

Westinghouse Technology Systems Manual

Chapter 15

RADIOACTIVE WASTE MANAGEMENT

Section

15.0 Radioactive Waste Management

15.1 Liquid Radioactive Waste Processing Systems

15.2 Solid Radioactive Waste Processing Systems

15.3 Gaseous Radioactive Waste Processing Systems

Westinghouse Technology Systems Manual

Section 15.0

Radioactive Waste Management

TABLE OF CONTENTS

15.0	Radioactive Waste Management.....	15.0-1
15.0.1	Introduction.....	15.0-1
15.0.2	Overview of Waste	15.0-2

LIST OF FIGURES

15.0-1	Sources of Radioactivity in the Plant
--------------	---------------------------------------

15.0 RADIOACTIVE WASTE MANAGEMENT

15.0.1 Introduction

The purposes of the radioactive waste management systems are to collect, process and store radioactive waste. By meeting these purposes, the release of radioactive materials to the environment is minimized.

A major aspect of nuclear power plant operation is management of the radioactive waste generated as a byproduct of nuclear power through activation or as fission products from nuclear power generation. Of all the problems associated with the nuclear power industry, probably none is so chronic, and its solution so controversial, as that of management of the radioactive wastes generated. Management of these wastes is complicated not only because of their diverse physical and chemical characteristics, but also because of the level and duration of containment required for some of the radioactive constituents.

The development of facilities and equipment to handle and process radioactive waste has provided the nuclear industry with the capability to treat, process, store, or dispose of the radioactive wastes within applicable regulatory requirements.

Appendix I of 10 CFR 50 requires consideration of population doses from discharged radionuclides at a much lower level than previously permitted. Design objectives are in the range of 3 to 10 mrem/year per reactor, hence any pertinent environmental radiation measurements will have to be extremely sensitive. It also requires the licensee to compute population doses on the basis of effluent measurements and calculational models of radionuclide release to the environment.

Successful operation stems from providing adequate storage, sufficient processing capacity, and flexibility in routing feed and process streams. Equipment redundancy and consideration of the requirements for sampling, operation, and maintenance, while maintaining radiation exposures to operating and maintenance personnel “as low as reasonably achievable” (ALARA), are an integral part of the design philosophy.

The formation of radioactive materials (Figure 15.0-1) occurs during the operation of a nuclear power plant. The concentration of radionuclides in the reactor coolant is a function of the reactor power level, the fuel burnup, type of fuel cladding, impurities and chemical additives in the reactor coolant, the reactor coolant volume, and the rate of reactor coolant purification. These radioactive materials will be in the form of solids, liquids, and gases and will be treated with different waste processing systems. Three types of systems are utilized in the management of radioactive wastes. These systems are:

- Liquid radioactive waste processing systems (Section 15.1),
- Solid radioactive waste processing systems (Section 15.2), and
- Gaseous radioactive waste processing systems (Section 15.3).

It is not the intent of this manual to present a “standard system,” for it is clearly recognized that there are many equipment combinations which meet the performance objective.

15.0.2 Overview of Waste

Radioactive waste is classified as either low-level waste (LLW) or high-level waste (HLW). LLW may be disposed of in burial facilities that are controlled by state compacts. The compacts are responsible for providing for burial facilities. These are licensed in accordance with 10 CFR Part 61 which provides for burial approximately 30 meters from the surface. LLW is classified in terms of increasing radiological hazard and half-life as class A, B or C. Class B and C waste must be placed in a container that will provide for stability of the waste over 300 years. In addition, disposal of Class C waste requires protection against an inadvertent intruder for a period of 500 years due to the significance and duration of the radiological hazard. Due to the delayed development of LLW facilities, many licensees are using volume reduction techniques, such as supercompaction and incineration, to reduce the volume of their solid radioactive waste. Liquid wastes are not acceptable for burial as LLW or HLW.

Examples of HLW include spent fuel and waste that is classified as greater than Class C. HLW cannot be buried at a LLW disposal facility. Disposal of HLW is to be conducted at a facility licensed to DOE by the NRC according to 10 CFR Part 60, which requires a suitable container and disposal in a geological repository. Presently DOE is evaluating the suitability of a site at Yucca Mountain in Nevada. Development of the HLW facility is funded by revenue from generation of electric power by reactor facilities deposited into the Nuclear Waste Fund.

HLW may be temporarily stored in a monitored retrievable storage (MRS) facility, which is a facility operated by DOE, or an independent spent fuel storage installation (ISFSI), which is operated by a private company. An ISFSI may be located either at a reactor licensee’s site or at a separate location. Both MRS facilities and ISFSIs must be licensed by the NRC according to 10 CFR Part 72. This rule includes requirements for the storage facility as well as requirements for storage casks. Many utilities are developing facilities for above-ground temporary storage of spent fuel as their spent fuel pools reach capacity.

In addition, 10 CFR Part 20 includes a provision for incineration of contaminated oil from power reactor facilities.

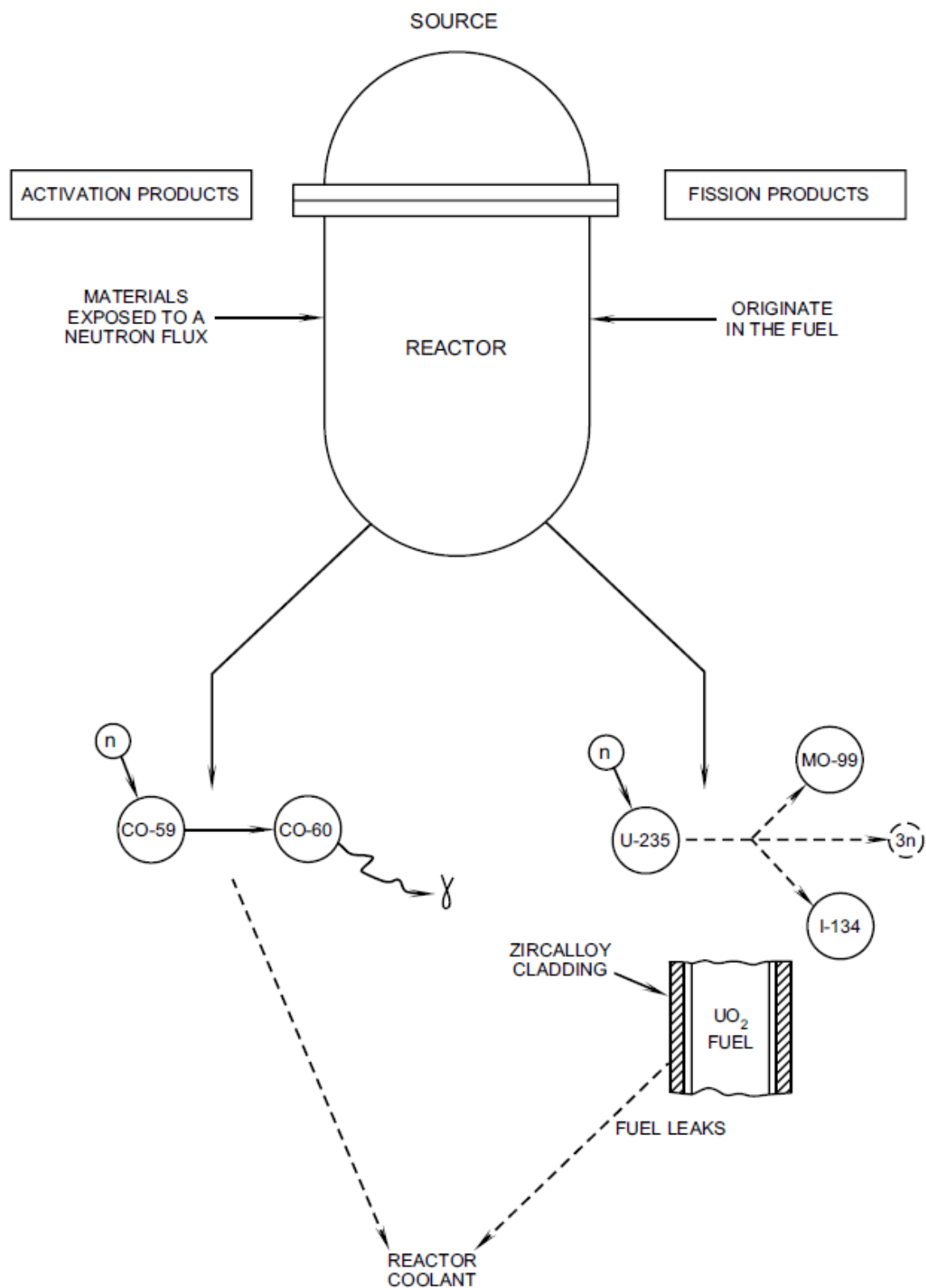


Figure 15.0-1 Sources of Radioactivity in the Plant