**SANDIA REPORT**
SAND2009-2757
Unlimited Release
Printed May 2009

# Assembly and Comparison of Available Solar Hot Water System Reliability Databases and Information

David Menicucci

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

Sandia is a multiprogram laboratory operated by Sandia Corporation,
a Lockheed Martin Company, for the United States Department of Energy's
National Nuclear Security Administration under Contract DE-AC04-94AL85000.



SAND2009-2757
Unlimited Release
Printed May 2009

# Assembly and Comparison of Available Solar Hot Water System Reliability Databases and Information*

David Menicucci
Building Specialists, Inc.
1521 San Carlos SW
Albuquerque, NM 87104

*Sandia Purchase Order No. 836745*

## Abstract

Solar hot water (SHW) systems have been installed commercially for over 30 years, yet few quantitative details are known about their reliability. This report describes a comprehensive analysis of all of the known major previous research and data regarding the reliability of SHW systems and components. Some important conclusions emerged. First, based on a detailed inspection of ten-year-old systems in Florida, about half of active systems can be expected to fail within a ten-year period. Second, valves were identified as the probable cause of a majority of active SHW failures. Third, passive integral and thermosiphon SHW systems have much lower failure rates than active ones, probably due to their simple design that employs few mechanical parts. Fourth, it is probable that the existing data about reliability do not reveal the full extent of fielded system failures because most of the data were based on trouble calls. Often an SHW system owner is not aware of a failure because the backup system silently continues to produce hot water. Thus, a repair event may not be generated in a timely manner, if at all. This final report for the project provides all of the pertinent details about this study, including the source of the data, the techniques to assure their quality before analysis, the organization of the data into perhaps the most comprehensive reliability database in existence, a detailed statistical analysis, and a list of recommendations for additional critical work. Important recommendations include the inclusion of an alarm on SHW systems to identify a failed system, the need for a scientifically designed study to collect high-quality reliability data that will lead to design improvements and lower costs, and accelerated testing of components that are identified as highly problematic.

* The work described in this report was performed for Sandia National Laboratories under Purchase Order No. 836745.