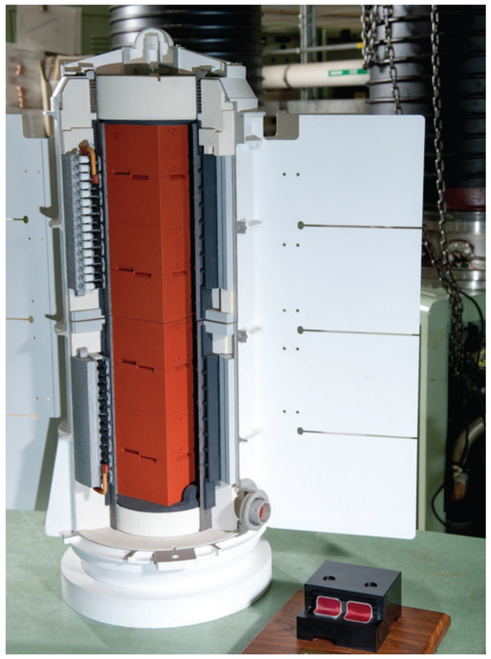
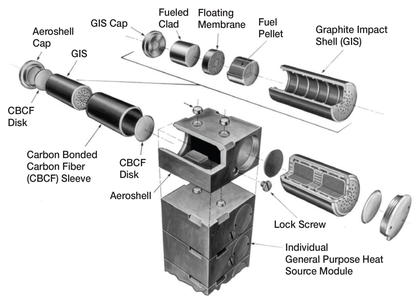
Mars 2020 Draft SEIS
Launch Nuclear Safety

Similar to Curiosity, the Mars 2020 rover receives its electrical power from a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG).



Full-scale cutaway models of an MMRTG (left) and one of its eight General Purpose Heat Source modules (below); each of the modules contain four pellets of heat source plutonium dioxide protected inside several layers of protective material. An MMRTG is about 26 inches (66 centimeters) tall and has a mass of about 98 pounds (45 kilograms).



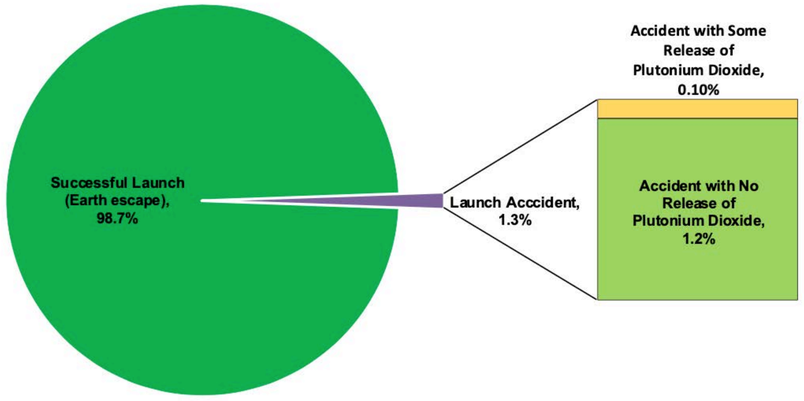
An MMRTG contains 10.6 pounds (4.8 kilograms) of plutonium dioxide as a dependable source of heat used to produce the electricity. The main type of plutonium used in a radioisotope power system, plutonium-238, is different from the material used for nuclear weapons, and it cannot explode like a bomb.

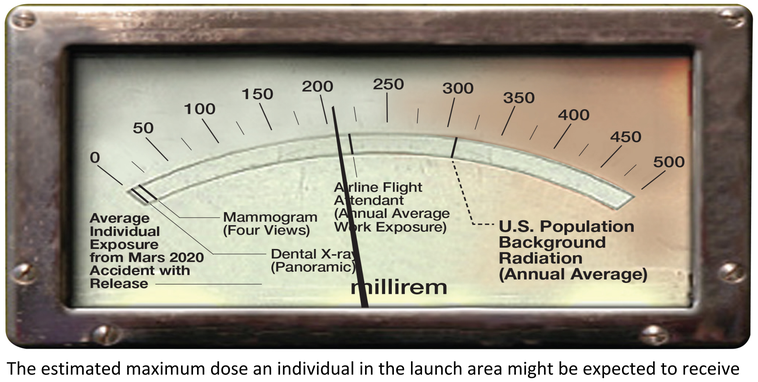
Although any type of launch accident is unlikely for the Mars 2020 mission, and an accident that results in a release of the plutonium dioxide fuel is more unlikely, analysis of a wide range of possible accident scenarios acknowledges that it is possible that some of the plutonium dioxide fuel inside the MMRTG could be released. In order for this situation to pose a potential health risk, the released fuel particles must be small enough to be carried away by winds into the atmosphere or onto food crops, and then inhaled or swallowed.

Extensive technical analysis and computer modeling has been conducted by NASA and DOE. The most recent technical analysis found that the most probable outcome for Mars 2020 is a successful launch, with a 98.7 percent probability. The chances of any launch accident are small—about 1.3 percent (a 1 in 80 chance). The overall chance of a launch accident that would be severe enough to release some amount of radioisotope fuel is smaller —about 0.1 percent (a 1 in 960 chance of a launch accident with some release).

There is about an overall 1 in 1,100 chance of an accident that would release some amount of plutonium dioxide within 62 miles, or 100 kilometers, of the launch site. There is about a 1 in 12,000 chance of an accident outside the launch area that would release some amount of plutonium dioxide.

NASA prepares contingency response plans for every launch that it conducts. To manage the response to an accident with a release of radioactive material in the launch area, NASA establishes a radiological assessment and command center staffed by a variety of subject matter experts.





The estimated maximum dose an individual in the launch area might be expected to receive from a Mars 2020 launch accident, about 210 millirem, is shown in comparison to other common radiation exposures. The total annual background exposure from natural sources for a person living in the United States (calculated using effective full-body dose, in millirem) is also shown. Data sources: Health Physics Society and the Mars 2020 Draft Supplmental Environmental Impact Statement.

NASA's response plans for a mission using a radioisotope power system are developed and tested with the combined efforts of the U.S. Department of Homeland Security, the Federal Emergency Management Agency, the Department of Energy, the Department of Defense, the U.S. Department of State, the U.S Environmental Protection Agency, the State of Florida, and surrounding Florida counties.

Should a release of radioactive material occur in the launch area, the State of Florida and county and local governments would determine an appropriate course of action for any off-site areas (such as sheltering in place, exclusion of people from contaminated land areas, or no action required), and would have full access to the results of the coordinated Federal response.

In the unlikely event of an accident in the launch area with a release of some portion of radioactive fuel, the estimated maximum dose of radiation an individual might be expected to receive is about 210 millirem, which is equivalent to about eight months of natural background radiation exposure. For context, U.S. residents receive an average of 310 millirem of radiation each year from natural sources (e.g., cosmic radiation, radon in soil, and certain foods). The dose from human-made sources (e.g., medical procedures and consumer products) adds an additional 310 millirem, on average.