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Present State of Radioactive Waste Management and Treatment Technology at the Research Centre Seibersdorf

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ABSTRACT - INTRODUCTION - Since 1976 the Austrian Research Centre Seibersdorf has the task to collect, treat and store radioactive waste (Radwaste) arising in Austria. Within the Department of Waste Management a variety of appropriate treatment systems are installed. For storing unconditioned and conditioned waste proper storage-halls are available. The collection of Radwaste is carried out using 100 l drums, for the conditioned waste the 200 l drum concept is used. The interim storage of conditioned waste is done at Seibersdorf until a final repository is built. The present plan foresees one to be in operation at the year 2012.

1. Radioactive Waste Management

In Austria there are in total about 600 producers of Radwaste. Sources of Radwaste in Austria are medicine, research and industry. Only low level and intermediate level waste arise from those sources. Spent fuel elements from research reactors are returned to the country of origin.

The department of Waste Management serves as centralised facility to treat all types of low level and intermediate level Radwaste arising in Austria. These are solid burnable, solid non burnable, liquid burnable and liquid non burnable waste. The task is to collect, to control the documents on the incoming waste, to reduce its volume if possible, to condition and to store (Figure 1).

2. Treatment Systems

Various types of waste require different methods of treatment. The following treatment systems are established at Seibersdorf.

Excess air incinerator: With a total height of about 5 m, an outer-diameter of 2 m and an inner diameter of 1 m an incinerator is installed in a three-floor-building. A simplified diagram of this incinerator including the off-gas cleaning system is shown in Figure 2. The incinerator is a shaft type which can be feed either batchwise from top at a capacity of 40 kg/h for solid burnable waste or continuously in the lower part of the unit at a capacity of 70 kg/h for powdery burnable waste (for instance ion exchange resins). The combustion chamber is heated up by a gas burner and operates between 800 °C and 1100°C. The gas burner is supplied with an installation to inject organic liquid waste at a capacity of up to 180 l/h, dependent on viscosity and calorific content. The off gas cleaning system installed includes hot gas filters, two step wet scrubber and HEPA-filters. A quench is placed in front of the wet scrubber. 20 m^3/h of water circulate continuously by 4 nozzles to cool down the off-gas from 700 °C to 70 °C before entering the wet scrubber. There are an acid - and an alkaline stage where sodium hydroxide is injected. This stage is also supplied with a demister on the top. At the end of the filter system four HEPA-filters are arranged. A low-pressure of 10 mbar in the combustion chamber is maintained by a fan at a rate of about 600 m^3/h. The off-gas is mixed with 30.000 m^3/h of building exhaust air.

Water treatment facility: Laboratories of the Research Centre, wet scrubber, thin film evaporator, conical dryer, heated drum vacuum chamber and some other sources produce contaminated water, which has to be treated. Chemical precipitation is applied and a filter apparatus for dewatering is used to separate water and sludge. Four tanks having a capacity of 80 m^3 each are installed for that purpose.

Thin film evaporator: This equipment was part of a bituminization system which was in use for research during 1975 - 1980. This possibility for conditioning was not selected at Seibersdorf, so the project was abandoned. The equipment was later on used for treating contaminated liquids i.e. drying of liquids. It has a capacity of 40 l/h. At the moment it is out of operation, since higher drying capacity was needed for a special project.

Heated conical dryer: This special project is the treatment of contaminated ion exchange resins. These resins have to be dried at a moisture content of 30 % before incineration. The water content of ion exchange slurry is up to 80 %. As usual for that technique, all surfaces of the equipment in contact with the product are heated so the water evaporates into a cooler supported by vacuum. The capacity of this equipment is about 1000 kg/8 hours resulting into about 500 kg of dried resins. A throughput of more than 800 tons could be obtained within the last three years (Figure 4).

100 t compactor: It is used to press waste into 100 litre drums. A lot of contaminated glass in the form of vials, bottles and similar waste is separated out and pressed in such drums. The bottles are empty but not dry. So a quantity of remnant liquids sums up with the volume in the drum which has to be removed. For this procedure a heated vacuum chamber is used.

In combination with the 100 t compactor a device has been constructed which allows to reduce the size of filters in such a way, that they fit into a 100 l drums. This Cs-137 contaminated filters where collected all over the country after Tschernobyl-accident. Due to the quantity of about 1000 m^3 of these air filters, we are still working on them. For this waste volume reduction factor of 13:1 is reached using this compactor.

1200 t high force compactor: At the beginning of 1995 a high force compactor was installed in a newly erected multi purpose hall for treating Radwaste. After licensing according to the radiation protection regulation by the regarding authority a test run with precompacted air filters was performed. The waste is pressed in a sheet metal cartouche. A very satisfactory additional volume reduction of better then 2,5:1 could be reached. Till now 300 pellets would be compacted routinely containing airfilters, scrapmaterial and dried slurry at a volume reduction of 2:1 (Figure 5).

Cementation equipment: An **In-drum-mixer** is used to mix ash/cement and water or the homogenize sludge inside a 200 l drum. A gear-box is driving two eccentrically positioned mixers which fit tightly into the drum.

To improve the quality of cemented ash or cemented slurry a **mix-dryer** was supplied in May 1995. This equipment can be used either for cementation of batches up to 1000 litre or homogenisation and drying. A horizontal cylinder of a volume of 2 m^3 with a rotating mixer inside ensures a homogeneous batch. Since Sept. 1995 - 650 drums (200 l) with ash and slurry could be homogenized and cemented (Figure 6).

Intermediate storage facilities: Depending on the type of waste, i.e. burnable, not burnable or liquid different halls are available for storage. Most of the segregation work is already done by the producers of waste. Strict incoming controls (transparent bags) and if necessary penalty prices have led to a good discipline regarding separation. All incoming waste has to be stored before treatment.

For the conditioned waste, most of it in 200 l drums, two engineered storage halls are in use for interim storage.

Conditioning method: At Seibersdorf only cementation is applied for conditioning. Most of the conditioned waste is stored in 200 l drums, which contain cemented waste in two ways: either ash is mixed up in a homogeneous cement matrix, or a 100 l drum containing waste is placed within a 200 l drum and surrounded by cement mortar. A comprehensive quality assurance program ensures and maintains constant quality of the product (Figure 3).

A special case of treatment is the conditioning of Radium sources. They are kept retrievable for the next future. For safety they were encapsulated in stainless steel tubes using appropriate shielding for the acting person during this work. Additional lead shielding is used for a specially precemented 200 l drum were the sources are placed during interim storage. Up to 500 mg of Radium is stored in one package.

During the last years we gathered experiences on **decontamination work**. For that purpose a lot of equipments are available, i.e. an unconditioned release limit better than 0,4 Bq/cm^2 could be reached in the old Radium-Institute in Vienna.

3. Documentation

A detailed recording process was developed in order to include all informations available on the radioactive waste to be recorded. During the incoming inspection the regarding documents are checked and completed if necessary. Each incoming drum receives a number which together with all other information is fed into a computer. From that point all movements of the content of such a drum can be followed through the regarding treatment stages until the preliminary last step of interim storage in conditioned form.

4. Transportation

The transportation of radioactive waste is carried out on road or rail according to the international regulation ADR/RID [1] which are implemented into the Austrian national regulations [2]. Producers of Radwaste have the possibility to send their waste directly to Seibersdorf or they take advantage of a service and have their waste to be collected by vehicles of Seibersdorf on demand.

The normal routine work of collecting including incoming control is under permanent consideration with respect to sorting. On one hand the producer of waste will be supported for his task by providing proper drums, transport forms, informations and advises on radiation protection problems, regulations and laws in particular on latest developments. On the other hand, however, he is being reminded on increasing discipline in sorting the waste into the appropriate categories and quantities so that reselection and requantifying into suitable batches (for combustion) is avoided.

5. Disposal

At present there is no final repository available for the Radwaste in Austria. There are plans to define a suitable site where the repository should be installed and operated. Investigations covering this topic are still going on. Main problem for a solution is the lack of public acceptance.

References

[1] ADR European Agreement concerning the International Carriage of Dangerous Goods, BGB1 No 522/1973 in the currently valid version

RID Regulations concerning the International Carriage of Dangerous Goods by Rail, BGB1 No 137/1967 in the currently valid version.
RID is Annex I to Appendix B (CIM) of the Convention concerning International Rail Transport (COTIF).

[2] GGSt Bundesgesetz über die Beförderung gefährlicher Güter auf der Straße (Federal Law concerning the Carriage of Dangerous Goods by Road), BGB1 No 209/1979 in the currently valid version; Ordinances - see section 5: Ordinances under the GGSt.

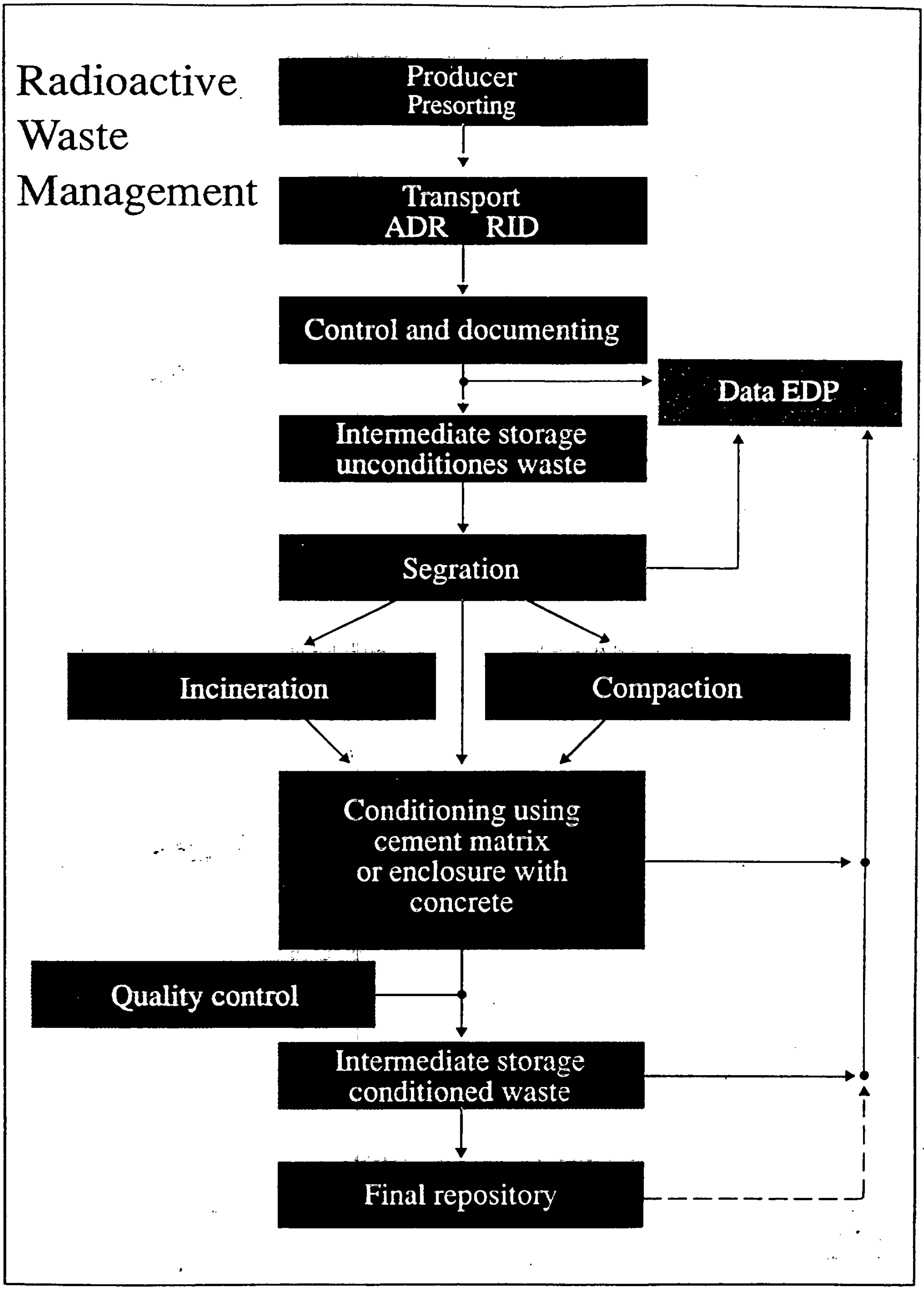

Radioactive Waste Management
Producer
Presorting
Transport
ADR RID
Control and documenting
Data EDP
Intermediate storage
unconditiones waste
Segration
Incineration
Compaction
Conditioning using
cement matrix
or enclosure with
concrete
Quality control
Intermediate storage
conditioned waste
Final repository

Figure 1

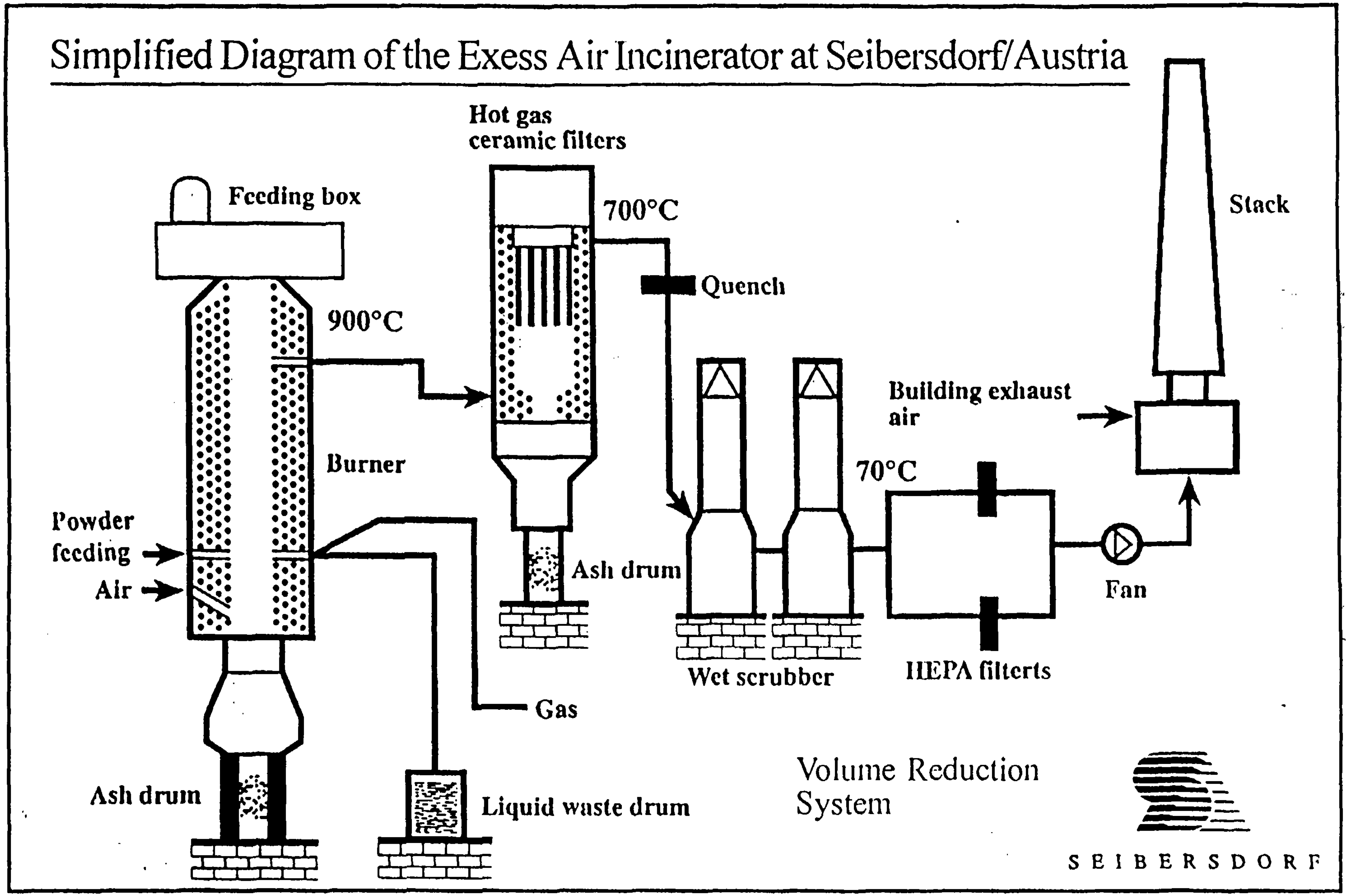
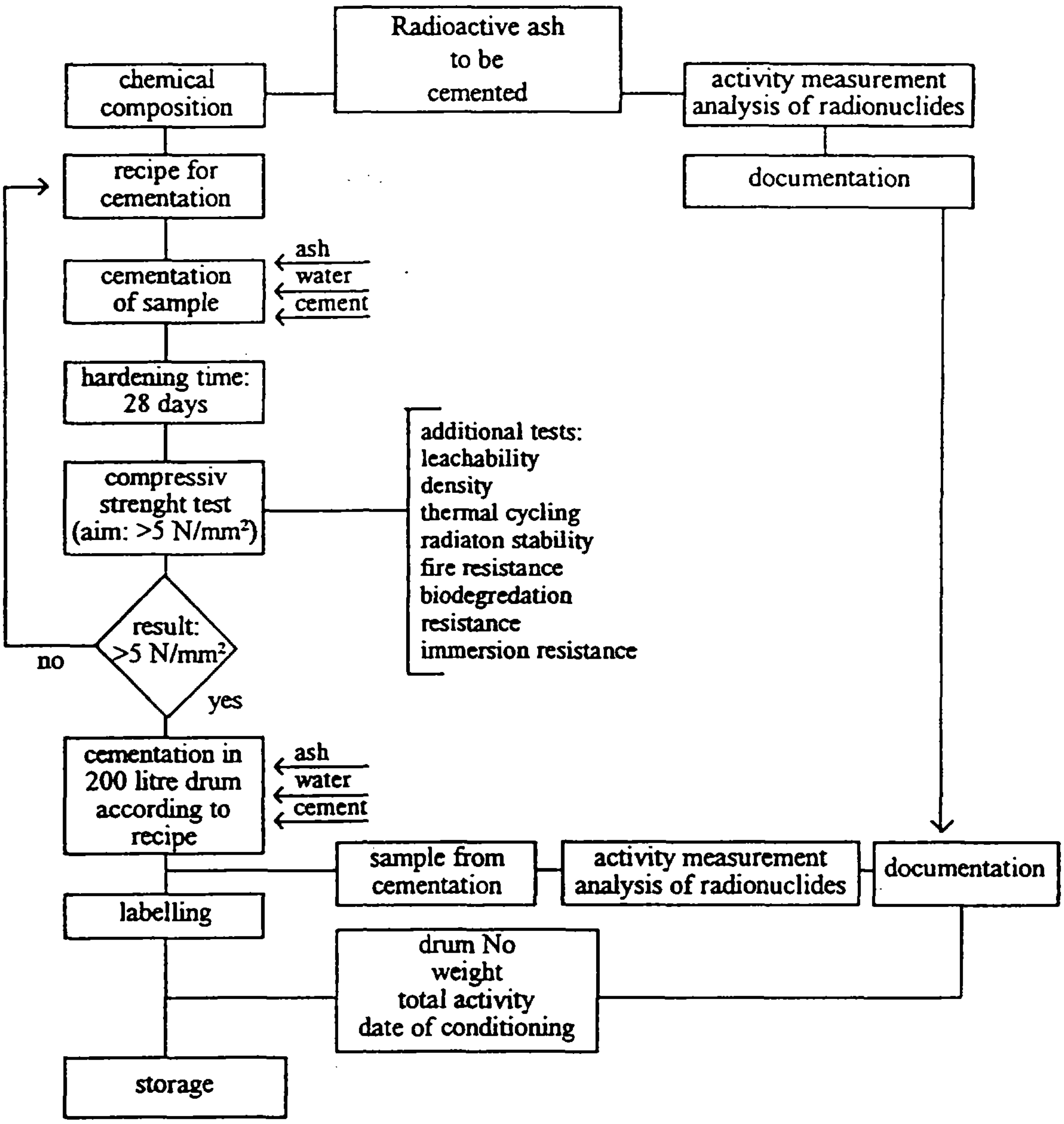

Simplified Diagram of the Exess Air Incinerator at Seibersdorf/Austria
Hot gas
ceramic filters
Feeding box
700°C
Stack
Quench
900°C
Building exhaust
air
Burner
70°C
Powder
feeding
Air
Ash drum
Fan
Wet scrubber
HEPA filterts
Gas
Volume Reduction
System
Ash drum
Liquid waste drum
SEIBERSDORF

Figure 2

Conditioning of Radioactive Waste

Qualification and Control Programme



SEIBERSDORF

Figure 3