ABSTRACT:
The Los Alamos National Laboratory tritium processing facility purchased an Antech Series P300 Isothermal Tritium calorimeter from the Antech Corporation in 2005. The instrument is used to non-destructively measure the quantity of tritium in an item based on a heat output generated by the tritium decay. Instrument performance data collected over the past two years will be presented showing that this instrument can detect as low as 0.001 Watts (0.003 gr. of tritium) within large measurement canisters of approximately 170 mm. (6.8 in.) diameter by 610 mm. (24 in.) long. With a manufacturer-stated measurement power range of 0.005 Watts to 15 Watts, this calorimeter has performed beyond the specified purchase requirements. Using a combination of sensors for its thermal element, the P300 calorimeter has demonstrated exceptional sensitivity and precision.

Purpose:
Calorimetry is used for tritium accountability (tracking amounts of nuclear materials) and for tritium process beds, such as molecular sieve traps, down to quantities of regulatory interest (e.g., <7 TBq for a “Type A” transportation or waste packaging). To meet safety requirements, these tritium-containing items are placed within quality-tested secondary containers. NOTE: 0.91 mW/TBq = ~0.324 W/gr. of tritium. 1 gr. of tritium equals ~9619 Ci or ~356 TBq.

RESULTS AND DISCUSSION:
PRECISION:

EXPERIMENTAL:
The electrical standard can be set to any Wattage setpoint within the range of the calorimeter with an increment of 0.1 mW. With the instrument in “Auto Mode”, multiple runs with setpoints may be obtained without operator attendance. Using selected setpoints, numerous runs with the electrical standard were used to obtain statistical information. These statistics were used to evaluate the quality of the different measurement types; the instrument precision, detection limit, and accuracy, and the calibration stability. Base Powers are run frequently to monitor instrument and environmental stability.

The calorimetry results obtained for a variety of tritium-containing items were also compared with results obtained from other calorimeters and other techniques.