October 1973

U.S. ATOMIC ENERGY COMMISSION

REGULATORY GUIDE

DIRECTORATE OF REGULATORY STANDARDS

REGULATORY GUIDE 3.13

GUIDE FOR ACCEPTABLE WASTE STORAGE METHODS AT UF_6 PRODUCTION PLANTS

A. INTRODUCTION

In 10 CFR Part 20, "Standards for Protection Against Radiation," section 20.106 "Radioactivity in Effluents to Unrestricted Areas," generally prohibits the use of licensed material in a manner which results in the release to an unrestricted area of radioactive material in concentrations which exceed the limits specified in Appendix B, Table II of Part 20. Section 20.1(c), "Purpose", states that in addition to complying with the requirements set forth in Part 20, licensees should make every reasonable effort to maintain radiation exposures and release of radioactive materials in effluents to unrestricted areas, as far below the limits specified in Part 20 as practicable. To comply with these requirements, licensees store many of the waste materials generated at UF_6 production plants onsite for various periods of time awaiting final disposal. It is important that waste storage areas and retention systems be constructed and maintained in accordance with sound engineering principles since their purpose is to prevent or control the release of radioactive materials and chemicals to the environment. This regulatory guide describes design guidelines acceptable to the Regulatory staff for the safe storage of radioactive wastes from plants producing UF_6 from uranium mill concentrate.

B. DISCUSSION

UF_6 production plants which employ the solvent extraction process for purification of uranium mill concentrate produce small amounts of solid radioactive waste which are usually disposed of by burial onsite. Large volumes of liquid chemical waste containing concentrations of radioactive material slightly in excess of those specified in Table II of Appendix B of Part 20 are also generated and stored in earthen embankment retention systems. When neutralization and precipitation are successful in reducing the soluble chemical and radioactive concentrations in the liquid waste to an acceptable level, precipitated material is collected and stored in a settling basin and the liquid is released to the environment. When further treatment is required to reduce the radioactive and/or chemical concentrations to acceptable release levels, solids are collected and stored in a settling basin and liquids allowed to overflow to a retention basin for storage.

UF_6 production plants which employ a fluoride volatilization process for purification produce liquid waste which is handled in the same manner as liquid waste generated in the solvent extraction process. However, the amount of solid waste produced is too great to be buried onsite, so it is stored in onsite radioactive waste storage areas until transferred to a licensed commercial radioactive waste disposal firm.

The following definitions are used in this guide:

1. **Earthen Embankment Retention System** means a watertight system of one or more settling and/or retention basins including their associated engineered safety features.

2. **Retention Basin** means a watertight basin in which liquid wastes are held for any one or more of the following reasons: (a) analysis to verify activity levels permitting release, (b) evaporation, (c) recycle for treatment.

3. **Settling Basin** means a watertight basin designed for separating sludges and sediments as a layer on the bottom. The liquid is disposed of by overflow to the environment, transfer to a retention basin, or solar evaporation.

4. **UF_6 Production Plant** means a plant used for the sole purpose of commercial purification and conversion

of uranium mill concentrate (U_3O_8) to uranium hexafluoride (UF_6).

C. REGULATORY POSITION

Storage areas for solid radioactive waste and retention basins for liquid radioactive waste should be designed to provide reasonable assurance that the health and safety of the public is not endangered during normal operation nor as a result of credible accidents. The following guidelines are generally acceptable to the Regulatory staff for the design of storage systems for solid and liquid radioactive waste generated in UF_6 production plants:

1. Solid Radioactive Waste Storage

a. Except for sludges in liquid retention systems, storage of solid radioactive wastes should be in appropriate containers approved by the Department of Transportation.

b. Storage areas for solid radioactive waste should be used exclusively for storage of natural uranium waste generated at the plant, including contaminated equipment. Process operations, storage of non-nuclear material, and other functions not directly a part of normal storage operations should be kept separate from storage areas for solid radioactive waste.

c. Features should be provided at storage areas for solid radioactive waste to permit recovery or impoundment of waste which may be lost from containers.

d. Storage containers for solid radioactive waste should be marked or coded to indicate the type and amount of contained radioactive material.

e. Materials of construction in storage areas for solid radioactive waste should be fire-resistive or noncombustible to the maximum extent practicable. Fire-suppression equipment capable of minimizing the propagation of fires should be provided.

f. Ventilation systems should be provided if the need for such equipment is indicated.

g. Storage areas for solid radioactive waste should be designed to prevent unauthorized access to and unauthorized removal from or diversion of stored material.

2. Liquid Radioactive Waste Storage

a. A lined earthen embankment retention system is an acceptable liquid storage facility in regions where the evaporation rate is significantly greater than the rainfall. In other regions, the use of these systems is acceptable only for interim storage prior to treatment.

b. The site of the embankment retention system should be owned by the licensee and located by survey, and should not occupy the channel of any permanent or intermittent watercourse.

c. The pertinent basic design considerations, methods of stability analysis, and minimum factors of safety contained in the United States Department of the Army, Corps of Engineers, Manual EM-1110-1-1902, "Engineering and Design Stability of Earth and Rock Fill Dams," dated April 1, 1970,[1] provide an acceptable basis for the design of a safe settling or retention basin structure.

d. The interior of each retention or settling basin should be lined with an essentially impervious synthetic lining material designed to prevent seepage. The number of construction joints and penetrations of the liner should be minimized, and protection from mechanical damage should be provided.

e. Provisions should be made to maintain a safe embankment freeboard above the liquid level in each basin.

f. Basin embankments should be stabilized to prevent erosion. Provisions should be made to stabilize loose radioactive material produced by evaporation of liquid from the basins.

g. The site should be permanently protected against water runoff from surrounding drainage areas. Grading and/or diversion channels should be provided to enhance natural drainage if necessary.

h. The site should be provided with a security fence designed to restrict access by animals and unauthorized individuals. The fence should be constructed at a sufficient distance from the system to permit maintenance on the outer slopes of embankments. Provisions should be made to discourage waterfowl from landing on the pond surfaces.

i. Underbed drainage systems, ground resistivity measurement systems, or other seepage assessment systems should be included in the design. Seepage assessment systems should be located in potential seepage zones as determined by the hydrology and geology of the area. The design of seepage assessment systems should provide protection against contamination by surface waters.

j. The design should provide for the needs of routine system maintenance, the stabilization of the basins when manufacturing operations are terminated, and alternative methods of storage if the integrity of any basin is determined insufficient to retain its contents safely.

---

[1] This document is available from the Department of the Army, Office of the Chief of Engineers, Washington, D.C. 20314.