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Annex

PERSONNEL REQUIREMENTS DURING DECOMMISSIONINGOF NUCLEAR POWER PLANTS

A.1. Introduction

This annex presents information on the numbers and types of personnel required for the various phases of decommissioning. It includes some illustrative staffing profiles for nuclear reactor decommissioning. It also includes prognoses for how the overall demand for personnel may evolve over the coming decades, based on general scenarios for nuclear reactor decommissioning. The information presented here is based on review of a series of staffing profiles from decommissioning projects in a number of Member States and data obtained from the IAEA Power Reactor Information System (PRIS) database.

A sufficient number of suitably qualified and trained personnel will be required to implement the decommissioning programme for each facility. Estimates of the staffing requirements for nuclear power plant decommissioning vary significantly, depending on such factors as reactor design, as well as on operational and organizational considerations impacting on how the plant will be decontaminated and dismantled. It is necessary to assess the number of personnel needed for the growing number of nuclear facilities that are reaching or approaching the decommissioning phase.

A.2. Staffing during decommissioning

An example of staffing requirements during a nuclear power plant decommissioning project is given in Table 5. These staffing numbers are based on a decommissioning scenario for a medium sized, single unit, LWR in a country with experience in decommissioning and an established system of regulatory oversight for decommissioning. It is assumed that the plant has had a relatively straightforward operating history, without major incidents during operation giving rise to significant contamination of the facility or its site. Finally, the values in the table assume the intention is to complete decommissioning as quickly as practicable.

TABLE A–1: SUMMARY OF STAFFING EQUIREMENTS DURING A TYPICAL NUCLEAR POWER PLANT DECOMMISSIONING PROJECT

Period/staffing category	Operation	Maintenance	Engineering	Management and administrative support	Security and emergency planning	Radiological protection and chemistry	Waste	Total
Planning and Preparation	4	2	10	10	0	2	2	30
Post-operation	60	69	49	57	180	38	16	469
Deferral	2	16	1	8	12	10	1	50
Decontamination and dismantling within the controlled area	9	10	41	75	31	105	16	287
Conventional demolition and site release	0	2	2	9	8	24	5	50

The following points are pertinent with respect to the values in the table:

— The staffing values reflect personnel dedicated to the decommissioning project (‘core staffing’). Other resources, such as staff from specialist contractors or subcontracted temporary labour (for example, craft labour or health physics technicians) are not included. Similarly, the table does not include support from corporate resources which may be used on an intermittent basis (e.g. environmental or legal staff).
— Management and administrative support staff indicated in the table includes management and supervisory personnel, as well as personnel from support areas such as quality assurance, procurement, safety and human performance, fire protection, human resources, and licensing.
— Depending on the contracting strategy, the core staffing may be provided primarily by the utility or in large part by a general decommissioning contractor. This is particularly true during the decommissioning period.
— Although the staffing levels are not constant during each decommissioning period, they tend to decrease stepwise as major activities are completed. Examples are spent fuel transfer to dry storage during transition and major component removal during decommissioning.
— The resource requirements for some staffing categories are driven by regulatory requirements or plant design considerations, and the actual numbers may thus be substantially different from the values provided, particularly for security and emergency planning, and operational staff.
— Similarly, staffing values may be affected by the planned duration of the decommissioning project and may be substantially lower if decommissioning is performed at a slower pace.
— Multiple unit decommissioning in a common plant would also impact staffing levels depending on the nature of the work and the speed at which it is completed.

Figure A–1 shows an example of a core staffing profile for the decommissioning of a nuclear power plant in an immediate dismantling scenario, with the facility proceeding directly to decommissioning following shut down and post-operation. Consistent with Table 5, the figure does not include specialty contractors or specialist external resource profiles. The figure indicates the change in the relative number of core decommissioning staff from an initial low level at the end of operation. The steep initial growth indicates the decommissioning project resources required to manage and implement the project at the outset. The core staffing resource profile begins to decline as the fuel is removed from the reactor core and subsequently from the facility. The facility decontamination, dismantling and conventional demolition phases are usually completed with significant contractor resources and, as a result, the core staff will further decline during these phases.

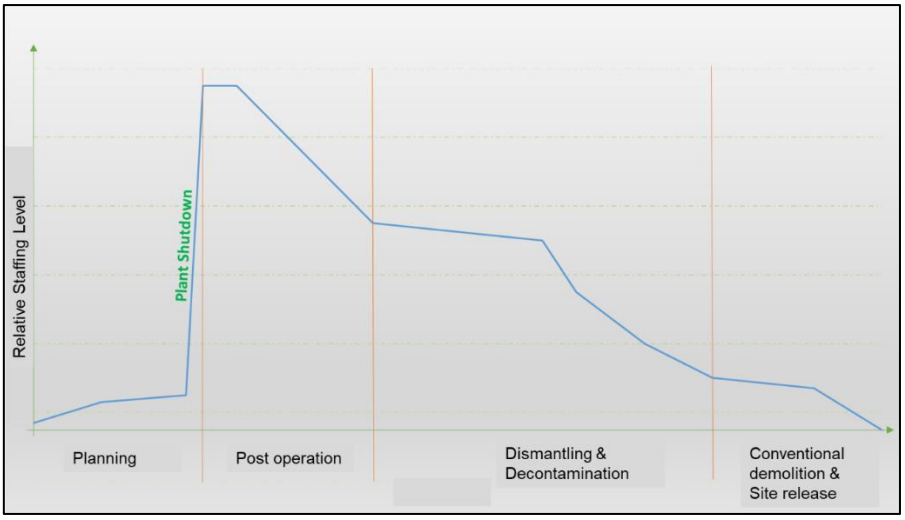

FIG. A–1. Core staffing profiles for nuclear power plant decommissioning in an immediate dismantling scenario.

Figure A–2 shows an example of a core staffing profile for the decommissioning of a nuclear power plant in a deferred dismantling plan. In this example, there are two peaks. The first peak is associated with plant shutdown and defueling as in the case of the immediate dismantling scenario, as well as the actions needed to put the facility into a surveillance and monitoring condition for the deferral period. Towards the end of the deferral period, staffing levels will rise again to prepare for the facility dismantling, demolition and site restoration phases. In this scenario, it is to be noted that retention or recruitment of skilled staff with specific knowledge of the plant is more difficult than in the immediate dismantling scenario. Thereafter, the staffing profile parallels that of the immediate dismantling scenario.

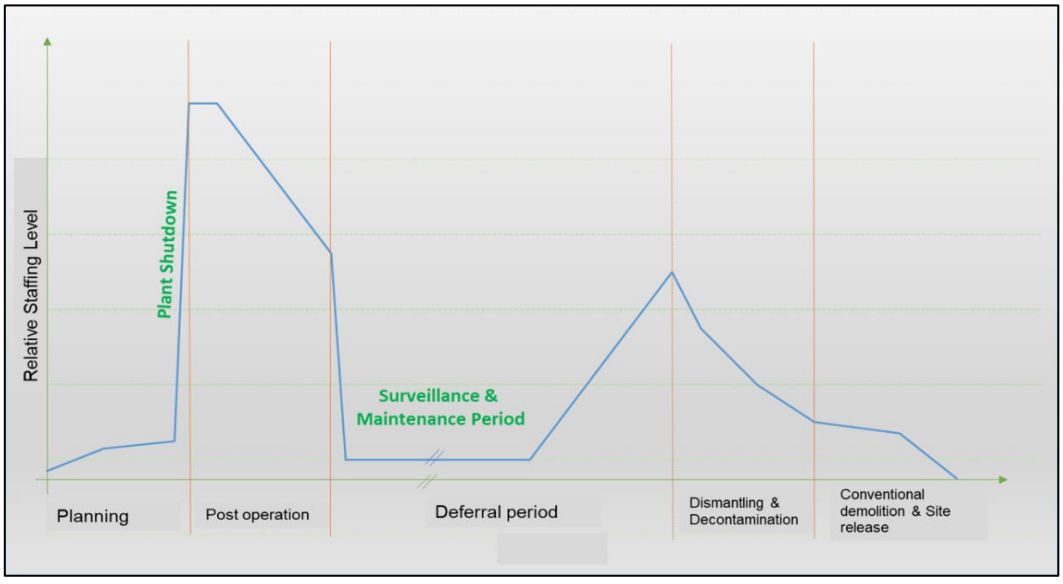

FIG. A–2. Core staffing profiles for nuclear power plant decommissioning in a deferred decommissioning scenario.

A.3. **Projections of workforce requirements for nuclear power plant decommissioning**

As of January 2021, data from IAEA PRIS indicated that there were 442 nuclear power reactors in operation in the world, with approximately 65% operating for more than 30 years. A considerable proportion of these can be expected to be permanently shut down and enter into decommissioning in the coming two–three decades. Based on PRIS and information provided from Member States on nuclear power plant decommissioning scenarios and timing, it is possible to make projections regarding the growth in demand for personnel dedicated to decommissioning these plants. These projections can be presented at different levels of detail and illustrate specific areas, for example reactor design, region or country, or different staff categories.

Three examples of such projections are presented below:

— An estimate of the number of staff by category required for the staffing profile for nuclear power plant decommissioning in a deferred dismantling scenario, as outlined earlier;
— An estimate of the total number of reactors being decommissioned globally till 2055, by phase of decommissioning;
— An estimate of the total workforce requirements to 2060, indicating internal and external (contractor) staffing numbers.

It ought to be noted that such projections are dependent on the available data and information and are at present subject to considerable uncertainty. For the projections presented here, a scenario based on a minimum lifetime of 50 years has been used and includes assumptions on the decommissioning strategy most likely to be implemented. Figure A–3 presents an estimate of the number of staff by category for the staffing profile for nuclear power plant decommissioning in a deferred dismantling scenario, as outlined earlier. The figure illustrates how each phase of nuclear power plant decommissioning requires a different combination of workers and distribution of the workforce.

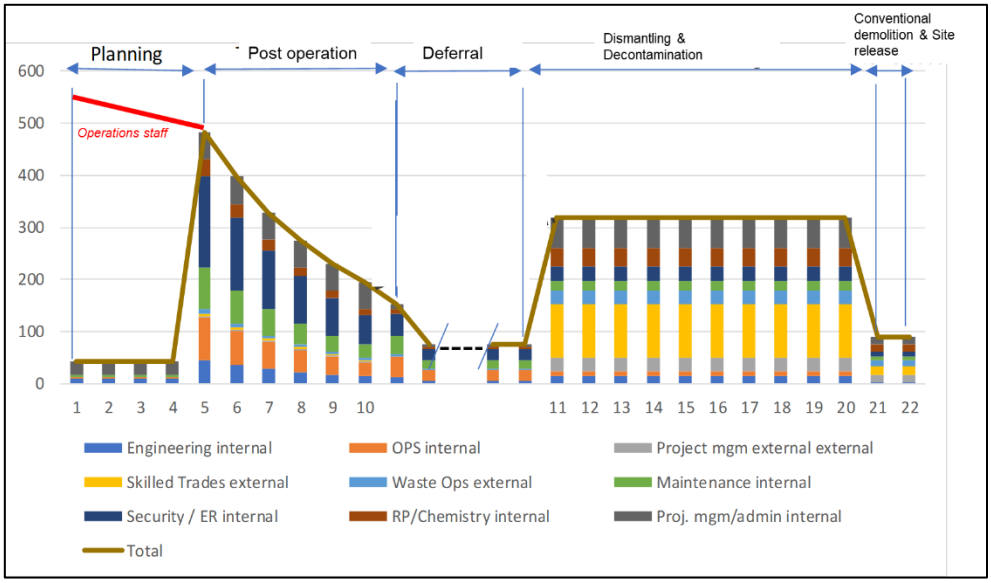

FIG. A–3. Estimate of the number of staff by category for nuclear power plant decommissioning in a deferred dismantling scenario.

Figure A–4 presents a projection of the total number of reactors in decommissioning globally to 2055. The graph is subdivided to indicate the number of nuclear power plants during each phase of decommissioning.

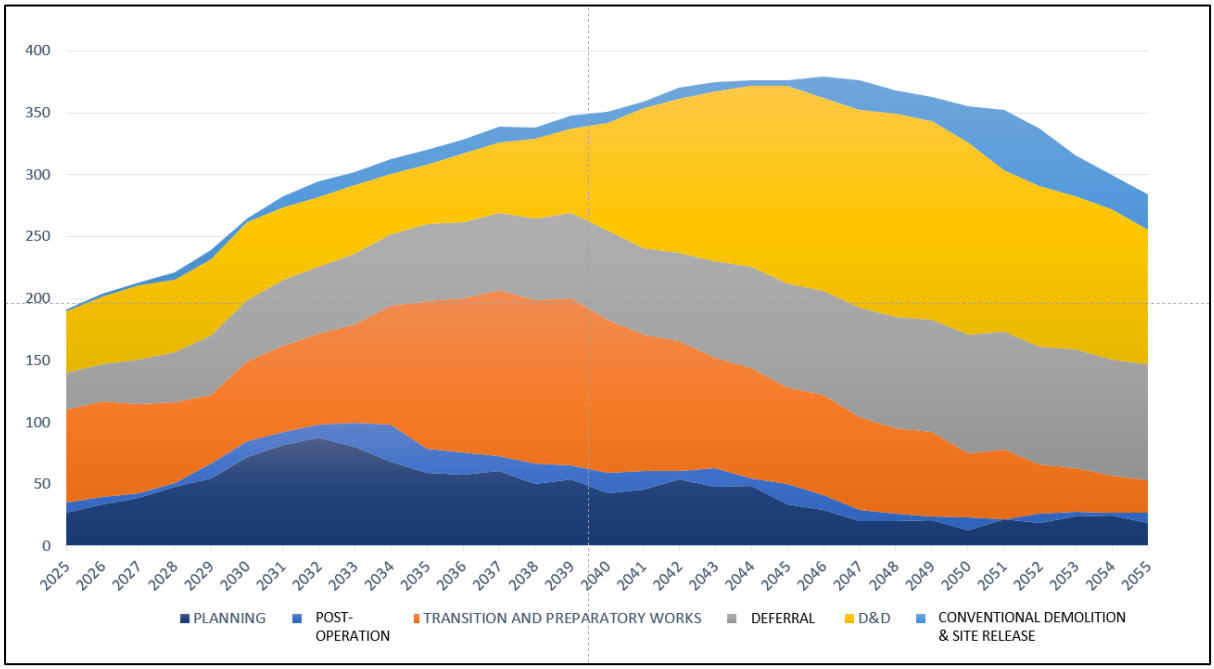

FIG. A–4. Projection of the number of reactors in decommissioning globally to 2055.

Figure A–5 presents a projection of the total decommissioning workforce requirements to 2060. It also gives an indication of the proportions of internal and external (contractor) staffing in the overall decommissioning workforce. On the basis of the general assumptions outlined above, this projection indicates growth in the decommissioning workforce over the relatively short term from 40 000 to more than 80 000 people.

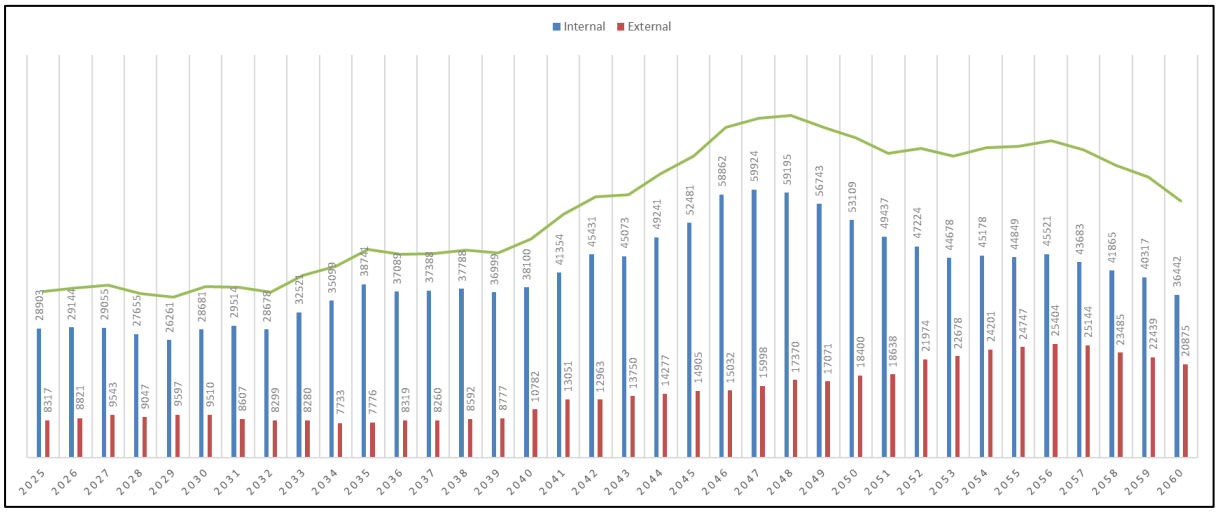

FIG. A–5. Projection of decommissioning workforce requirements to 2060.