A. Gonin/CEA

Shielded cells L6–L7 in the Atalante facility, at CEA's Marcoule Center, where preparation is carried out of pellets or targets bearing fission products, for the investigation of in-reactor transmutation.

III. ADVANCES FOR TOMORROW AND AFTER

Players in the nuclear power industry have always seen waste processing as part of a wider approach, founded on the taking on board of scientific and technological advances. It is such advances that, over the past decades, have enabled ever improving characterization of that waste, drastic reductions in its volume, and optimization of its fabrication, conditioning, and storage conditions. Further advances, potentially invested with even greater significance, have required, or require still, long-term research efforts. This is the case for advances relating to long-lived, high level waste, for which final management solutions, while indeed lacking any urgent character, are still awaiting a decision.

In France, a country that has acted as a pioneer on this issue, an Act has set the framework for this research effort, since 1991. Some of the results arrived at, concerning waste volume reduction, have already been put to use, gradually, but with spectacular results. From 2006, a new Act should set the framework for industrial development work on long-term management modes, over more or less extended timespans, and for the carrying through of the investigations supporting that effort, or the launching of further investigations.

Potential avenues for advances, as corroborated by the results already achieved, are to be found equally in the area of enhanced separation of long-lived radionuclides, and their conditioning – which may be effected, for some of these nuclides, in specific matrices – or in the area of curbing waste at source, and of possible transmutation of part of these nuclides. The aim? To achieve a significant – drastic even – reduction in the lifespan of such nuclides, and, ultimately, in their potential harmfulness.

Concrete implementations of such advances, which have now reached varying degrees of maturity, would have major industrial consequences, whether it be on the nature of nuclear power systems, assigned in whole or in part to waste destruction, or on specifications for reprocessing, storage, and disposal facilities. Investigation of the various possible scenarios stands as a prime element for decision-makers to base their choices on. The decision to go, or not to go, for dedicated installations for transmutation, whether critical reactors or subcritical reactors coupled to accelerators (ADSs), would indeed result in highly distinct fleet configurations and fuel characteristics, both requiring sustained R&D efforts, particularly as regards ADS fuels, heavily loaded as these are with minor actinides. For every formula that may be contemplated, fuels must be designed, and fabricated, which must not only "work," but which may also be safely reprocessed, and handled. Striving for the goal of safeguarding the health of future generations should not result, indeed, in exposing workers to unacceptable risks, whether today or tomorrow, even as the principle holds, that time is the strongest ally, in the struggle against the dangers and hazards of radioactivity.