A key challenge for Discharge Produced Plasma (DPP) devices is achieving sufficient brightness to support the throughput requirements of High-Volume Manufacturing (HVM) lithography exposure tools. One method for improving source brightness is to simulate the source environment in order to optimize the EUV output. An integrated model for the description of hydrodynamics and optical processes in a DPP device has been developed and integrated into the HEIGHTS-EUV computer simulation package. Model development consisted of three main tasks: plasma evolution and magnetohydrodynamic (MHD) processes; detailed photon radiation transport, and physics of plasma/electrode interactions. Plasma flows have multidimensional character in pinch systems. Regions with different propagation speed of perturbations require accurate numerical solutions of the MHD equations. The Total Variation Diminishing (TVD) numerical method for the description of magnetic compression and diffusion in a cylindrical geometry was used in the HEIGHTS package. For the opacity calculations several models have been developed and implemented. Radiation transport of both continuum and lines is taken into account with detailed spectral profiles. Preliminary response of electrode materials to plasma particles and radiation interactions are also studied. The HEIGHTS package can also study detailed hydrodynamic and radiation processes in DPP devices as a function of device geometry and electric circuit to optimize brightness throughput. Preliminary simulation results of Xenon gas hydrodynamics and photon radiation output for different plasma conditions are presented and discussed.