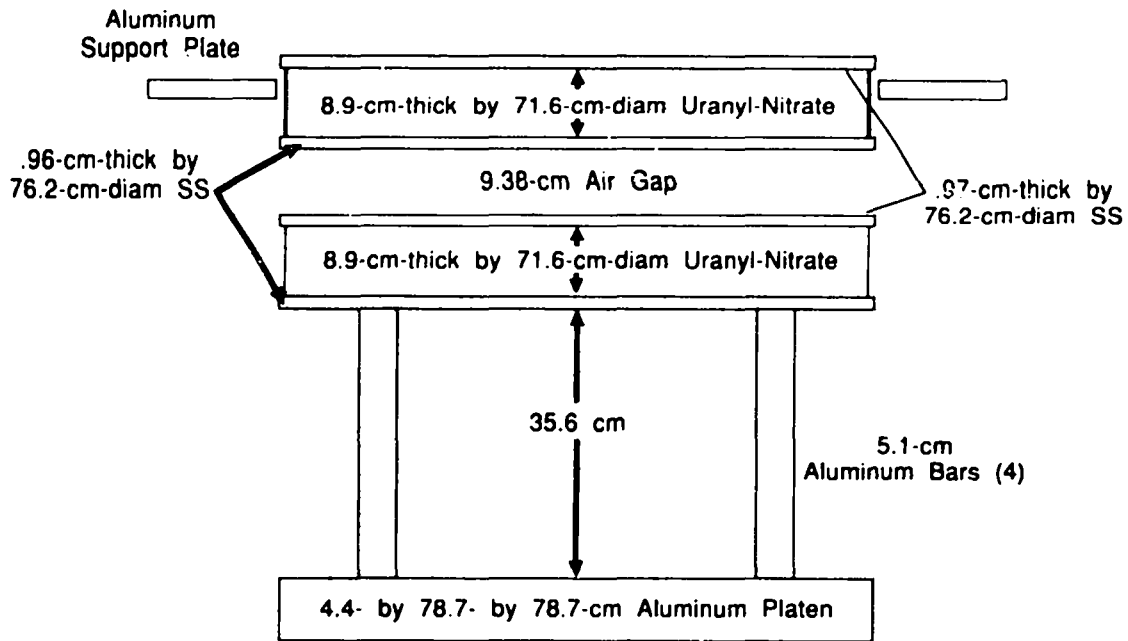


Fig. 1. Reference case for the 1988 WINCO experiments.

bias increases to ~ 3-4%. These results imply that either KENO is not doing an adequate job at subcritical values or that the subcritical measurement technique used by LANL is incorrect. To test LANL's technique, WINCO has asked John Mihalzo, ORNL, to use his Cf-noise analysis technique on a few selected geometries of the new slab tanks and to compare his results with those obtained via the source-jerk technique for the same geometries. This experiment has been planned for May 1989.

## B. Solution Arrays and SHEBA Upgrade

Richard Anderson, LACEF, discussed a solution array experiment that will address some small discrepancies between existing experiments and Monte Carlo calculations. It has been suggested that array assemblies are not equally well described when unreflected or fully reflected, and that the discrepancy may increase with the array size.

Solution containers have been manufactured, and the preparation of the 400-g/l uranyl-nitrate solution should begin soon, along with work on the horizontal split-table assembly machine.

A solution burst assembly, SHEBA II, is currently under construction. This assembly will allow us to study the properties of excursions and to perform a wide range of radiation dosimetry studies.

The first design is a low-pressure tank for studying transients with an initial period of 5 s or longer. After studies of these relatively slow transients are completed, including the static properties of the assembly, a more substantial high-pressure tank will be constructed. The new vessel will permit much faster transients to be observed. In addition, the tank's head pressure may be varied to determine how the transients change if the evolution of radiolytic gas is suppressed. The information gained from this experiment will be compared with experiments that are currently being performed in France on the CRAC and SILENE assemblies.

## IV. OMA (Office of Military Applications) Programs

Gene Plassmann, LACEF, discussed the ongoing experiments of interest to the weapons program. During its entire forty-year history, the LACEF has provided benchmark measurements required by the Laboratory to verify their computer codes, expand the nuclear data base, and predict criticality safety.

### A. Uranium-Hydride Criticals

With the availability of several 6-in.-diam disks of U(93)-hydride, we have been able to define a set of critical configurations using cylindrical reflectors from a previous experiment. The generic setup (Fig. 2) was done on the COMET universal assembly machine. During the past year, we made measurements using the 2.54-cm-thick, D-38 reflector set (Fig. 3) for the approach to critical. The plotted data (Fig. 4) are extrapolated to a critical separation distance, then supercritical measurements are made, as shown, to obtain the reactivity coefficient with respect to closure. Another set of measurements was subsequently made with more UH<sub>3</sub> in the core. The entire set of measurements made to date (see Table I) was then discussed.

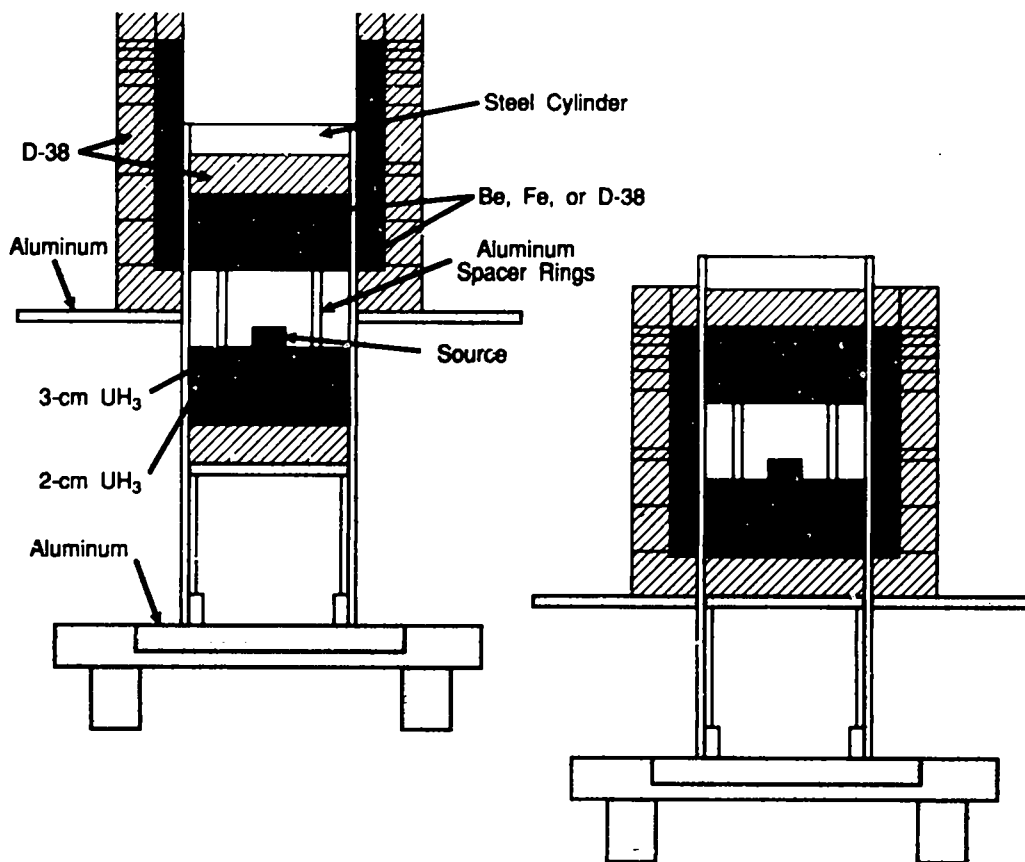


Fig. 2. Generic uranium-hydride critical assembly.

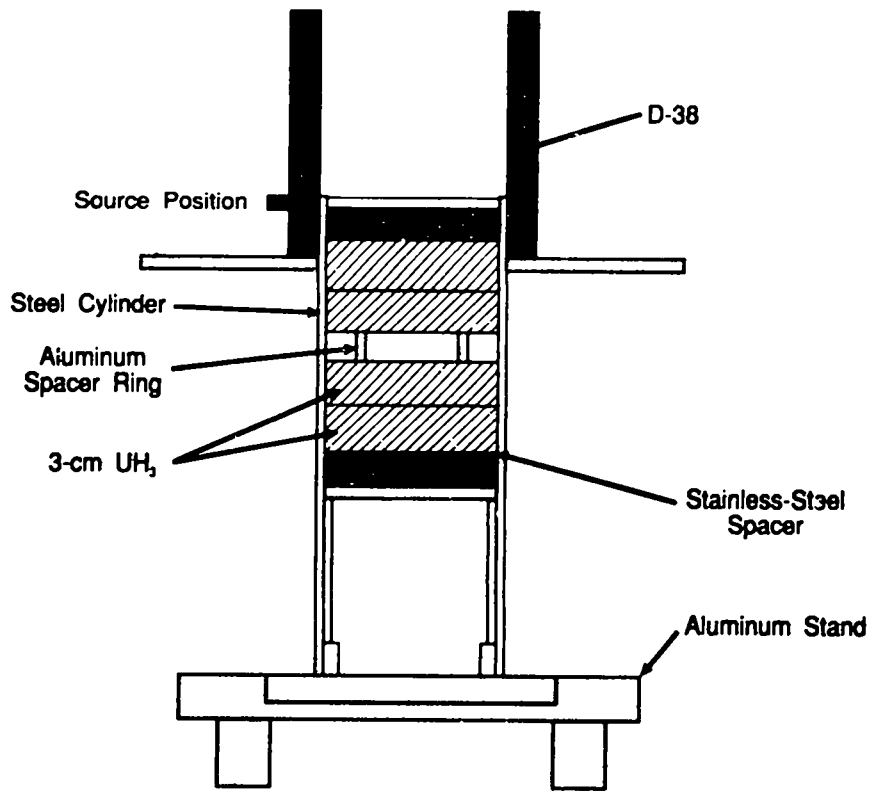


Fig. 3.  $\text{UH}_3$  (12 cm) assembly with 2.54-cm D-38 reflector.

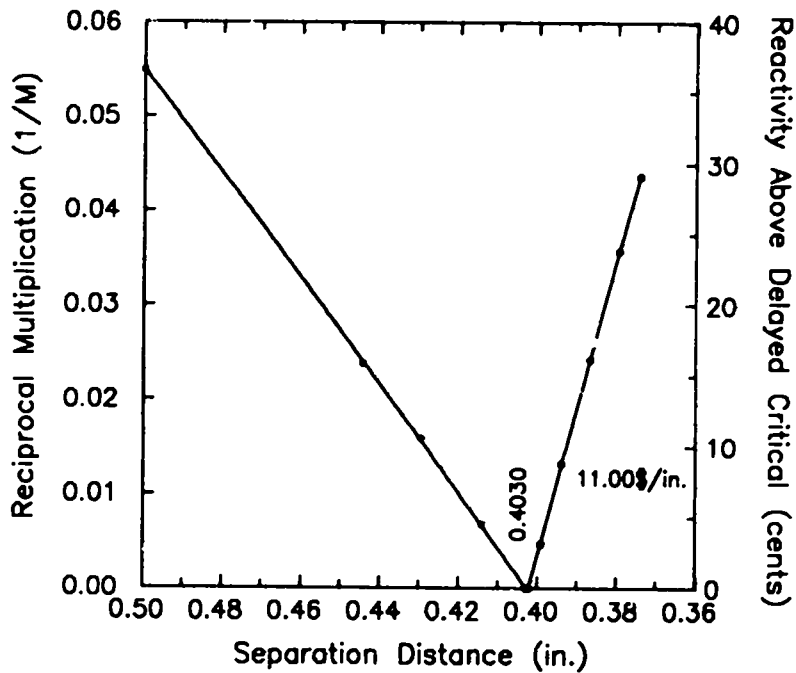


Fig. 4. Criticality measurements with 12 cm of  $\text{UH}_3$  and a 2.54-cm D-38 reflector.

Reflector		Mass UH <sub>3</sub> (kg)	Critical separation distance (cm)	\$/cm at critical
Outer	Inner			
D-38	D-38	18.03	2.24	---
D-38	Be	18.03	3.529 <sup>a</sup>	2.34
D-38	Be	18.03	3.705	2.13
D-38	Fe	18.03	1.371	3.88
---	Be	21.68	0.370	4.00
---	D-38	21.68	0.217	5.26
---	D-38	23.50	0.40 <sup>2</sup>	4.33

<sup>a</sup>with UH<sub>3</sub> disk A inverted

### B. Plutonium Ball-and-Shell Experiment

This experiment (Fig. 5) will provide a simple spherical geometry for checking computer codes that predict criticality safety. The 4.5-kg alpha-plutonium ball has already been fabricated and canned in stainless steel. However, the delta-plutonium hemi-shells, which were machined to size several years ago, have yet to be nickel coated for safe handling because of MST-Division priorities. This set of experiments will define the critical thicknesses of polyethylene reflectors as the alpha-plutonium core is reduced in size as shown in Fig. 5.

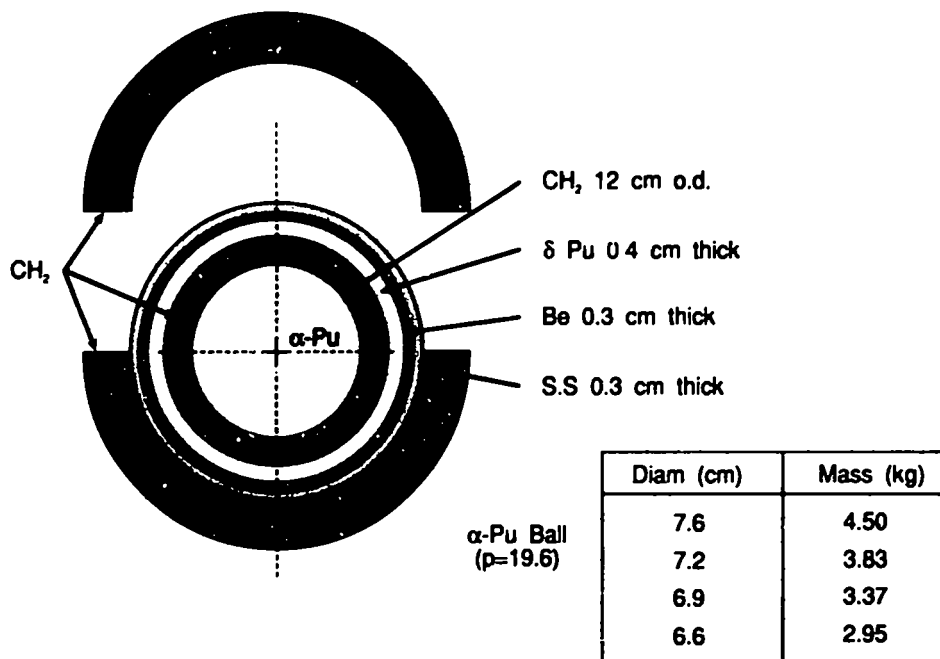


Fig. 5. Plutonium ball-and-shell experiment.



### C. Thick Beryllium-Reflected Alpha-Plutonium Criticals

Because we already had the plutonium ball that was made for the above ball-and-shell experiment, we thought it was an excellent time to redo a 1958 Livermore experiment (Fig. 6) whose results had never been successfully calculated. This historic anomaly has been a constant source of conservatism in any system using plutonium and beryllium. We had already found the critical reflector thickness (see Table II) for the 4.5-kg core, using the COMET assembly machine setup (Fig. 6). While this thickness differed significantly from that expected using the old Livermore data, it also differed from Monte-Carlo calculations performed in our group in 1985. However, calculations made this past year now corroborate the 1985 experiment. Although we plan to continue this investigation with the smaller sized plutonium cores to determine finally the minimum critical mass in a beryllium reflector, we must wait for the first step in the ball-and-shell experiment before continuing.

TABLE II. Beryllium-Reflected 4.5-kg $\alpha$ -Pu Sphere	
	Critical Be thickness (in.)
Present result	3.293-3.305
1985 MCNP calculation	2.86
1958 Livermore experiment	3.7

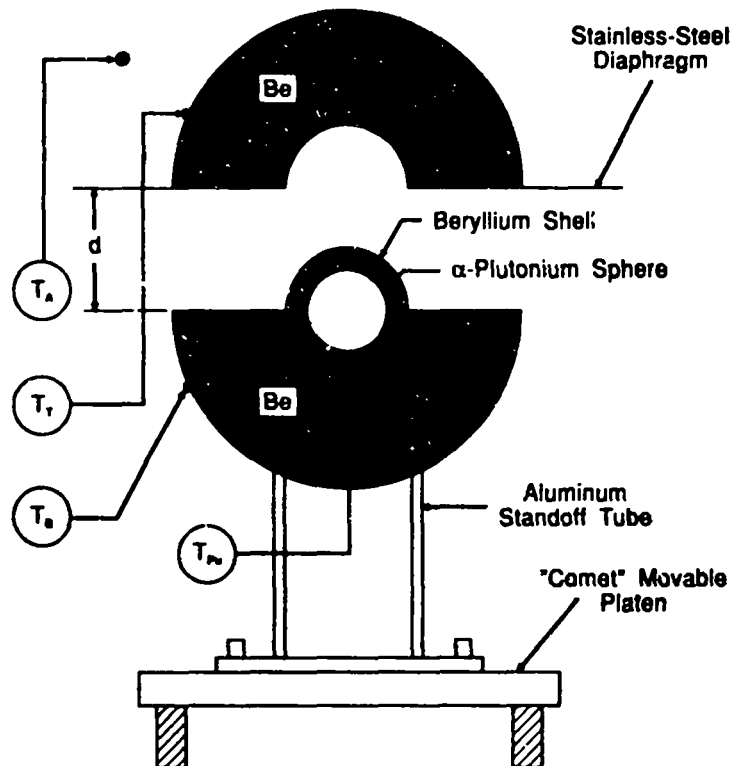


Fig. 6. Thick beryllium-reflected alpha-plutonium ball assembly.

### D. Dispersed Plutonium Experiment

Criticality calculations (Fig. 7) have been made for various concentrations of plutonium solution in different-sized cores. It now appears that the experiment (Fig. 8) can easily examine plutonium concentrations from 60 to 250 g/l. Chemists in MST-13 have made samples of uranium-oxide suspended in a sugar, or hard candy-like, CH compound. We have asked them to make a large hemisphere of the material from depleted-uranium so that dispersion uniformity can be examined. If this promising process works, we can proceed with the actual material.

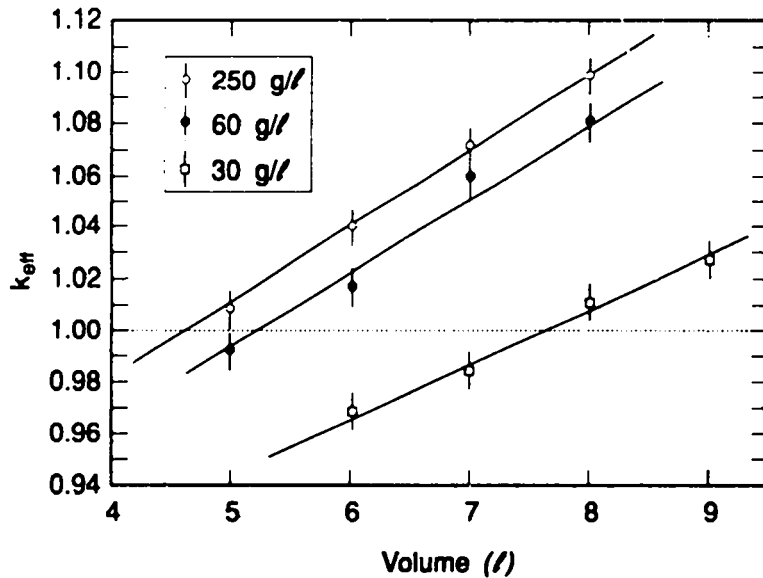


Fig. 7. Dispersed-plutonium experiment critical volume design calculations.

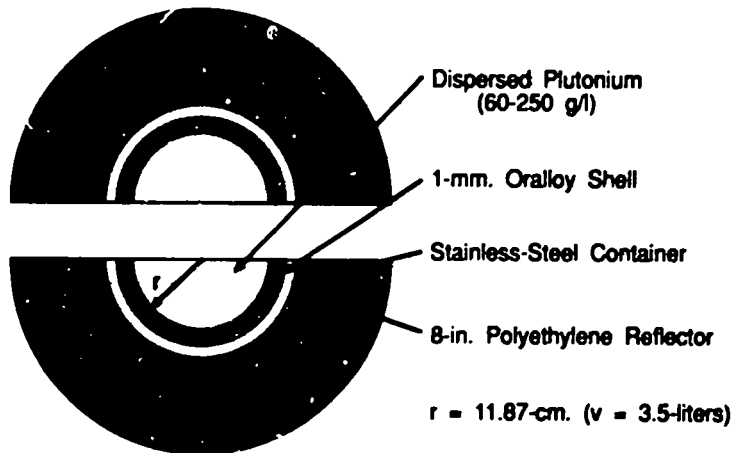


Fig. 8. Dispersed-plutonium experiment critical volume design calculations.

## **E. Weapons Initiatives**

Richard Paternoster, LACEF, discussed a number of interesting weapons initiatives. His presentation will be available in a classified memo.

## **F. Fast-Burst Assemblies**

Tom Wimett discussed the status of the Skua and Godiva assemblies. The latter assembly has had a good deal of use this past year because the weapons program is actively using this neutron source to test detectors and advanced concepts. It is also providing a test capability for the SDI (Strategic Defense Initiative) program in the detector development portion of the neutral-particle-beam (NPB) program. To develop detectors for the NPB program, it is necessary to observe their operating characteristics during a burst of fission spectrum neutrons; Godiva provides this environment.

Skua has been approved for burst operation by the DOE. All that remains to be done is a preoperational checkout that will be performed in May. A number of experiments have been proposed as soon as the assembly has been checked out. Some of these are discussed below.

## **G. Proposed Skua Experiments**

Ellen Leonard, LACEF, discussed a set of five experiments that are being proposed for Skua. The Skua assembly has a number of features that make it especially attractive for experiments. It has a 9-in. central experimental area, a peak central flux of  $1.5E18$  that can be tailored from fast to thermal, and a burst width that can be varied from 100-400  $\mu$ s.

1. The Mimas concept is a scheme for transferring neutron energy from a reactor or burst assembly to a material that will vaporize and act as a propellant, which will be used to accelerate a projectile to velocities of interest. Preliminary calculations using MCNP to calculate the energy created in the propellant and an ideal gas EOS (equation-of-state) have given some interesting sound speeds in the material. Experiments must be performed to determine the actual EOS.

2. A proposal has been written to use  $^3\text{He}$  to seed a DF/CO<sub>2</sub> laser to allow neutronic energy coupling during a neutron burst from Godiva or Skua. Calculations have shown that enough energy can be deposited in this way to uniformly ignite the chemical laser. This procedure has an advantage over the currently used electron-beam initiation because it allows a much larger volume to be uniformly ignited, which, in turn, leads to larger diameter beams.

3. Under development is a fiber-optic-pressure measurement technique that will allow time-dependent pressure measurements to be performed during a burst from Godiva or Skua. This technique will be very handy for EOS and similar measurements, since we are planning to do experiments inside the Skua central cavity.

4. The University of Florida and the Innovative Nuclear Space Power Institute (INSPI) have been proponents of a gas-core reactor for some time. This gas-core system would provide extremely high temperatures that could be used to produce electricity via an MHD (magnetic hydrodynamic) generator. Although the LACEF has been supporting some MHD experiments, there are a number of other areas that it can lend support for the advancement of this concept. A variety of potentially interesting fuel forms could be examined under the appropriate conditions of temperature and pressure within an instrumented vessel inside Skua's central experimental volume. This is similar to other experiments that are of interest to LACEF and would fit well into the program.

5. A proposal is currently under discussion for a fissile-vapor experimental facility. A vessel would be designed in which fissile materials could be vaporized inside the Skua flux trap. An extensive diagnostic capability would be included in this facility for making time-dependent pressure and temperature measurements during a Skua burst. We would also like to measure recombination rates and nonequilibrium distributions if there is a significant amount of ionization in the material.

## **V. OFFICE OF SAFETY ASSURANCE (OSA)**

### **A. Criticality Training**

Since the early 1970s, LACEF has been used as a facility for training nuclear material handlers and workers in the area of criticality. This facility is unique because it is the only place where students can actually assemble nuclear material in a critical configuration.

During the past year, eleven Nuclear Criticality Safety Classes (see Appendix D) have been given in collaboration with Group HSE-6. Six of these were five-day classes, and the remainder were two-day sessions. Since most of the outside (DOE contractor, etc.) personnel attended these longer, more intensive sessions, the proportion of actual time spent in their instruction was much greater than that for Laboratory personnel. The instruction includes discussions by HSE-6 of basic criticality safety and actual hands-on critical experiments supervised by Group N-2 assembly operators. During the five-day classes, visits to Laboratory facilities that routinely handle SNM give further practical demonstrations of criticality safety.

### **B. French Criticality Information Exchange**

In 1986, a Memorandum of Understanding (MOU) for the exchange of nuclear criticality safety information was signed by the US-DOE and French-CEA (Commissione Energie d'Atomique). Gene Plassmann discussed the results of his June 1988 trip to France with the DOE coordinating official to generate a document (Appendix E) that defines each country's participation. Then in September 1988, a working meeting was held in Los Alamos (attended by M. Francis Barbry, from the Valduc Laboratory, France, and participants from the LACEF, DOE, and University of Arizona) to establish experiments and milestones (Appendix F) for this information exchange. The French will supply results from their CRAC and SILENE experiments, and we (LACEF) will provide all past SHEBA data and the results of new experiments with a modified SHEBA that can operate as a solution burst assembly. At the meeting we also critiqued our plans for the SHEBA upgrade.

David Hetrick, University of Arizona, has been actively involved in modeling solution bursts for a number of years. He discussed his mathematical modeling of bubble formation and compared various calculational techniques with past experiments.

## **VI. CONCLUSIONS**

The LACEF continues to provide a variety of much needed services and capabilities to the scientific community: training for SNM handlers and critical experiments for new reactor designs, weapons applications, and nuclear material handling. A number of speakers discussed the discrepancies between calculation and experiment in both the subcritical and the critical regimes. These discrepancies are prevalent in a variety of assemblies from solutions to solids. Therefore, the need to perform critical experiments will never be replaced by calculational capability. The NPR and new reactor designs in the future will require a facility to provide critical experiments. The LACEF is seen as such a facility. A number of new concepts were presented which require the use of fast bursts of neutrons. These concepts could not even be investigated if not for the existence of the LACEF. New

restrictions on nuclear weapons testing will lead to the necessity for innovations in design, as exemplified by the SDI program, which has already put some new requirements on the design of nuclear weapons. Some of these innovations have already led to the need for acquiring new criticality information, and the LACEF was instrumental in providing the experimental support for these new designs. The use of this facility for training continues to be of considerable importance. The consensus of the attendees was that the LACEF has been making significant contributions to the criticality community, and that there is still much work to be done.

## **REFERENCE**

1. David L. Hetrick, "Simulation of Power Pulses in Criticality Accidents with Fissile Solutions," in *Proceedings of International Topical Meeting on Safety Margins in Criticality Safety* (ANS National Meeting, November 26-30, 1989, San Francisco, California), p. 70.

## APPENDIX A

### LOS ALAMOS CRITICAL EXPERIMENTS FACILITY ANNUAL PROGRAM REVIEW

March 14-15, 1989

#### ATTENDEES

Name	Organization	Telephone
Raymond I. Greenberg	DOE-HQ/NMP	233-3784
Albert E. Evans	DOE/OWRDT (DP-2422)	233-3098
Jerry Koelling	N-DO, LANL	667-5590
Robert Seale	U. of Arizona	602-621-2311
Ellen Leonard	N-2, LANL	505-665-1238
Richard Paternoster	N-2, LANL	505-667-4728
Charles Billups	DP-2.2	896-3058
Louis Willet	DOE-HQ/GMA	233-5796
D. R. Finch	SRL	239-5291
Richard Taylor	Y-12	FTS:624-3529
Les Brown	WHC/Plutonium Finishing Plant Operations	FTS:440-5712
Calvin M. Hopper	ORNL	FTS:626-8617
Gene Plassmann	N-2, LANL	FTS:843-5283
David Hetrick	U. of Arizona	602-621-2514
Eugene Redden	DP-22 DASMA (SAIC)	301-353-0174
John Malanify	N-2, LANL	843-4839
Robert Wilson	WINCO	583-1361
Nicholas Nicholson	N-2, LANL	FTS:843-4512
J. T. Thomas	ORNL	624-5261
Richard E. Anderson	N-2, LANL	FTS:843-2821
Robert Walston	DOE/AL	FTS:846-1323
Robert Knopf	DOE/DP-52	233-6823
Charles Goulding	N-2, LANL	FTS:843-0769
Marcia Lucas	N-2, LANL	FTS:843-4839
John T. Mihalcz	ORNL	FTS:624-7164
William L. Kirk	N-DO, LANL	FTS:843-5590
John D. McCarthy	Rockwell Intl.	FTS:320-2412
Gary R. Smolen	ORNL	FTS:624-7164
Steven B. Ross	DOE/AL	FTS:846-1325
Ken Elliott	DOE/AL	FTS:846-1319
Tom McLaughlin	HSE-6, LANL	FTS:843-7628
Charles S. Barnett	LLNL	FTS:532-5096
Thomas Hirons	N-DO, LANL	FTS:843-5590
Paul T. Cunningham	WT-WM, LANL	FTS:843-9807
Richard Malenfant	ADS, LANL	FTS:843-4998

## APPENDIX B

### LOS ALAMOS CRITICAL EXPERIMENTS FACILITY ANNUAL PROGRAM REVIEW

March 14-15, 1989

#### AGENDA

##### Tuesday, March 14:

9:00	Opening Remarks	John Malanify
9:15	Laboratory Welcome	John Whetten
9:30	Division Statement	Tom Hirons
9:45	Group Welcome	Nick Nicholson
10:00	DOE Review Committee	Al Evans
10:15	Nuclear Criticality Community	Joe Thomas
10:30	COFFEE BREAK	
10:45	LANL ONMP Program	Paul Cunningham
11:00	LANL NPR Program	Walt Kirchner
11:15	LACEF Overview	John Malanify
12:00	LUNCH	
	<u>Solution Criticals</u>	
1:30	WINCO and Subcriticality Measurements	Greg Spriggs
2:15	Solution Arrays and SHEBA Upgrade	Rick Anderson
3:00	BREAK	
	<u>Weapons Work</u>	
3:30	Uranium Hydride, Be-Reflected Ball, Ball-and-Shell	Gene Plassmann
4:00	Weapons Initiatives	Rick Paternoster

##### Wednesday, March 15:

	<u>Fast Burst Assemblies</u>	
8:30	SKUA and GODIVA Status	Tom Wimett
9:00	Proposed SKUA Experiments	Ellen Leonard
	<u>Other Programs</u>	
9:45	Criticality Training, French Exchange, etc.	Gene Plassmann
10:00	BREAK	
10:30	SDI/NPB Measurements	Chuck Goulding
11:00	CNPS and Possible NPR Work	Gordon Hansen
11:30	Computer-Controlled Console	Ray Martin
12:00	LUNCH	
1:30-4:00	Unstructured	
	LACEF Tours	Ray Pederson
	Committee Meetings	
	Private Discussions	

## APPENDIX C

### DOE CRITICALITY SAFETY PROGRAM STUDY COMMITTEE

#### Defense Programs

Charles Billups	DP Assistant Secretary Staff, ES&H
Roy Lee	Office of Weapons Safety & Operations
Gene Reddin	SAIC Consultant, OWSO
Lou Willett	Office of Weapons Production
Al Evans	Office of Weapons Research, Development, and Testing
Ray Greenberg	Office of Nuclear Materials Production
Bob Knopf	Office of Planning & Program Management

#### Environment, Safety, and Health

Jerry Counts	Office of Safety Appraisals
John Yoder	Office of Safety Policy and Standards

#### New Production Reactor

Bob Kratzke

#### Consultants

Jerry Koelling	Office of Nuclear Materials Production
Joe Thomas	Nuclear Criticality Technology and Safety Project, LANL



## APPENDIX D

NUCLEAR CRITICALITY SAFETY CLASSES FOR 1988		
Class	Personnel	
	Laboratory	Outside
January 11-15*	3	9
February 2-3	15	2
March 2-3	12	2
April 11-16*	--	13
April 26-27	14	3
May 10-11	11	1
May 16-20*	1	15
July 12-13	12	3
July 18-22*	3	9
September 20-21	9	2
December 5-9*	4	7
	84	67

\*5-day sessions

**Lab divisions represented:**

CLS, ENG, HSE, J, MEC, MST, N, OS, WX

**Outside entities:**

Babcock and Wilcox; Battelle Pacific NW;  
DOE/ALO; DOE/SRP; LLNL; Martin Marietta,  
Y-12; Ohio Mound Plant; ORNL; NRC; Pantex  
Plant; Portsmouth Plant; REECO-NV; SRP;  
US Army-Aberdeen, -FT. Story; USAF Wright  
Patterson; Westinghouse-Hanford.

**APPENDIX E**  
**STATEMENT OF UNDERSTANDING**  
**US - FRANCE CRITICALITY INFORMATION EXCHANGE**  
**JUNE 1988**

The US presented the technical details of its criticality accident information exchange program to CEA personnel at Valduc. The French provided a summary of applicable activities at CEA-Valduc.

As a result of this information exchange, a tentative agreement was reached on the initial level and type of information to be exchanged. A summary of the agreed upon information to be exchanged is as follows:

**A. US Department of Energy will provide:**

1. All available SHEBA data. (Will include future SHEBA experimental data as they become available).
2. Current computer models that are applicable to criticality excursions in solution.
3. Analytical model using the complete equation of state for liquid containing gas bubbles and an improved computation of reactivity feedback.

**B. France-CEA will provide:**

1. All CRAC super-prompt data that is non-divergent after the initial excursions.
2. A selected set of the SILENE data. This set will comprise all applicable data and a list summarizing these experiments.
3. Safety analysis models (CEA) and other relevant analysis methods.

**C. US-France collaborative efforts will be initiated in the following areas:**

1. Simplified models for predicting criticality safety.
2. Dosimetry measurements (direct and shielded) from various US and French operating machines.

To effectively accomplish this transfer of information and initiate work efforts, a working group meeting has been proposed for September 26-27, 1988 at Los Alamos. The working group would be composed of CEA/IPSN at Valduc, Los Alamos, and University of Arizona

personnel. The specific topics to be discussed and information to be exchanged include the following:

1. A full description of the applicable US and French experiments.
2. Analytical and analysis models (both US and French) that are pertinent.
3. Methods for effective data transfer.

In addition, the US is modifying SHEBA to provide additional experimental data in support of this exchange. By separate letter, the IPSN is being requested to critique the design of the upgraded SHEBA so that the data obtained from the operation serve this agreement as well.

The results of this exchange will be reported through technical reports produced either jointly or individually as appropriately defined by the working group. Collaboration is encouraged.

## APPENDIX F

### MINUTES OF SEPTEMBER 26-27, 1988 WORKING MEETING AT LOS ALAMOS ON THE US-DOE, FRENCH CEA AGREEMENT ON EXCHANGE OF CRITICALITY SAFETY INFORMATION

Commitments made on data exchange in next year:

#### Los Alamos National Lab:

Summary Report of the initial phase of SHEBA experiments including a system description, results of experimental runs, summary of available radiation dosimetry results, and an assessment in the uncertainties in the experimental data will be prepared. A draft of this report will be available by March 31, 1989.

The design of the new SHEBA II burst assembly, with modifications and capabilities as discussed during this meeting should be completed in a few months. Completion of fabrication and initial criticality is expected by six months.

The assembly will be designed for operation to 1000 psi. We decided that the burst rod should be a poison rod to be inserted from the bottom of the solution vessel. A series of radial and axial ports will be incorporated for diagnostic measurements. Redundant thermocouples, pressure transducers, and ultrasonic sensors are desirable.

All information on the SHEBA II critical and burst operation will be provided to the CEA as it becomes available.

#### Valduc Laboratory, CEA:

Data from the SILENE reactor operation will be made available as follows:

- A characterization of the SILENE facility and system characteristics will be available by December 31, 1988.
- A report on 10 completed pressure wave experiments will be available by December 31, 1988.
- A summary of selected prior experiments covering the range of sub- and super-prompt critical excursions will be available by December 31, 1988.
- A summary of radiolytic gas evolution capsule experiments (8 with uranyl nitrate and 2 using uranium fluoride) will be available by March 31, 1989.
- A review of all prior SILENE experiments will be completed by December 31, 1989.

#### University of Arizona:

**A progress report on the kinetics modeling of excursion experiments will be prepared by June 30, 1989.**

**Visits for the exchange of information and the discussion of technical questions that may be possible at the convenience of the persons involved are an important resource. (Such visits may occur as the results of other travel activities.) The administrative and technical coordinator should be informed of such possible meetings prior to their occurrence and informed of the general agenda. Following such meetings, a trip report summarizing the results of the meeting will be submitted. No commitments will be made at such informal visits; their purpose is for information exchange only.**

**We decided that a workshop, sponsored by the US-DOE, will address the dosimetry capabilities of facilities in the US and France. Facilities to be represented are the HPPR at Oak Ridge, SPR-III and ACRR at Sandia, Albuquerque, GODIVA and SHEBA at Los Alamos, and CRAC and SILENE in France. We will schedule the workshop near the end of 1989.**

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