CONCEPT AND REALIZATION OF QUALITY CONTROL IN FRG

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ABSTRACT

Radioactive waste packages to be disposed of in FRG must meet the waste acceptance requirement of the repository. Compliance with the waste acceptance requirements must be checked by a quality control. Fourteen relevant properties are necessary to be assayed.

The waste producers are responsible for the waste package quality. They must submit documents which demonstrate that the waste acceptance requirements have been controlled. The Physikalisch-Technische Bundesanstalt, which is responsible for the disposal of radioactive wastes in FRG, charged by contract the Kernforschungsanlage Jülich (KFA) to execute the quality control examinations and the Deutsche Gesellschaft zum Bau und Betrieb von Endlagern für Abfallstoffe (DBE) to operate the repository. The quality control group at KFA supports the observance of the waste acceptance requirements by the following measures:

- checking of the documentation of the waste producers
- random tests at conditioned radioactive wastes
- qualification of conditioning processes
- control of the qualified processes by inspections

The relevant properties of disposal are termed and their checking by non-destructive and if necessary destructive test methods will be explained as well as quality control by process control, i.e. qualification of conditioning processes by instrumentation and documentation.

The mobile and stationary testing facilities will be outlined.

INTRODUCTION

Radioactive waste packages to be disposed of must meet the waste acceptance requirements of the repository. Compliance with the waste acceptance requirements must be checked by an independent waste package quality control.

In FRG, the Physikalisch-Technische Bundesanstalt, PTB, is responsible by law for the disposal and acts on behalf of the federal government.

The Kernforschungsanlage Jülich (KFA), has been charged by the PTB to execute the quality control examinations for waste packages and has established a quality control group (PKS).

The planned first repository is the Konrad iron ore mine at Salzgitter, which should be operable in 1991. For the licensing authorities, a "Plan Konrad" was drawn up, which describes the purpose and the design of the repository, the operational and post-operational phase of the repository and the waste acceptance requirements (1).

PROPERTIES RELEVANT TO DISPOSAL

The waste acceptance requirements for waste packages have been derived from safety considerations in this repository. Normal operation, as well as incidents in the operational phase and the long-term aspects of the radionuclide release from the repository are taken into account (2, 3, 4, 5, 6).

Up to now, 14 properties of waste packages relevant for the quality control of radioactive waste packages have been derived from the safety aspects (see Table I).

TABLE I

Relevant Properties for Quality Control

1. Total activity
2. Activity of relevant radionuclides
3. Dose rate
4. Surface contamination
5. Chemical composition of primary waste
6. Quality of immobilization material
7. Quality of waste container
8. Quantitative proportion of waste/immobilization material/water/additives
9. Mixing
10. Mass
11. State of setting
12. Water content and/or residual moisture
13. Thermal behavior
14. Stackability

RESPONSIBILITIES

The quality control must guarantee that the waste acceptance requirements are met (7).

- The waste producers are responsible for the waste package quality and therefore take suitable technical, organizational and administrative measures and prove the efficiency of these measures.

- The quality control group judges the observance of the waste acceptance requirements by:
  - checking the documentation of the waste producers
  - random tests of waste packages
  - qualification of conditioning processes
  - control of qualifical processes by inspections
- The operating company of the repository, acting on behalf of the PTB, checks the identification of waste packages and the radiation protection requirements for handling.
- The PTB is the responsible operator of the repository and, therefore, supervises the operating company of the repository as well as the quality control group and makes decisions in the case of faulty or defective waste packages.

QUALITY CONTROL

The quality control of radioactive wastes can be performed in two ways:

1) Checking of conditioned waste packages by non-destructive or if necessary by destructive test methods.

2) Qualification and inspections of conditioning processes.

Control of Waste Packages from Conditioning Processes Without Process Qualification

Existing waste packages from conditioning processes without process qualification will be checked by random tests on these waste packages. Three different kinds of waste packages have to be assayed.

1) 200 and 400 l drums (As the drums have been packed into containers for final disposal, the checks must be performed before the drums are placed in the containers.)

2) Concrete shielded waste packages

3) Cast iron containers

The type and extent of necessary controls is dependent on the waste producer's documentation, the radiological relevance of the waste package, the homogenity of the lot, etc.

The selection of waste packages for sampling inspections will be made on a statistical basis and/or as a result of visual inspections.

The following non-destructive test methods will be applied during sampling inspections of drums (Fig. 1 and 2).

- Visual inspections, i.e. for recognition of packaging corrosion
- Surface dose rate
- Smear tests for determination of surface contamination
- Weighing
- Neutron measurements for ascertaining uranium- and transuranic-content
- γ-scanning

In case of concrete shielded waste packages, cast iron containers and in the case of limited number of drums, sampling tests will be performed in the hot cell facility at KFA like:

- Opening the waste packages for visual inspections
- Taking samples by drilling
- α-, β-, γ-spectroscopy after sample preparation
- Test of compressive strength to check setting

The necessary equipment will be installed until the end of this year (Fig. 3 and 4).

In any case, the method requiring the minimum effort to achieve the aims of the tests will be applied.

Quality Control by Process Qualification

To avoid destructive and non-destructive random tests on conditioned waste packages, the quality of waste packages alternatively can be guaranteed by qualified and well-instrumented conditioning processes.

The quality control group will examine the conditioning processes for its warranty to meet the waste acceptance requirements by a qualification of the process and subsequent inspections.

For a process qualification, it is indispensable that the conditioner has to fix the operation mode and the band-with control including instrumentation and data logging in a handbook which will be finally amended after the process qualification. The process qualification itself will be performed on basis of these fixed conditions by active and inactive test runs under supervision of the quality control group.

Qualified conditioning processes will be inspected once or twice a year by the quality control group to confirm that the process has been operated within the limits fixed in the final version of the handbook. In addition, samples are taken from the operating process to check the relevant properties.

For the purpose of illustration, the control of a conditioning process for the in-drum cementation of waste is to be seen in Fig. 5.

In this process, the liquid radioactive waste is dried on a drum drier. The dry powder (125 kg) is falling in the 200 l drum. The drum with the drum drier product will be transported to the cementation station. After connecting, about 120 l of water will be dosed in the drum and about 290 kg of cement PZ35F will be added. Simultaneous to water dosing, the mixing system is started. The mixing will be controlled by a data logging of the moment of reaction. Finally, the filled drum is weighed by a crane balance.

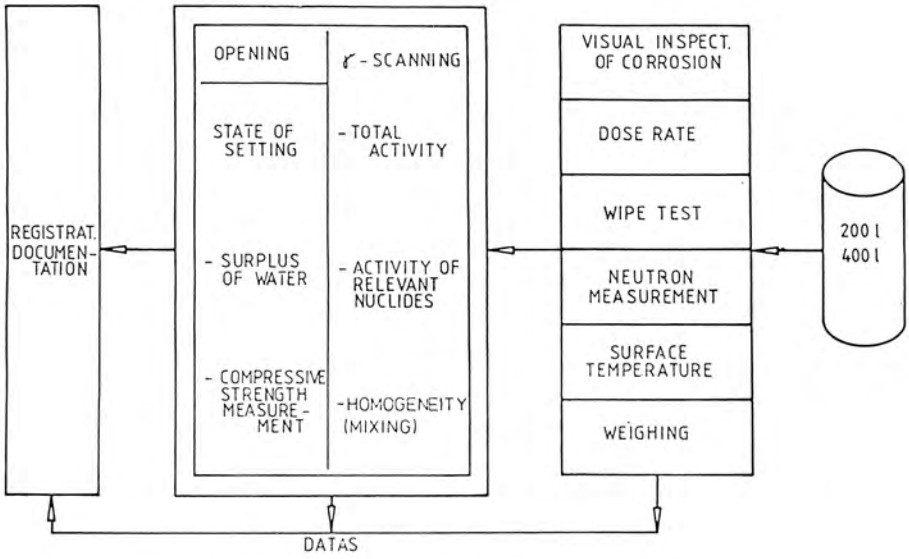

Fig. 1. Control of Product Quality.

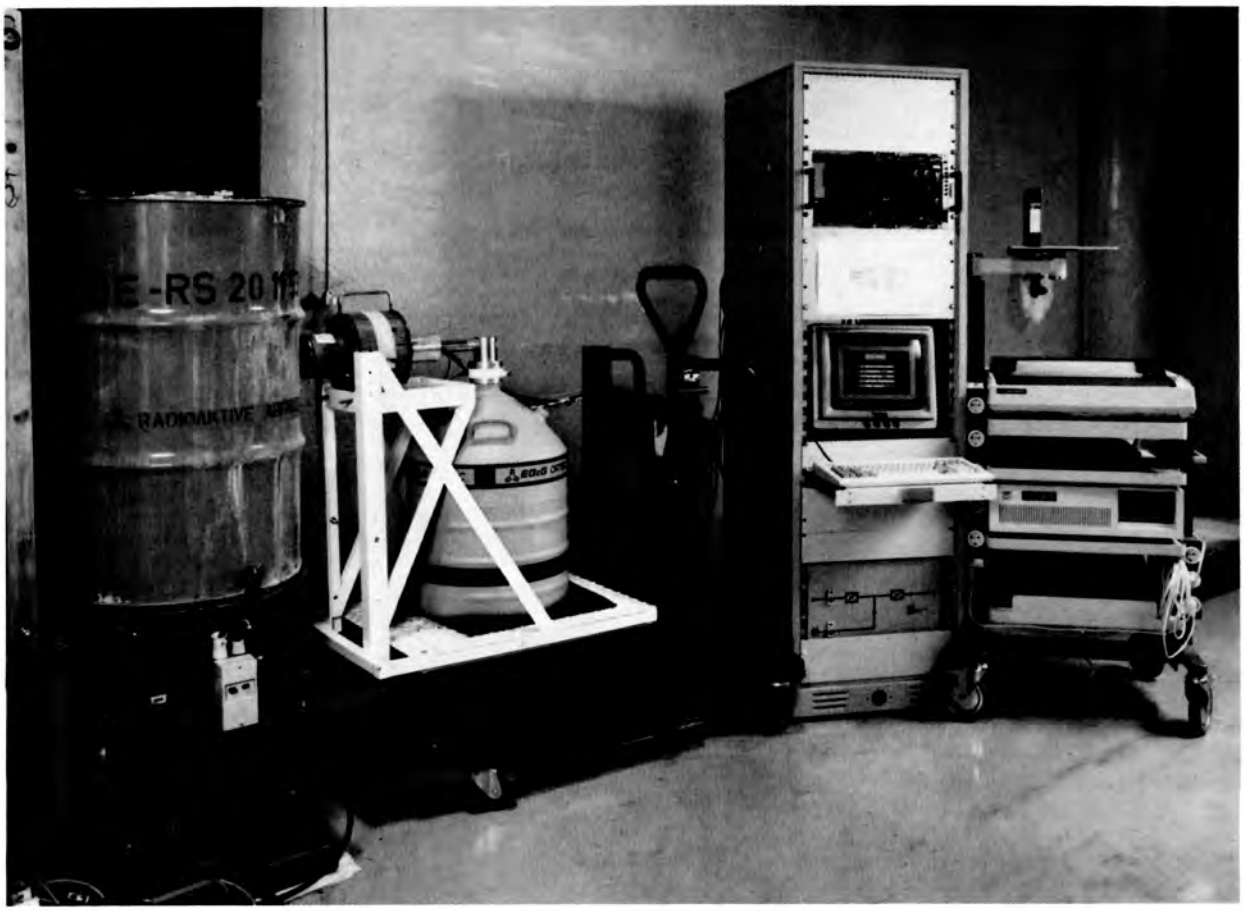

Fig. 2. γ-Scan-System for Testing.

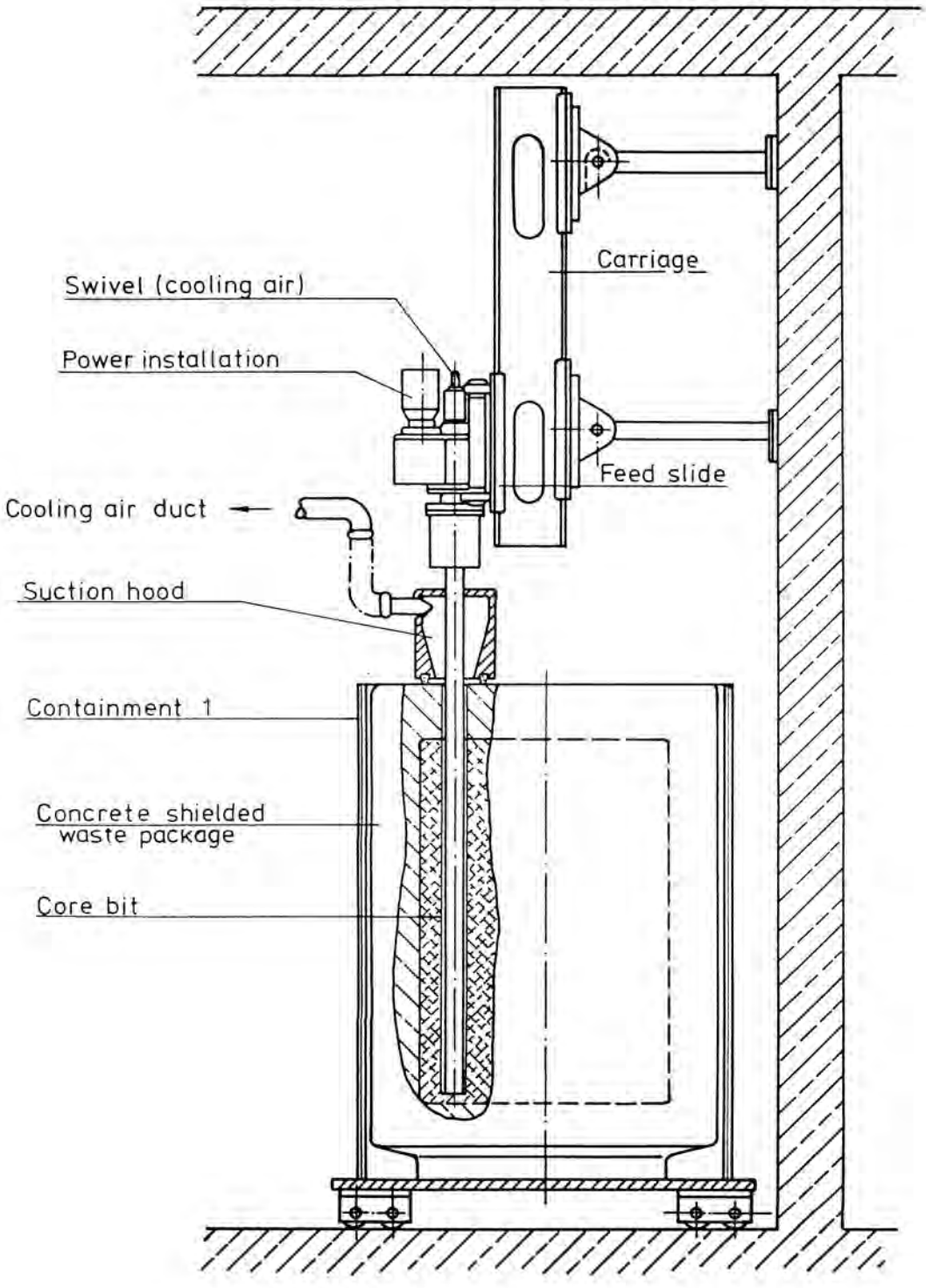

Fig. 3. Assay of Concrete Shielded Waste Packages in Hot Cells.

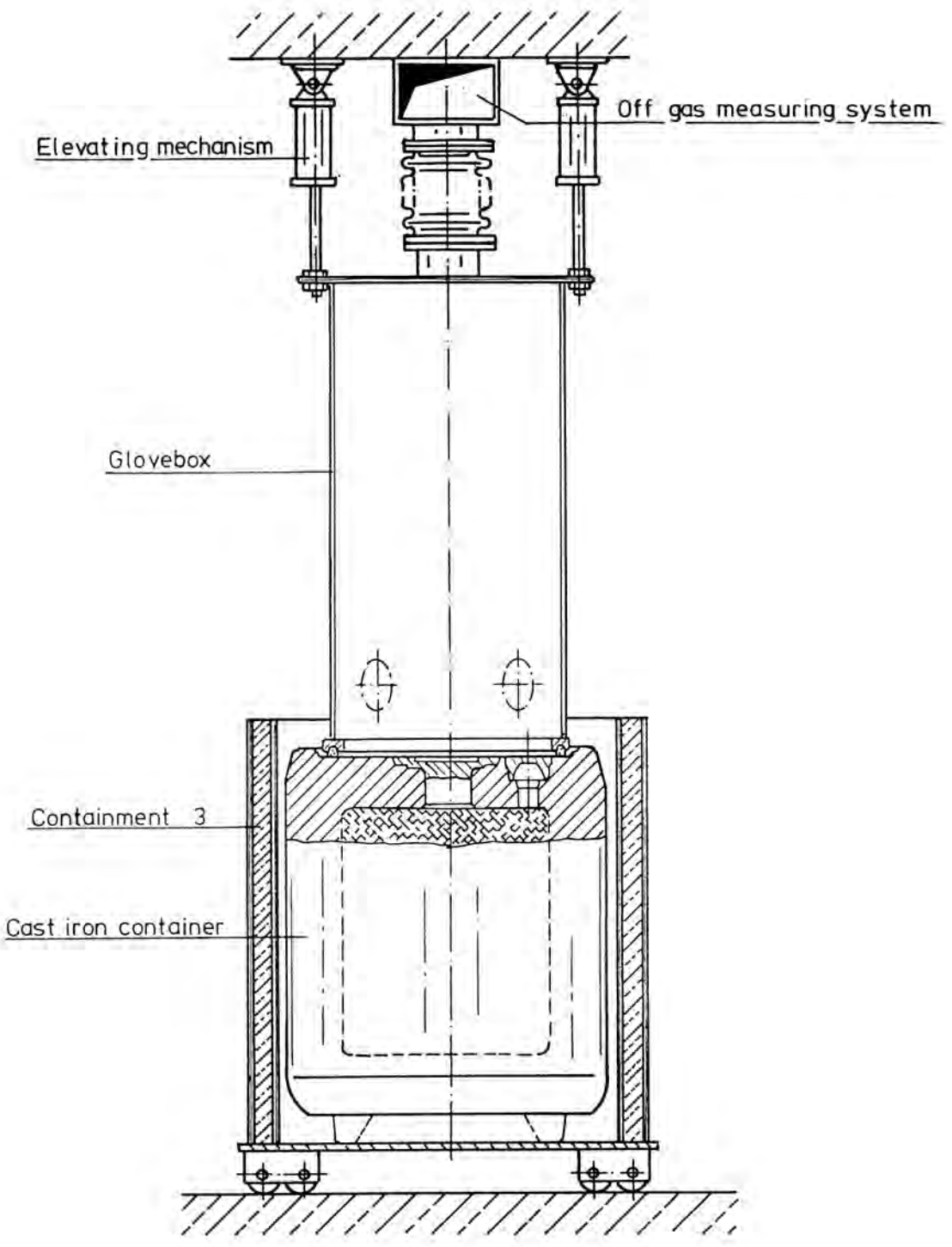

Fig. 4. Assay of a Cast Iron Container (Activity 1 TBq).

FINAL REMARKS

Non-destructive sampling inspections by γ-scans can start in July 1987 whereas the destructive tests can begin in the KFA-facility one year later.

Until now, seven conditioning processes from five different conditioners are on the way for process qualification.

Regarding this, it is evident that sufficient waste packages, which have passed through the quality control, will be available when the Konrad Repository is planned to go into operation in 1991.

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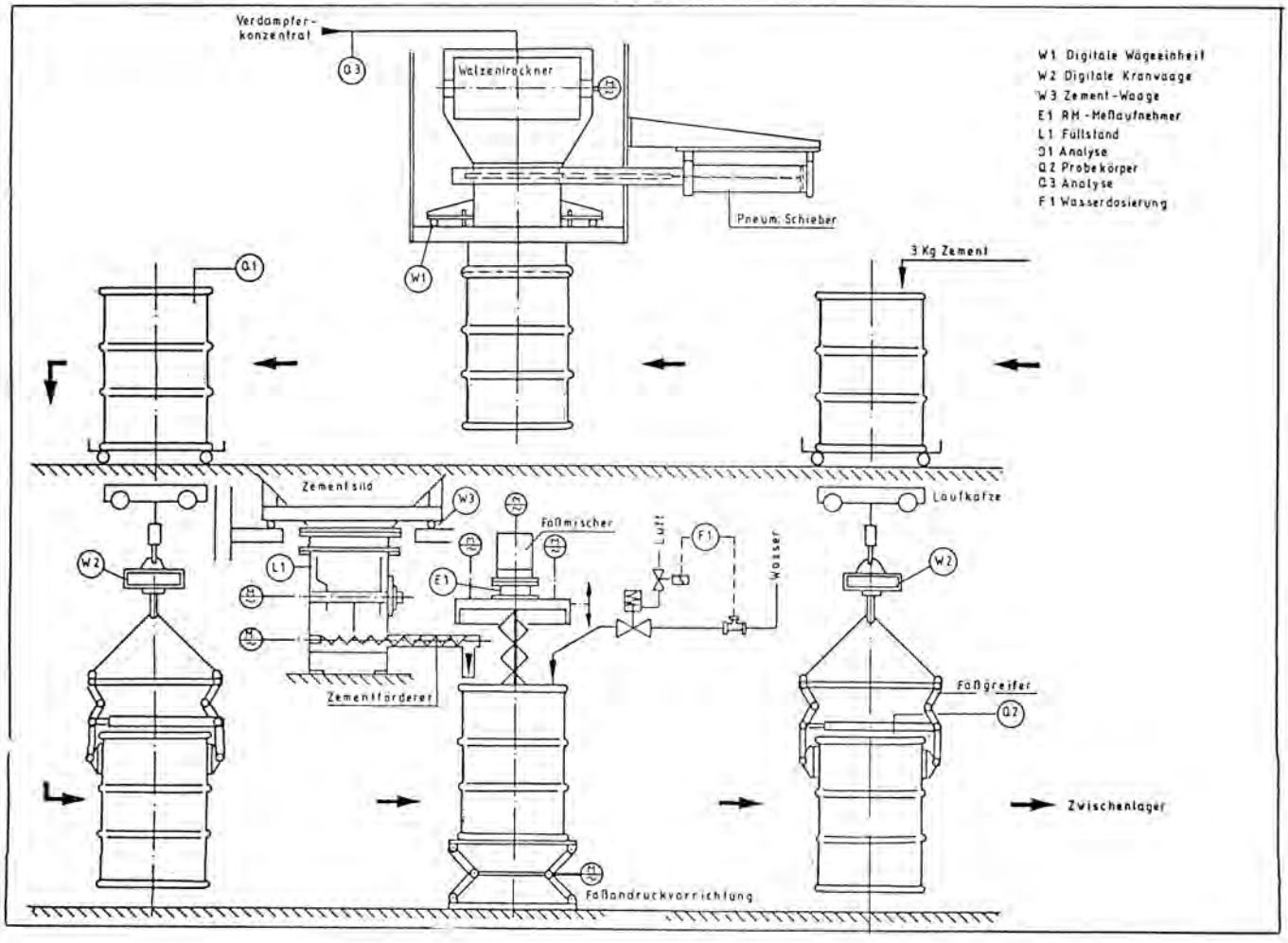

Fig. 5. Principle of Process for Cementation of Waste.