PRODUCTION OF SHORT-LIVED RADIOACTIVE NUCLEI IN SUPER ASYMPTOTIC GIANT BRANCH STARS. C. L. Doherty[1], M. Lugaro[1], H. Lau[2], L. Siess[3], J. C. Lattanzio[1], P. Gil-Pons[4]. [1]Monash Centre for Astrophysics (MoCA), Monash University, Australia. E-mail: carolyn.doherty@monash.edu. [2]Argelander Institute for Astronomy, University of Bonn, Germany. [3]Institut d'Astronomie et d'Astrophysique, Université Libre de Bruxelles, Belgium. [4]Department of Applied Physics, Polytechnical University of Catalonia, Barcelona, Spain.

Introduction: From the composition of early Solar System condensates it is well know that now-extinct short-lived radionuclides (SLR) were present at the time when these condensates formed [1]. One of the current scenario for the origin of these SLRs involves an external stellar source to have polluted the early Solar System. One main issue with this scenario is to find an appropriate source that could generate the unique pattern as seen in the SLRs [see, e.g., 2]. We investigate the production of SLRs in a nearby Super Asymptotic Giant Branch (SAGB) star, including for the first time the radionuclides heavier than Fe. SAGB stars have initial stellar masses in the range of ~ 7–11 solar masses [3,4]. They burn H, He, and C in their core, but do not experience further core burning. After core C burning they go through the SAGB phase, with the H and He shells activated alternately, episodic thermal pulses in the He shell, and strong stellar winds driving the H-rich envelope into the surrounding interstellar medium. The final remnants of the evolution of SAGB stars are mostly O-Ne white dwarfs, although electron-capture supernovae could also occur.

Method: The stellar structure of our SAGB models have been computed using the Monash/Mt Stromlo stellar evolution code [5]. Temperatures, densities, and convective velocities in convective regions were extracted from these calculations and fed into the Monash stellar nucleosynthesis post-processing code [6]. This program couples the stellar structure information with a detailed nuclear network of the isotopes up to Bi to compute the abundance changes brought by nuclear reactions and mixing in the star.

Results: We find that neutron captures occur in the H-burning ashes during the red giant phase and in the He-burning shell during the SAGB phase and produce ^{36}Cl, ^{41}Ca, and ^{60}Fe, together with the heavy Mg isotopes, ^{25}Mg and ^{26}Mg made by ^{22}Ne+α. These nuclei are carried to the stellar surface by dredge-up episodes. At the same time, proton-captures at the base of the convective envelope produce ^{26}Al and modify the C, N, and O composition of the star. We also present the first predictions of the production of the heavy SLR isotopes ^{107}Pd, ^{182}Hf, and ^{129}I in SAGB stars. Results from a simple pollution model of the Solar Nebula by a SAGB star and discussion of the likelihood of a SAGB star as the source of SLRs in the early Solar can be found in [7]. SAGB are found to produce the SLR abundance pattern seen in the early Solar System.

References: [1] Scott E. R. D. 2007. *Ann. Rev. EPS* 35, 577-620. [2] Wasserburg G. J. et al. 2006. *Nuclear Physics A* 777, 5-69. [3] Siess L. 2006. *Astron. Astrophys.* 448: 717-729. [4] Doherty C. L. et al. 2010. *MNRAS* 401, 1453-1464. [5] Lattanzio J. C. 1986. *Astrophys. J.* 311: 708-730. [6] Cannon R. C. 1993. *MNRAS* 263: 817-838. [7] Maddison S.T. et al. 2012. *These Proceedings.*