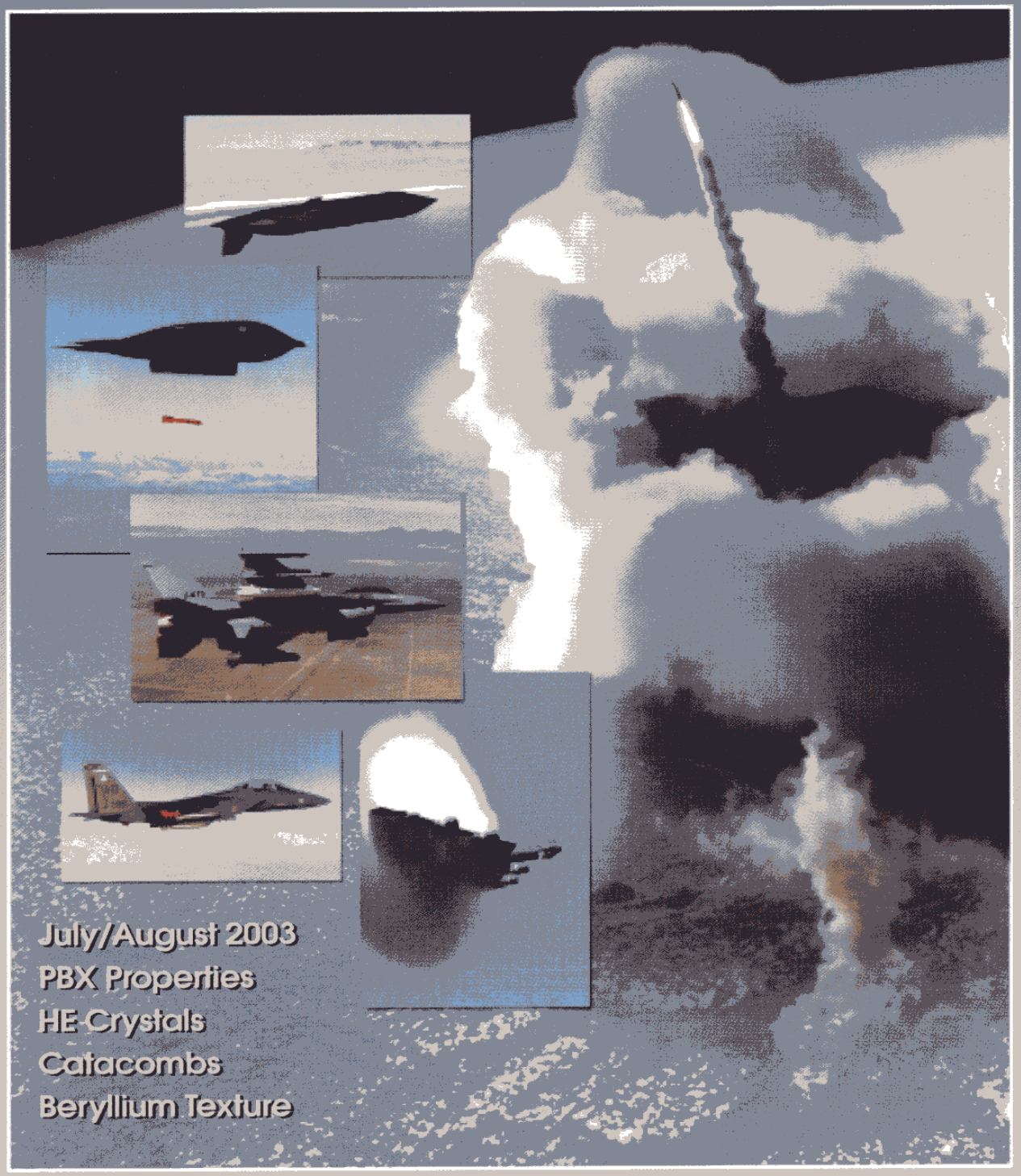
nuclear weapons journal



July/August 2003

PBX Properties

HE Crystals

Catacombs

Beryllium Texture

Weapons Science and Engineering at Los Alamos National Laboratory

July/August 2003 LALP-03-011
Nuclear Weapons Journal is an unclassified publication.
Los Alamos National Laboratory
Mail Stop A107
Los Alamos, NM 87545

About the cover: The Laboratory continues to provide for the nation's deterrent by maintaining reliable warheads for the existing strategic and tactical delivery platforms. Los Alamos is committed to providing a continuing deterrent as the nation's requirements evolve in the 21st century.

Nuclear Weapons Journal highlights accomplishments in the nuclear weapons program at Los Alamos National Laboratory. *NWJ* is funded by the Weapons Physics and Weapons Engineering and Manufacturing Directorates. The Weapons Communication Team produces *NWJ* bimonthly:

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The Catacombs: Archiving Nuclear Test Debris

Postshot nuclear test debris collected in support of the Nuclear Weapons Test Program is stored at Los Alamos National Laboratory in a room known as the Catacombs. This collection of debris represents more than 50 years of US nuclear test history. Although the Catacombs may not be viewed as a national treasure, it is the repository with the most complete collection of postshot test debris samples.

From the days of the Trinity test to the end of testing in 1992, radiochemical (radchem) analysis of postshot debris has provided a direct measure of plutonium and/or uranium fission yield and integrated neutron fluence; it is the method by which other diagnostic techniques are calibrated. The original purpose for archiving test debris was to provide weapons designers with material that could be reanalyzed at a later date to answer questions related to device performance. Analytical methods used in the past may not have provided optimal data. It was anticipated that future chemistry and measurement techniques would require reanalysis of test debris. Today, these archived samples provide an opportunity for weapons stockpile stewards to reexamine performance issues to benchmark modern weapons codes.

A sample analyzed by mass spectrometry was, for example, a combination of several individual samples because the importance of phenomena such as physical fraction of the debris was not recognized at that time. We now know the significance of some of these physical processes and their impact on the interpretation of radchem results. These samples are available, the integrity of the samples is excellent, and modern radchem analytical and mass spectrometry methods may help refine original assessments. Reanalysis of these samples may provide researchers with important answers to stockpile reliability and confidence issues in the absence of testing.

Archived debris exists in three different forms: filter paper, core samples, and acid solutions. We have between 300 and 400 filter papers obtained by aerial collections of post-shot debris from atmospheric tests and more than 10,000 core samples containing nuclear test debris incorporated into fused rock formed as a result of underground testing. Many of the filter papers and fused rock samples originally collected were dissolved in strong mineral acids; the resulting solutions were processed to obtain radchem diagnostic information. More than 3,000 acid solutions containing dissolved debris are archived in the Catacombs.

We have evaluated each of the archived samples on a set of criteria to verify that they are still useful for radchem diagnostics. These criteria included sample container integrity, physical state, and quantity. We have evaluated the physical condition of the containers used to store the samples. The major problem encountered in the Catacombs was that many of the original storage containers holding the individual debris samples are nearing the end of their useful service life due to corrosion by acid fumes, aging plastic, etc. Among the problems encountered during the assessment of the archived samples were evaporation of the solutions, salting out (precipitation) of material from solution, salt deposits on the exterior of the lids, deterioration of bottle lids, deterioration of silastic seals, and embrittlement of plastic containers. Over 99% of the archived samples have met our criteria and are still useful for radchem diagnostics.

We are now undertaking the major effort of repackaging and stabilizing each of the archived radchem samples so that they will remain viable for radchem diagnostic analyses for an additional 50–100 years without any future stabilization efforts. We are replacing the old lids, which are

phenolic, with polyvinyl liners. The acid fumes over the years have caused deterioration of polyvinyl liners, which in turn have caused cracking and blistering of the phenolic lid. The replacement lids are also phenolic but contain a Teflon™ liner and a polyethylene film/foam backing that provides a tight seal for excellent chemical resistance. The lids are then wrapped in Teflon™ tape and sealed with heat-shrink tubing.

The pertinent information for the archived test debris is currently in hardcopy form in notebooks housed in the vault in Building RC-1. We are developing a database to consolidate the information and make it more readily available for scientists who are evaluating previously obtained radchem results. This database will also facilitate future measurement requests. The database is being populated with the original information, uniquely identifying each sample, and each sample is being assigned a barcode that is readable by an optical scanner. The database cross references the samples to the chemists' laboratory notebooks and contains many unique comments about sample collection or analyses. In the future, the database will be expanded to incorporate search and sort routines. ✹

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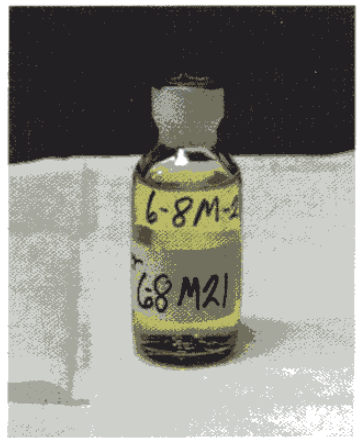
The majority of the postshot debris archived at Los Alamos is still suitable for radchem diagnostics. The debris is stored to ensure its integrity for at least 50–100 years. Pertinent information about each debris sample is placed in a database to facilitate use and management of the materials. The debris is an enduring and valuable resource for the Nuclear Weapons Program.