Introduction to "A Summary of NRL Research on Anomalous Effects in Deuterated Palladium Electrochemical Systems" (Published in 1996)

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In January 1992, NRL began an ONR-funded project to replicate experimental procedures provided by NAWC and NRaD (now SSC-Pac) to verify the results. At ICCF-2, Stan Szpak reported that thermometry showed that the heat source in Pd/D co-deposition was the cathode (this was later verified using infrared imagery), the emission of X-rays using photographic film, and tritium production. In the thermometry measurements done at NRaD, a large diameter cell was used and the anode and cathode were completely immersed in the electrolyte.

NRL attempted to do calorimetry of the Pd/D co-deposition system using the small calorimeter designed by Mel Miles of NAWC. NRL claimed that the excess enthalpy was controversial because of catalytic recombination of evolved gases occurs readily and is exothermic. Our experience has shown that, as long as the Pd/D deposit is fully immersed in the solution and is wet, no recombination occurs. It is noteworthy to mention that Miles also tried to measure excess heat in Pd/D co-deposition using his small calorimeter. Because of the small diameter of the cell, Pd particles would break away from the cathode and bubbles from the evolving gases would carry the particles to the air solution interface where he observed recombination to occur. Miles made adjustments in his experiments to eliminate recombination (something NRL did not do). Using his small calorimeter, Miles observed excess heat in two out of 34 co-deposition experiments. In the two experiments that showed excess heat, 0.150 W of excess power was generated using 0.002 cm^3 of Pd (this was the volume of Pd that had plated out). This translates into a power density of 75 W cm^{-3} for the amount of Pd present in the experiment. For solid Pd rods, the typical power density, as reported by Pons and Fleischmann, was 1 W cm^{-3} of Pd. If 0.002 cm^3 of Pd produced as a result of co-deposition generated this power density, only 0.002 W of excess power would have been produced. This amount of excess power would not have been detectable using the small calorimeter. Miles later found that when he went to a larger cell that increased the volume of plating solution and assured that the Pd deposit was fully immersed in the solution, he saw reproducible excess heat and no recombination.

With regards to tritium measurements, NRL claimed that tritium measurements were controversial because the separation factor is not accurately known. This uncertainty could have been eliminated by recombining the gases and measuring the tritium content in both the gas and liquid phases or they could have operated using a closed system. In any case, NRL decided to postpone tritium measurements until excess power had been measured. Since they did not measure excess power in either Pd/D co-deposition or in electrolysis using bulk Pd or Pd alloys, these measurements were

never done. This in itself was an interesting decision on the part of NRL since Bockris had shown, as early as 1990, that tritium did not correlate with heat production.

To detect radiation emissions produced during Pd/D co-deposition, NRaD used photographic film. A thin plastic sheet separated the photographic film from the Ni screen cathode onto which PD/D co-deposition occurred. Consequently, the cathode was in very close proximity to the photographic film. In their measurements, NRL used an X-ray detector with a beryllium window and a germanium detector to measure gamma rays. Initially these detectors were placed 10-20 cm away from the cells. When they realized that the calorimeter and bath would severely attenuate any X-ray and gamma ray emissions, they began to place their cells in front of the germanium detector. No calorimeters nor water baths were used in these later experiments. NRL reported that no changes were observed in the radiation data. In their report, there is no mention of the efficiency of these detectors nor how long they acquired data or how they manipulated the data. As of 1992, there were sufficient reports from other researchers that the emission of neutrons, tritium, and gamma rays occurred in bursts. Photographic film is ideal for detecting events that are sporadic or occurring in bursts because it is a constantly integrating detector, meaning that once an event occurs it is permanently stamped on the film. It is not known when the event occurs, however, the event does not get averaged away. This is not true of detectors that operate in real time, such as the detectors used by NRL.

In summary, great care needs to be taken in designing and conducting experiments to study anomalous effects in the Pd/D system. It requires a multidisciplinary team of scientists and care in choosing the appropriate geometries and instrumentation to conduct the experiments. At ICCF14, Mike McKubre of SRI advised, “Reproduce exactly first. Work with the originator directly, in person, understand their procedures at every step until the original effect is recreated.” With regards to the Pd/D co-deposition experiments, NRL did not do this.