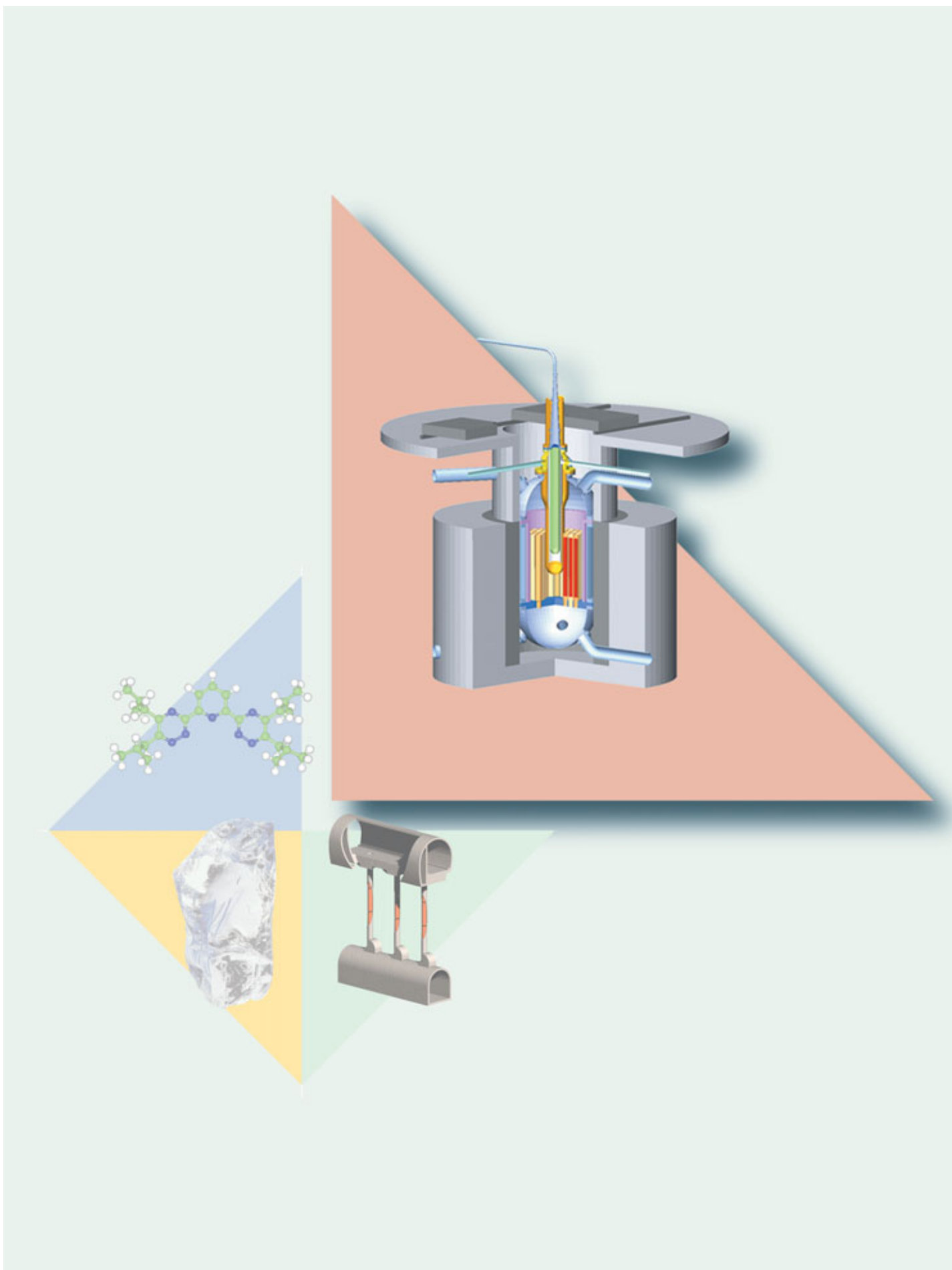




II. TRANSFORMING

In France, spent fuel is not considered as waste, and its various components are sorted and separated from one another. Partitioning can be carried further to implement the most suitable management mode for each of these components (see chapter I).

In the case of plutonium, which is the radionuclide representing the most significant radiotoxic inventory, its use as fuel should be continued and optimized, so that this energy-rich element can be transformed as it is extracted.

In view of their radiotoxic inventory, the next priority should be given to the three minor actinides, americium, curium, and neptunium, which are ten times less abundant than plutonium. These could be transmuted, i.e. transformed into shorter-lived or even non-radioactive elements, after being extracted using advanced separation methods. Two fission products could be transformed in the same way, technetium-99 and iodine-129.

The scientific feasibility of transmuting this waste to minimize its quantity has been demonstrated. The waste is transformed into short-lived elements. In light of this, it appears that nuclear reactor systems could be designed to recycle their own waste.

To achieve this research, teams have closely investigated all the various transmutation options in existing reactors as well as in new facilities, including hybrid systems that would combine particle accelerators and subcritical nuclear reactors. Why? To propose the most promising processes for application on an industrial scale.

These teams must also invent the best procedures for handling substantial amounts of highly radioactive elements to add them to reactor fuel, whether the elements in question are spread throughout fuel assemblies, or concentrated in capsules where they would be the target of “transmuter” neutrons. While full-scale tests in experimental reactors are being prepared, researchers must also predict the behavior of nuclear facilities to ensure that these can always safely “digest” this unusual fare.

The final phase of this work will be to compare the overall performance of the various facility configurations integrating this new “philosophers’ stone” to a greater or lesser degree.