Why Are Caesium-137, Strontium-90 and Iodine-131 Dangerous Fission Products of Uranium-235?

Caesium (銫), Strontium (鍶) and Iodine (碘) are the common fission products of uranium-235. Caesium is usually in the form of Caesium-137 (\(^{137}\text{Cs}\)) and Caesium-134 (\(^{134}\text{Cs}\)), Strontium in the form of Strontium-89 (\(^{89}\text{Sr}\)) and Strontium-90 (\(^{90}\text{Sr}\)) and Iodine in the form of Iodine-131 (\(^{131}\text{I}\)) and Iodine-133 (\(^{133}\text{I}\)).

Caesium-137
Caesium-137 and Strontium-90 are the most dangerous radioisotopes to the environment in terms of their long-term effects. Their intermediate half-lives of about 30 years suggest that they are not only highly radioactive but that they have a long enough half-life to be around for hundreds of years. Besides its persistence and high activity, cesium-137 is chemically behaving like potassium. It has the further insidious property of being mistaken for potassium by living organisms and is taken up as part of the fluid electrolytes. This means that it is passed on up the food chain and re-concentrated from the environment by that process. Caesium-137 is water-soluble and chemically toxic in small amounts. Caesium compounds cause hyperirritability and spasms (A spasm is a sudden, involuntary contraction of a muscle, a group of muscles, or a hollow organ.)

Strontium-90
Strontium-90 and Caesium-137 are the radioisotopes which should be most closely guarded against release into the environment. They both have intermediate half-lives of around 30 years, which is the worst range for half-lives of radioactive contaminants. It ensures that they are not only highly radioactive but also have a long enough half-life to be around for hundreds of years.

Strontium-90 is chemically similar to calcium and is taken up by living organisms and made a part of their electrolytes as well as deposited in normally calcium-rich regions, such as bones. As a part of the bones, it is not subsequently excreted like Caesium-137 would be. It has the potential for causing cancer or damaging the rapidly reproducing bone marrow cells, causing leukemia.

Strontium-90 is not quite as likely as Caesium-137 to be released as a part of a nuclear reactor accident because it is much less volatile, but is probably the most dangerous components of the radioactive fallout from a nuclear weapon.

Iodine-131
This is because Iodine-131 is a major uranium fission product, comprising nearly 3% of the total products of fission.

Iodine-131 is a major concern in any kind of radiation release from a nuclear accident because it is volatile and because it is highly radioactive, having an 8 day half-life. Iodine-131 may give a higher initial dose, but its short half-life ensures that it will soon be gone.
It is of further concern in the human body because iodine is quickly swept up by the thyroid, so that the total intake of iodine becomes concentrated there. The thyroid has a maximum uptake of iodine, however, so some protection against iodine releases can be afforded by taking potassium iodide tablets to load up the thyroid to capacity so that radioactive iodine would be more likely to be excreted.

Due to its mode of beta decay, Iodine-131 is notable for causing mutation and death in cells which it penetrates, and other cells up to several millimeters away.