SAMPLING AND CHARACTERIZATION OF RADIOACTIVE WASTES IN THE UK

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ABSTRACT

By the year 2000 some 60,000m^3 of Intermediate Level Wastes (greater than Class C), mainly from Reprocessing operations, will have been generated in the UK. Over the past 10-15 years AEA Technology in conjunction with BNFL have developed and used a range of remote sampling techniques to obtain full-active samples of untreated wastes from process plant and waste-storage facilities. A great amount of experience of the sampling and characterization of waste solids, sludges and suspensions from storage facilities and operating plant has been accumulated.

INTRODUCTION

By the year 2000 some 60,000m^3 of Intermediate Level Wastes, mainly from Reprocessing operations, will have been generated in the UK. Over the past 10-15 years AEA Technology in conjunction with BNFL have developed and used a range of remote sampling techniques to obtain fully-active samples of untreated wastes from process plant and waste-storage facilities.

This paper will discuss:

- The reasons for sampling and characterization work.
- The range of wastes examined.
- The type of remote sampling equipment developed and used.
- The type of facilities sampled.

NEED FOR SAMPLING AND CHARACTERIZATION

Information from sampling and characterization is used to design and develop safe processes for the retrieval, transfer and encapsulation of the untreated waste. The information may be required:

a. To develop process options from retrieval to encapsulation.

b. To provide physical and radiochemical data for process flowsheets.

c. To provide data for safety cases, shielding and ventilation needs.

d. To formulate inactive simulants for full-scale process development and plant-commissioning work.

e. To specify effluent treatment and particulate filtration needs.

The UK policy on Intermediate Level Wastes is direct cementation with a minimum of pre-treatment. Nevertheless each waste-stream requires process development from retrieval to cementation. Retrieval may be by mechanical grab or by pumping. Transfer may be by pipeline or flask. Size classification by screening may be required before transfer and/or cementation.

The cementation process itself puts stringent demands on the free water associated with a waste-stream; some Dewatering of sludges and solids is often needed before cementation.

Simulant development is particularly important for long-stored wastes which may have degenerated by radiolysis, corrosion, physical attrition or compaction, and which may degrade further during processing. Different simulants may be required at different stages of the process.

Retrieval transfer and screening processes often necessitate water addition, for waste-washing or to increase fluidity. Usually this water must be removed before the cementation process. This waste-water usually contains soluble and particulate activity, and must undergo particulate removal and possibly further effluent treatment. Characterization of settling and filtration characteristics of the waste-water is often needed to design the particulate removal stage.

RANGE OF WASTES EXAMINED

The wastes examined range from fuel-cladding materials and ion-exchangers to thick, gritty settled sludges, mobile reprocessing flocs and aqueous suspensions. The specific activity varies considerably with waste type. Fuel-cladding and ion-exchange wastes may contain up to 1000 TBq/m^3 beta/gamma whereas reprocessing flocs may have up to 10 TBq/m^3 alpha activity.

Whilst reprocessing flocs and ion-exchangers may be fairly homogeneous other wastes, such as fuel-cladding materials and settled flocs, are often very variable. Knowledge of variations in chemical and radiochemical composition and physical characteristics of the waste-stream is important in all these processes, especially the cementation process itself. Statistically-designed sampling programs are used to quantify these variables.

TYPES OF REMOTE SAMPLING EQUIPMENT USED

Sampling systems have often been tailor-made for location and access to a specific facility and retrieval of a representative sample. Radiological safety and minimization of operator dose have been important considerations. The nature of each waste has determined shielding and containment requirements. For example, the high beta-gamma wastes were withdrawn into shielded transfer flasks, whereas glove box containment was developed for sampling high alpha wastes. In some cases, such as with aqueous suspensions or easily degradable material, it was essential to develop a sampling method relevant to a specific part of a process. The sampling equipment developed includes:

a. Core-Samplers capable of penetrating compacted material and recovering sludge samples from discrete depths.

b. Syringe-Samples for mobile sludges and liquors, again recovering samples from specific depths, or from the whole depth.

c. Grab and Bucket Samplers for solids.

d. Remotely Operated Submersibles for pond-floor sludges.

RANGE OF FACILITIES SAMPLED

Samples have been taken from many different facilities. Examples are:

- Settled storage tanks down to a depth of 10 meters.
- Down to a 16m depth in $500m^3$ concrete storage compartments.
- Ion-Exchangers trepanned from skips on a Cooling Pond floor.
- Cooling Pond floor-sludges.
- Power station waste-storage vaults.
- Mixed IX resin storage tanks.

A new range of sampling techniques is now being developed for the sampling and assay of materials from facilities undergoing post-operational clean-up and decommissioning.

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