

Above Ground Antineutrino Detector for Reactor Safeguards

LLNL and SNL have been exploiting the unique characteristics of reactor antineutrinos for nearly a decade in an effort to develop an independent means of monitoring fissile material diversion for reactor safeguard programs. Recently, we have constructed a less intrusive and mobile detector, which can be deployed at any nuclear reactor complex. It is designed to be operated above ground, utilizing a non-toxic, non-flammable water based detection medium.

We have outfitted a 20-ft shipping container with a 38 cm thick passive polyethylene shield surrounding 2.5 cm of borated polyethylene to reduce ambient neutron and gamma-ray backgrounds. The active detector volume consists of one tonne of de-ionized water doped with 0.2% GdCl_3 . Outside of the passive shielding is an active muon veto constructed of plastic scintillator which covers 5 sides of the cubic volume. Antineutrino detection utilizes the fast coincidence ($30\text{ }\mu\text{s}$) of the Cherenkov light produced from the prompt positron emission, from inverse beta decay, and the subsequent neutron capture on Gd.

Here we will present data from the commissioning of the system, describing the performance of the shield, active veto and water detector. We will also discuss a planned deployment of the system at the San Onofre Nuclear Generating Station, scheduled for the second quarter of 2010.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. Release number LLNL-POST-426259.

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