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Santiago, Chile, 1-3 July 1991

CASE STUDY INFORMATION

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ORDINANCE ON WASTE OILS

of 27 October 1987

The Federal Government,

- pursuant to Article 5a para 2 sentence 2 and para 3, Article 5b sentence 4 and Article 14 para 1 nos. 1, 2 and 3 of the Waste Avoidance and Waste Management Act (Abfallgesetz) of 27 August 1986 (Federal Law Gazette (BGBl) I, p. 1410), after hearing the parties concerned,
- pursuant to Article 13 para 5 no. 2 of the Waste Avoidance and Waste Management Act (Abfallgesetz),

The Federal Minister for the Environment, Nature Conservation and Nuclear Safety,

- pursuant to Article 11 para 2 sentence 3 of the Waste Avoidance and Waste Management Act (Abfallgesetz),

The Federal Government,

- pursuant to Article 7 para 1, Article 23 para 1, Article 34 para 1 and Article 35 para 1 of the Federal Immission Control Act (Bundes-Immissionsschutzgesetz) of 15 March 1974 (Federal Law Gazette (BGBl) I, p. 721), as amended by the Act of October 1985 (Federal Law Gazette (BGBl) I, p. 1950), after hearing the parties concerned,

- pursuant to Article 37 of the Federal Immission Control Act (Bundes-Immissionsschutzgesetz)

hereby decree, with the consent of the Bundesrat:

SECTION ONE

GENERAL PROVISIONS

Article 1

Reprocessing of Waste Oils

Reprocessing as defined by Art 5a para 2 sentence 2 no. 1 of the Waste Avoidance and Waste Management Act (Abfallgesetz) shall be any process aimed at producing from waste oils base oils, flux oils, process-related by-products or products destined for further processing after separation or chemical transformation of the noxious substances, the oxidation products and admixtures.

Article 2

Waste oils suitable for reprocessing

The following waste oils may be used for reprocessing:

1. engine oils and gear oils,
2. mineral machine, turbine and hydraulic oils.

Other waste oils may only be reprocessed if they do not contain any noxious substances which make the reprocessing process more difficult or which accumulate in the reprocessing products.

Article 3
Limit values

Waste oils shall not be reprocessed if they contain more than 20 mg PCB/kg, determined as 4 mg PCB/kg in accordance with the test procedure prescribed in Annex I, or if they contain more than 2 g total halogen/kg. This shall not apply if these noxious substances are destroyed by the reprocessing process or if they are only contained in the reprocessing products to the extent obtained when waste oils complying with the limit values are processed.

Article 4
Separate management, prohibitions against mixing

(1) Synthetic PCB-based oils and substitute products containing halogens which can in particular be contained in transformers, capacitors and hydraulic systems must be kept, collected or transported and sent for management separately from other waste oils. The competent authority can grant derogations to sentence 1 above if separate keeping at the place where the waste oil occurs is for technical operational reasons only possible at disproportionately high cost and if the owner of the waste oil provides proof of management in a facility authorised pursuant to Article 7 of the Waste Avoidance and Waste Management Act or Article 4 of the Federal Immission Control Act.

(2) It is prohibited to mix the waste oils listed in Article 2 sentence 1 with other waste oils or wastes, and in particular those within the meaning of Article 2 para 2 of the Waste Avoidance and Waste Management Act.

1.4 Sampling at the source of the waste oil

Where sampling is performed at the source of the waste oil pursuant to Article 5 paragraph 1 sentence 1, 250 ml of the sample shall remain at the source of waste oil and 250 ml with the waste-oil collector.

1.5 Sampling at the point of reprocessing

Where sampling is performed for the purposes of Article 5 paragraph 2 of this Ordinance the sample shall be divided into 4 sub-samples. Of these, one sample shall be destined for the testing laboratory, one sample for the supplier, one sample for the reprocessor and one sample for any eventual arbitratinal analyses (reserve samples).

Where in any one concrete case several samples are destined for one and the same place the number of sub-samples shall be reduced accordingly.

1.6 Observance of safety provisions

The relevant safety provisions, particularly those concerning fire protection, shall be observed when removing and handling samples.

1.7 Record of the Sampling

A record of the sampling shall be drawn up along the lines of the sample given in DIN 51 750 Part 1.

The suction tube of the vacuum tanker is connected to the discharge connection piece of the waste oil tank or placed in other containers. Once the tank of the vehicle has been placed under vacuum, slide valves 1 and 4 are opened with valves 2 and 3 closed and the transfer procedure begins. Both at the beginning of the process and then repeatedly until it has been completed, slide valves 1 and 4 are closed, the pipe inbetween aerated using valve 2 and the contents of this pipe connection piece then let out into a sampling container via valve 3. A total sample of at least 1 l is obtained from several such operations. Sampling should not begin immediately with the start of the transfer of the waste oil as this could produce distorted samples because of contamination.

1.2 Sampling containers

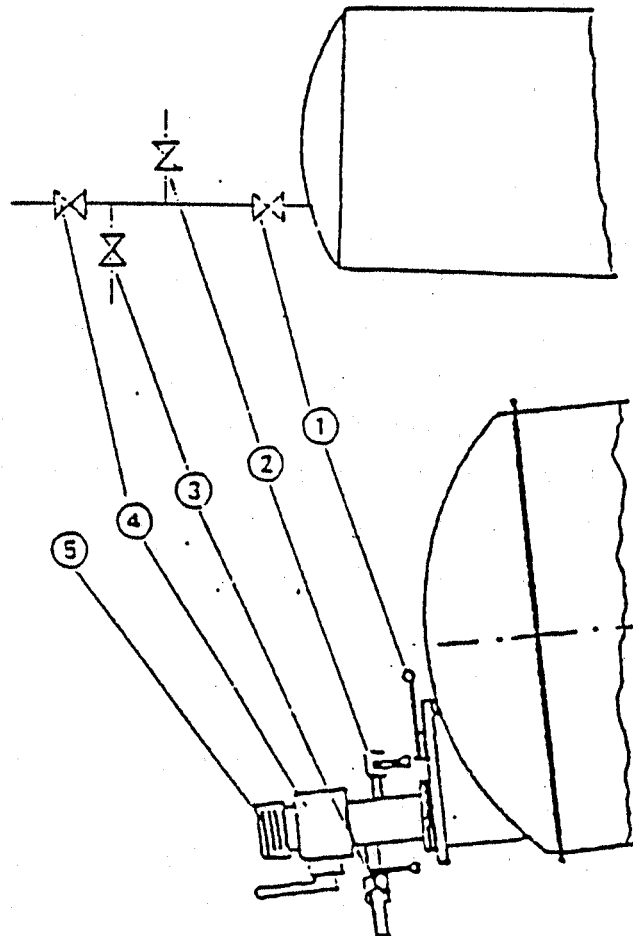
Glass or metal containers shall be used for removing and keeping the samples. Containers made of other materials shall be authorised if it is proven that the sides of the container do not absorb any PCBs which could affect measurements.

1.3 Amount of the sample

The amount of the sample shall in each case be at least 1 l.

Figure 1

Sampling device on the vacuum tanker



- 1) Tanker slide valve
- 2) Vent: ball valve, 3/8"
- 3) Outflow: ball valve, 1/2"
- 4) Isolating valve, 3"
- 5) Tanker coupling

Annex I

(ad Article 5 para 3)

Sampling and Testing of Waste Oil

1. Taking and keeping of the samples

Sampling for testing a waste oil for its content of total halogen and polychlorinated biphenyls (PCB) shall be conducted in accordance with German industrial standard DIN 51 750 Part 1, August 1983 edition, and Part 2, March 1984 edition.

Attention is drawn to the following points in addition to the provisions of German industrial standard DIN 51 750.

1.1 Use of vacuum tankers

When using vacuum tankers sampling can be performed as described below (see Fig. 1)

Article 12

Awarding of grants pursuant to the Waste Oil Act

Notwithstanding the regulations of this Ordinance the grants for the management of waste oils shall be paid according to Article 30 paragraph 2 sentence 1 of the Waste Avoidance and Waste Management Act until 31 December 1989.

Article 13

Berlin Clause

This Ordinance shall also be applicable in Land Berlin in accordance with Article 14 of the Third Transitional Law in conjunction with Article 31 of the Waste Avoidance and Waste Management Act and with Article 73 of the Federal Immission Control Act.

Article 14

Entry into Force

With the exception of Article 7 and Article 10 No. 7 this Ordinance shall enter into force on 1 November 1987. Article 7 and Article 10 No. 7 shall enter into force on 1 July 1988.

Bonn, 27 October 1987

The Federal Chancellor

Dr. Helmut Kohl

The Federal Minister for the Environment, Nature
Conservation and Nuclear Safety

Dr. Klaus Töpfer

2. contravenes Article 3 sentence 1 by reprocessing waste oils containing more than the prescribed limit values for the substances mentioned therein,
3. contravenes Article 4 paragraph 1 sentence 1 by not keeping, collecting, transporting or sending for management synthetic PCB-based oils or substitute products containing halogens separately from other oils,
4. contravenes Article 4 paragraph 2 by mixing waste oils specified in Article 2 sentence 1 with other oils or wastes, and particularly those within the meaning of Article 2 paragraph 2 of the Waste Avoidance and Waste Management Act,
5. contravenes Article 6 paragraph 1 sentence 1 by failing to submit a declaration or by failing to submit such a declaration correctly or completely,
6. contravenes Article 6 paragraph 3 sentence 2 by failing to present a copy of the declaration,
7. contravenes Article 7 by marketing engine oils or gear oils in containers without the prescribed marking/labelling, or
8. contravenes Article 8 paragraph 1 by failing to point out the reception facility or by failing to point it out in the prescribed manner.

Article 11

Relationship to the Tenth Ordinance on the Implementation of the Federal Immission Control Act (10. BImSchV)

The provisions of the Tenth Ordinance on the Implementation of the Federal Immission Control Act of 26 July 1978 (Federal Law Gazette (BGBl) Part I, p. 1138) shall not apply to waste oils.

Article 9

Exceptions for commercial final consumers, shipping

(1) Where commercial or other business enterprises or public institutions purchase engine oils or gear oils directly from the manufacturer or mineral oil trade the reception facility does not have to be established or indicated at the point of sale or in its vicinity. The vendor can make use of third parties in order to fulfil his obligation with regard to taking back returned waste oil.

(2) For the field of internal navigation and maritime shipping the vendor's obligation with regard to taking back waste oil shall be deemed to have been complied with if the purchaser makes use of the facilities for the separation of oil from bilge water or the reception facilities pursuant to the International Convention for the Prevention of Pollution from Ships (MARPOL).

SECTION THREE

FINAL PROVISIONS

Article 10

Administrative offences

An administrative offence within the meaning of Article 18 paragraph 1 no. 11 of the Waste Avoidance and Waste Management Act shall be deemed to be committed by any person who wilfully or by negligence

1. contravenes Article 2 sentence 2 by reprocessing other waste oils although they contain harmful substances which accumulate in the reprocessed products,

shall present a copy of the declaration to the customs office without being requested to do so.

SECTION TWO

REQUIREMENTS FOR THE HANDING OVER OF ENGINE OILS OR GEAR OILS

Article 7

Marking/labelling of containers

Engine oils or gear oils may only be marketed in containers if they are marked as follows by means of a stamp or label: "This oil should be taken to an oil reception facility after use! The improper disposal of waste oil endangers the environment! Any mixing with other substances such as solvents, brake fluids or coolants is prohibited."

Article 8

Waste-oil reception facility at the point of sale to the private final consumer

(1) Anyone who commercially sells engine oils or gear oils to private final consumers shall indicate, at the point of sale and by means of easily recognisable and legible signs, the reception facility for used engine oils and gear oils pursuant to Article 5b sentence 1 of the Waste Avoidance and Waste Management Act.

(2) If the reception facility is not located at the point of sale its distance from the point of sale must be such that purchasers can be reasonably be expected to make use of it.

limit values specified in Article 3 paras 1 and 2 shall be performed in accordance with the procedures described in Annex 1.

Article 6

Supplementary declarations on the keeping of records

(1) Anyone who

1. as a collector of waste oils hands over waste oils for the purposes of reprocessing, thermal recycling or transfrontier transport or
2. as a business enterprise or public institution commercially hands over waste oils to waste-oil collection companies or transports waste oils into, out of or through the area of applicability of the Waste Avoidance and Waste Management Act (Abfallgesetz) shall be required to submit a declaration in accordance with the sample given in Annex 2. Article 11 paras 2 and 3 of the Waste Avoidance and Waste Management Act (Abfallgesetz) in conjunction with the provisions of the Waste Control Ordinance (Abfall-nachweis-Verordnung) shall apply mutatis mutandis.

(2) Anyone who is obliged to examine waste oils pursuant to Article 5 para 2 sentence 1 shall also enter the determined contents of PCB and halogen in the declaration shown in Annex 2, even where he is under no obligation pursuant to paragraph 1 above.

(3) One copy each of the declaration shall be kept for three years by the party obliged under paragraph 1 sentence 1 above and the company receiving the waste oil. In the case of the transboundary transport of waste oil the party obliged under paragraph 1 sentence 1 above

(3) The prohibitions in paragraphs 1 and 2 above shall not apply in facilities authorised pursuant to Art. 4 of the Federal Immission Control Act or Article 7 of the Waste Avoidance and Waste Management Act for the reprocessing, thermal recycling or management of waste oils or wastes where mixing is provided for in the licence.

Article 5

Removal, testing and keeping of samples

(1) Waste-oil collection companies shall remove a sample when taking charge of waste oils. A part of this sample (reserve sample) is to be kept individually at the place where the waste oil occurs and by the waste-oil collection company until the test prescribed in paragraph 2 below has been carried out and it has been established that the waste oils can be managed in an orderly manner.

(2) Anyone who reprocesses, thermally recycles or transports waste oils into, out of or through the area of applicability of the Waste Avoidance and Waste Management Act (Abfallgesetz) must examine the PCB and total halogen contents or arrange to have these contents examined. The competent authority can specify a certain testing laboratory, provided that the tests are conducted by a testing laboratory which does not regularly participate successfully in intercalibration.

(3) A sample shall be taken from the waste oils to be tested. Part of this sample (reserve sample) shall be kept for three years by the party obliged to have the waste oils examined pursuant to para 2. The removal, examination and keeping of samples for monitoring the

1.8 Keeping of samples

Samples taken pursuant to this Ordinance shall be kept in accordance with Article 5 paragraphs 1 and 3. In the case of criminal proceedings or proceedings for the imposition of monetary fines the sampling containers envisaged for the arbitral analysis (arbitration proceedings pursuant to DIN 51 848, March 1984 edition) shall be kept until the end of the proceedings.

The samples taken are to be secured in such a way (e.g. by sealing with lead) that the amount of the sample remains unchanged, and so that the place and time of the sampling can be proven at any time.

2. Determination of polychlorinated biphenyls (PCBs)

2.1 Application of DIN 51 527

Polychlorinated biphenyls (PCBs) shall be determined according to German industrial standard DIN 51 527 Part 1, May 1987 edition.

2.2 Use of the Results

The results obtained in accordance with the provisions of the standard shall be used to monitor the limit value to be complied with pursuant to Article 3 via the determination value of 4 mg/kg PCB:

2.3 Preparation of the sample

The sample shall be prepared in such a way that the results obtained refer to the anhydrous oil phase.

2.4 Relationship between the determination value and the limit value

The use of a limit value and a determination value became necessary due to the use of different quantification procedures when establishing limit values at the international level, and particularly within the framework of EC law.

2.5 Permitted variation

The permitted error when determining the PCB content in accordance with this provision is ± 1 mg/kg PCB. The limit value to be complied with pursuant to Article 3 is therefore exceeded if the determined content is greater than 5 mg/kg PCB.

3. Determination of the total halogen content

3.1 Principle

The total halogen content of a waste oil is taken to mean the mass content of inorganic and organic halogen in the anhydrous oil phase, this mass content being determined as halogen under the operating conditions of this process.

The sample to be tested is placed in a weighing boat and vaporized in a Wickbold combustion device in accordance with DIN EN 41 and the resulting vapours burned in an oxyhydrogen flame with excess oxygen. Halogenides such as HCl, HBr and HI produced during combustion are absorbed in an absorption solution and determined potentiometrically.

3.2 Chemicals

Only chemicals of reagent purity and bidistilled water or water of the same degree of purity are used. The chemicals and feed gases used must be free of halogen compounds.

3.2.1 Sodium hydroxide hydrate

3.2.2 Hydrogen peroxide

$\omega(\text{H}_2\text{O}_2) = 30\%$

3.2.3 Sodium sulphate, anhydrous

3.2.4 Absorption solution

Dissolve 1.16 g sodium hydroxide hydrate ($\text{NaOH} \cdot \text{H}_2\text{O}$) and 100 ml hydrogen peroxide (H_2O_2) in water and fill up to 1 l with water. The solution can only be kept for a limited time.

3.2.5 Nitric acid $\omega(\text{HNO}_3) = 65\%$

3.2.6 Acetone

3.2.7 Silver nitrate solution, $c(\text{AgNO}_3) = 0.01 \text{ mol/l}$:

Dissolve in water 1.6987 g silver nitrate (AgNO_3) which has been previously dried at 150°C to constant weight, fill up to 1 l with water and store in a dark glass bottle.

Note:

Ready-made solutions available in the chemicals trade can be used instead.

3.2.8 Oxygen, hydrogen and nitrogen in compressed gas cylinders, commercial quality, halogen-free

3.2.9 Quartz wool, halogen-free

3.3 Apparatus

- Erlenmeyer flask, wide-necked, rated volume 250 ml, e.g. WE 250 DIN 12 385, September 1972 edition
- Measuring flasks, various rated volumes. e.g. Measuring flasks DIN 12 664 MSA 25 (100; 1000), Part 1, August 1983 edition and Part 2, January 1981 edition
- Measuring flask with spherical ground-glass joint, rated volume 100: 250 ml, spherical ground-glass joint S29/15 DIN 12 244, Part 1, April 1979 edition
- Volumetric pipettes, rated volumes 5, 10, 20 ml, e.g. pipette DIN 12 691-VPAS 5 (10; 20), April 1975 edition
- Beakers, tall (HF), rated volumes HF 50, HF 100 ml, e.g. HF 50 beaker, DIN 12 331, April 1971 edition

- Indicator electrode: silver electrode or silver-silver sulphide electrode or silver-silver chloride electrode in accordance with DIN 51 408, Part 1, June 1983 edition
- Reference electrode with halide-free salt bridge (e.g. mercury/mercury (I) sulphate electrode)
- Magnetic stirrer

3.3.1 Combustion apparatus in accordance with DIN EN 41

Figure 2 shows the schematic structure of the Wickbold combustion apparatus for viscous and solid samples. When burning samples of waste oil a BITC (Bureau International Technique du Chlor) burner for solids should be used instead of the burner shown (21).

3.3.2 Potentiograph with automatic burette or similar apparatus for automatically carrying out and evaluating potentiometric titrations

3.4 Method

3.4.1 Drying the waste-oil sample

The liquid sample to be examined is tested to see if there is any separable water present. If an aqueous phase is determined this is separated off using a separating funnel.

The oil phase obtained and samples with low contents of free water or emulsions are homogenised.

The water contents of the homogenised samples are removed with anhydrous sodium sulphate which is mixed into a sample quantity of 5 to 30 g in small amounts until the supernatant oil is clear.

Where necessary the sodium sulphate and other solids are centrifuged off from the oil.

Note:

The waste-oil sample should be dried in such a way that evaporation losses through volatile constituents are avoided.

3.4.2 Combustion of the waste-oil sample

Combustion is carried out in accordance with DIN EN 41 in a Wickbold apparatus (see Figure 2) using a BITC burner for solids. In contrast to the provisions of DIN EN 41 the secondary oxygen is replaced by nitrogen at the start of combustion (evaporation). This is fed directly from a two-stage pressure-reducing valve of a nitrogen pressure cylinder via the single-way cock (23) with the fine-control valve of the flowmeter (3) closed. After switching on the vacuum pump and turning on the cooling water between 1 to 2 bar gas admission pressure is regulated at the pressure-reducing valves for oxygen, hydrogen or nitrogen. An underpressure of around 0.5 bar (5,000 mm water column) is then set with the aid of the vacuum valve (9) with the fine-control valves of the flowmeters (3), (4) and (5) closed.

The BITC burner for solids is removed from the combustion chamber (20). A hydrogen flow of around 200 l/h is regulated by opening the fine-control valve flowmeter (4). Hydrogen is allowed to flow freely for around 30 seconds, the burner is lit and the primary oxygen is regulated slowly to around 200 l/h using the fine-control valve on flowmeter (5). The burner for solids is returned to the combustion chamber.

Around 1.0 g waste oil is weighed to an accuracy of 0.001 g in the quartz weighing boat (evaporative losses through volatile constituents should be avoided) and loosely covered with a layer of halogen-free quartz wool (around 0.2 g). The weighing boat is then pushed to the centre of the BITC burner for solids using a glass rod. After inserting the ground-glass stopper a nitrogen flow of 400 l/h is introduced via the air cock (23). Here, the fine-control valve (3) must remain closed.

The addition of the absorption solution is regulated in such a way using the single-way cock (18) that around 2 drops per second flow into the absorption tower (17), whereby the tailkey stopcock is brought into position "a".

The hydrogen flow is then set to 500 l/h, the oxygen flow to 700 l/h and the vacuum to 0.3 to 0.4 bar (3,000 to 4,000 mm water column); these are then readjusted during combustion. Maintenance of this pressure range is important in order to ensure even combustion of the samples. The sample is heated carefully using a Bunsen burner until it

begins to evaporate. The entire length of the tube of the BITC burner for solids is then heated to red heat with the Bunsen burner in order to ensure complete combustion. After extinguishing the flame behind the perforated plate of the BITC burner the nitrogen flow is replaced by the same quantity of oxygen and heated further until any uncombusted residues in the sample area and weighing boat have been fully combusted.

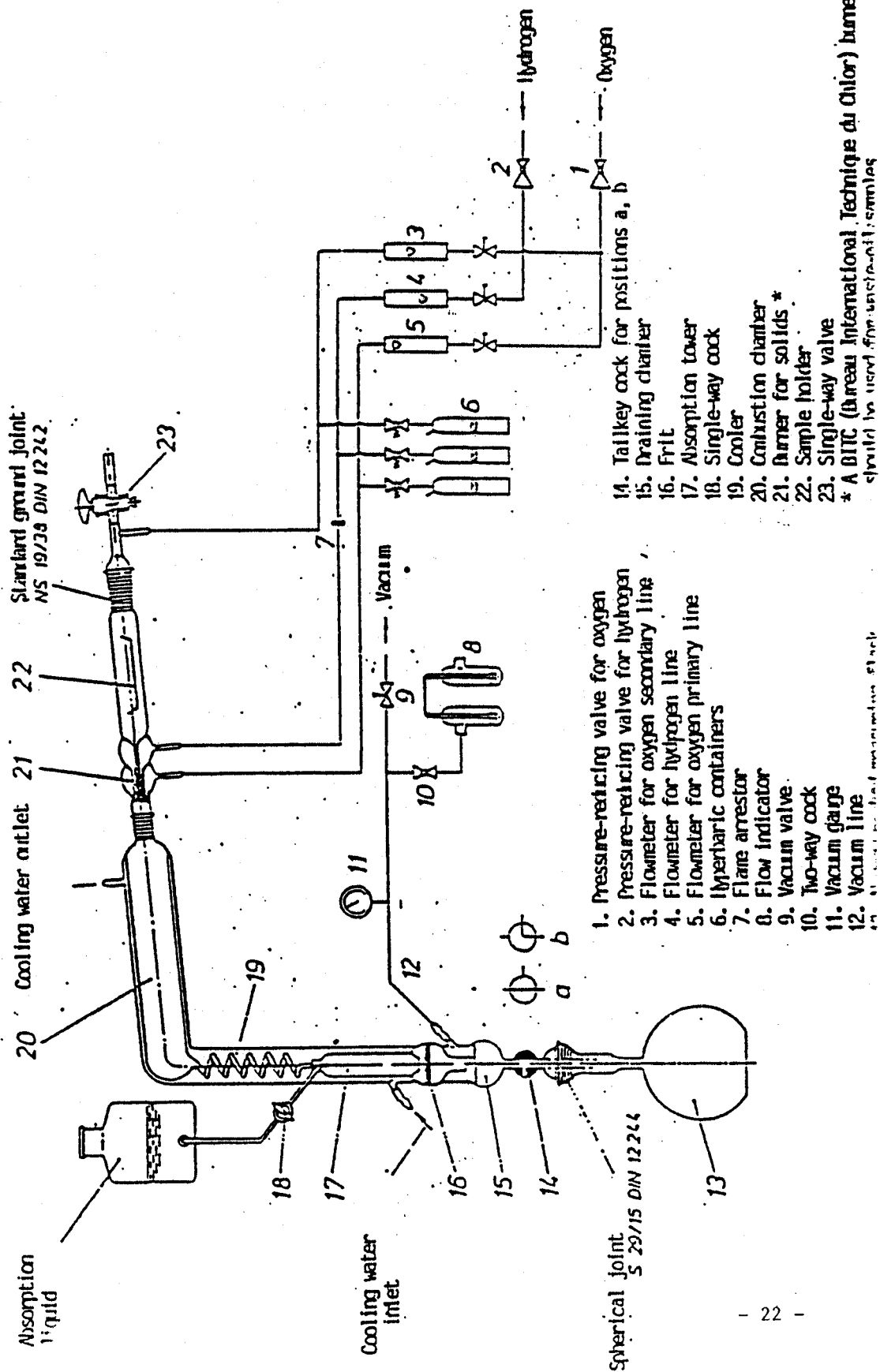
Once the combustion is completed the single-way cock (18) is first closed to stop the flow of the absorption solution. The ground-glass stopper is then detached from the apparatus together with the air cock (23) and the weighing boat (22) removed from the BITC burner for solids. The combustion chamber is rinsed out with 25 ml water. It may be necessary to rinse the chamber several times where a sample has a high halogen content.

The tailkey stopcock (14) is then turned to position "b", the narrow-necked flask (13) replaced with an empty measuring flask and the tailkey stopcock (14) returned to position "a", after which the next sample can be placed in the BITC burner for solids. The absorption solution contained in the narrow-necked flask (13) then undergoes the determination procedure described under 3.5.

FIGURE 2

Wickbold Apparatus

Schematic structure of the entire apparatus for the combustion of viscous and solid samples



3.5 Potentiometric determination

cf. also DIN 38 405, Part 1, December 1985 edition
and DIN 51 408, Part 1

3.5.1 Fundamental principles of the method

The halogen ions are titrated with silver ions.
For end point detection the voltage between a
reference electrode and an indicator electrode is
followed.

3.5.2 Contaminations

cf. DIN 38 405, Part 1

3.5.3 Method

The absorption solution obtained by combusting an
oil sample in accordance with the Wickbold method
is transferred quantitatively to a wide-necked
250 ml Erlenmeyer flask by rinsing twice with
water. The pH value is tested using a non-bleeding
pH-indicator strip and where necessary adjusted to
pH 8.5 to 10 using diluted sodium hydroxide solu-
tion. The contents of the flask are heated on a
hotplate for around 20 minutes to boiling point in
order to destroy the hydrogen peroxide. The resi-
dual solution, generally 10 to 20 ml, is quan-
titatively transferred to a 25 ml measuring flask
by rinsing twice with water and filled up to the
mark with water. After shaking the flask carefully
an aliquot of 5 or 10 ml is transferred to a 50 ml
beaker (tall) using a volumetric pipette, mixed
with 1 ml nitric acid (65%) and filled up with

water to a volume of around 20 ml. Both electrodes are immersed in the solution, which is then stirred intensively and titrated with 0.01 mol/l silver nitrate solution until the Chloride-ion point of inflection of the potential-energy curve is detected.

If no potential jump is indicated the concentration of halogen ions in the sample tested may be below the valid detection limit for the prescribed conditions of 3 to 8 microgrammes Cl^-/ml . The following procedure should be followed in such cases:

An aliquot of 5 ml is removed from a known volume of the absorption solution using a volumetric pipette and transferred to a 50 ml beaker (tall), mixed with 1 ml nitric acid and filled up to around 20 ml total volume with acetone. The solution is then titrated as above with a 0.002 mol/l or 0.005 mol/l silver nitrate solution. If it is necessary to identify the point of inflection corresponding to the chloride ions the determination process is repeated with the addition of a known quantity of chloride.

3.5.4 Blank reading

In order to monitor freedom from halogens blank tests must be carried out regularly, particularly when using new chemicals and feed gases.

For this, several combustion procedures are carried out one after the other as described in 3.1 but without a sample; the halogen ions in the absorption solutions obtained are then determined as in 3.5.

Depending on laboratory conditions the blank reading may be as high as 50 microgrammes total halogen, and does not need to be taken into account in such cases. Checks should be made for contamination if the blank reading is higher than 50 microgrammes total halogen.

3.5.5 Evaluation

If the potential-energy curve of the titration shows several points of inflection then the total volume of silver nitrate solution consumed up to the chloride ions shall be taken as consumption V_{Ag} .

The mass concentration of halogen in the waste-oil sample is calculated from equation (1).

$$B = \frac{V_{Ag} \cdot C_{Ag} \cdot f \cdot V_{MeB}}{E \cdot T_{Titr}} \quad (1)$$

whereby

B = Mass concentration of total halogen in the waste-oil sample in g/kg

V_{Ag} = Volume of the silver nitrate solution consumed during titration, in ml

C_{Ag} = Concentration of the silver nitrate solution, in mol/l

f = Equivalence factor: $f = 35.453$ g/mol

E = Initial weight of the waste-oil sample, in g

$V_{Me\beta}$ = Volume of the measuring flask (in accordance with 3.5), in ml

V_{Titr} = Volume used out of the measuring flask for titration, in ml.

3.5.6 Statement of the result

The values stated are rounded to the nearest 0.1 g/kg. DIN 1 333, Sheet 2, February 1972 edition is to be taken into consideration when rounding to the last significant figure.

Example: Total halogen content 1.8 g/kg.

The total halogen content permitted in accordance with Article 3 is in principle proven to have been exceeded if the determined content is more than 5% above the limit value.

Note:

In order to check whether the permitted total halogen content has been exceeded the use of a preliminary test using X-ray fluorescence analysis is permitted.

A test in accordance with the reference method is not necessary if the following values are not exceeded during the preliminary test:

Method	Total halogen content	Total chlorine content
<hr/>		
X-ray fluorescence analysis, wavelength dispersive	1.5 g/kg	1.2 g/kg
X-ray fluorescence analysis, energy dispersive	1.0 g/kg	0.7 g/kg

4. Publications of expert authorities

The publications of expert authorities mentioned in Sections 1, 2 and 3 are kept securely in archives at the German Patent Office in Munich. The DIN standards are published by the Beuth-Verlag GmbH of Berlin and Cologne.

ANNEX 2
(ad Article 6 paras 1 a

No. 1)

No foreign substances such as PCB-based synthetic oils or their substitutes, waste oils or wastes which are unsuitable for reprocessing, and particularly wastes within the meaning of Article 2, para 2 of the Waste Avoidance and waste management Act, have been added to the waste oil by the company.

Signature/Company stamp

Signature/Company stamp

Note should be taken of the following:

The party obliged to submit a declaration (Article 6 para 1 of the Waste Oil Ordinance) and, where applicable, by the party obliged to examine waste oils (Article 5 para 2 sentence 1, Article 6 para 2 of the Waste Oil Ordinance) shall submit the declaration on the management of waste oils in accordance with the following:

- 1) The number of the accompanying document should be inserted here where the party obliged to submit a declaration has to fill out an accompanying document in accordance with Article 11 para 2 or para 3 of the Waste Avoidance and Waste Management Act (Abfallgesetz) in conjunction with the Waste Control Ordinance (Abfallnachweisverordnung).
- 2) and 3) The names contained in the Waste Identification Ordinance (Verordnung zur Bestimmung von Abfällen) pursuant to Article 2 para 2 of the Waste Avoidance and Waste Management Act (Abfallgesetz), the names contained in the waste catalogue of the information leaflet "Abfallarten" (Types of Waste) or the names notified by the competent authority should be inserted here.
- 4) The information on the quantity of waste oil can be given in m³ or t.
- 5) The figure corresponding to the party obliged to submit the declaration should be inserted in the last box.

- 6) This information is to be given by the party obliged to examine the waste oil (Article 5 para 2 sentence 1, Article 6 para 2 of the Waste Oil Ordinance) (owners of waste oil who reprocess, thermally recycle or transport waste oil into, out of or through the area of applicability of the Waste Avoidance and Waste Management Act (Abfallgesetz). The information is also to be given where the tests for PCBs and total halogen are conducted by a third party on behalf obliged to examine the waste oil or by a test laboratory specified by the competent authority.

Dr. W. Drechsler, Federal Environment Agency Berlin

Regulation on the Disposal of Used Halogenated Solvents

As of 1 January 1990 new regulations apply for the disposal of used halogenated solvents. The new "Regulation on the Disposal of Used Halogenated Solvents" (German abbreviation HKWAbfV) of 23 October 1989 prescribes certain measures concerning the recycling or disposal of impure solvents with a halogenated hydrocarbon (HHC) content of more than 5% which apply operators using volatile halogenated solvents in, for example, metal de-greasing or dry-cleaning plants.

The regulation includes mandatory separate storage according to the main types of solvents and a ban on mixing the separated solvents with other substances. A major part of the regulation consists in the obligation of solvent suppliers to take back unmixed used HHC solvents, or to guarantee they will be taken back by a third party. This includes any impurities contained in the solvents arising from the processes for which they have been used.

In addition, users who avail of the possibility to return used solvents must submit a declaration stating the type and application of the used solvent being returned. In accordance with this regulation, as of 1 May 1990 volatile HHC solvents may only be sold in containers bearing a specified label with information about the correct method of disposal of used solvent and the ban on mixing.

The aim of this regulation is to significantly improve the recycling of used halogenated solvents and to avoid capacity problems in the disposal of hazardous waste in the future. In order to be able to comply with this regulation metal processing plants which use HHC solvents will have to make additional investments both in terms of planning and plant technology.

Regulation
On the Disposal of Used Halogenated Solvents

of 23 October 1989

Under Article 14, Paragraphs 1, 2, and 3 of the Waste Act of 27 August 1986 (*Bundesgesetzblatt*¹ I, p. 1410) and Article 7, Paragraph 1 of the Federal Act on Environmental Quality of 15 March 1974 (BGBl. I p. 721), having consulted the relevant parties, the Federal Government hereby decrees:

Article 1

Scope

(1) This regulation shall apply to solvents which must be recycled or disposed of properly after use and which are used in installations in which:

1. The surface of objects or materials, particularly those made of metal, glass, ceramics or plastic, is cleaned, greased, de-greased, coated, "de-coated", developed, phosphatised, dried or subjected to similar treatment.
2. Materials to be processed, particularly textiles, leather, furs, skins, fibres, feathers or wool are cleaned, de-greased, finished, dried or treated in a similar way.
3. Aromas, oils, fats or other substances made from plants, parts of plants, animals or parts of animals, are extracted.
4. Substances, preparations or products are extracted or produced with the help of these solvents.

(2) For the purposes of this regulation, solvents are aqueous substances or solutions containing more than 5% halogenated hydrocarbons and which have a boiling point between $293\text{ K} = 20^{\circ}\text{C}$ and $423\text{ K} = 150^{\circ}\text{C}$ at 1013 hPa .

Article 2

Separate Storage, Ban on Mixing

(1) Operators of installations described in Article 1, Paragraph 1 must store solvents separately after use according to the main constituent of the original substance in question, such as dichloromethane (methylene chloride), trichloromethane, tetrachloromethane, 1,2-dichloroethane,

1. Federal Law Gazette

1,1,1-trichloroethane (methylchloroform), trichloroethane (trychloroethylene, tri), tetrachloroethane (perchloroethylene, per), trichlorofluoromehtane (R-11), 1,1,2,2-tetrachloro-1,2-difluoroethane (R-112) or trichloro-1,2,2-trifluoroethane (R-113).

(2) It is prohibited to mix solvents of different origins after use with other solvents or with other substances or residues, particularly those mentioned in Article 2, Paragraph 2 of the Waste Act.

Article 3

Suppliers' Obligation to Take Back Used Solvents

(1) Those who distribute 10 or more litres of solvent over a period of one month to operators of the installations described in Article 1, Paragraph 1 are obliged to take used solvents as described in Article 2, Paragraph 2 back from the operator, or to guarantee that they will be taken back by a third party to be named by the supplier.

(2) The obligation to take back used solvents as referred to in Paragraph 1 relates to the type and volume of the solvent procured, and the other substances or solutions which have been added or which have accumulated in the course of normal use and processing.

Article 4

Declaration on the Use of Solvents

Should operators of the installations described in Article 1, Paragraph 1 avail of the right to return solvent to the supplier in accordance with Article 3, Paragraph 1, they must submit a declaration containing information pertaining to the type and use of the solvent based on the form provided in the annex of this regulation. Article 11, paragraphs 2 and 3 of the Waste Act and the regulations outlined in the Regulation on the Registration of Waste remain unchanged.

Article 5

Labelling

Solvents may only be introduced into circulation in packing drums if these have a clearly visible and legible imprint, stamp or sticker bearing the following words:

"This solvent must be recycled or disposed of correctly after use! If disposed of in an improper fashion it will cause harm to the environment! It is forbidden to mix this solvent with any other substance or solvent after use."

In addition the labelling must also indicate the main constituent of the original product (Article 2, Paragraph 1) and its boiling point (Article 1, Paragraph 2). In the case of loose goods, this information must be provided in the accompanying papers as indicated in sections 1 and 2.

Article 6

Offences

(1) Under Article 18, Paragraph 11 of the Waste Act it is an offence to wilfully or carelessly:

1. a) notwithstanding Article 2, paragraph 1, fail to store separately,
or
b) notwithstanding Article 2, paragraph 2, mix

solvents which must be disposed of after use.

2. Notwithstanding Article 3, paragraph 1, in conjunction with Article 2 fail take back solvents or guarantee that they will be taken back.
3. Notwithstanding Article 4, first section, fail to provide a declaration concerning the type and use of one of the solvents named in section 1, or to do so incorrectly or incompletely.
4. Notwithstanding Article 5, introduce solvents into circulation which do not bear the mandatory label.

(2) Under Article 62, paragraph 1, section 2 of the Federal Act on Environmental Quality it is an offence to wilfully or carelessly

1. a) notwithstanding article 2, paragraph 1 fail to store separately
b) notwithstanding article 2, paragraph 1 mix

solvents which must be recycled after use

2. Notwithstanding Article 4, section 1 fail to provide a declaration stating the nature and use of one of the solvents listed in section 1 or to do so in an incomplete or incorrect manner.

Article 7

Berlin Clause

In accordance with article 14 of the Third Transitory Law in conjunction with Article 31 of the Waste Act and Article 73 of the Federal Act on Environmental Quality, this ordinance is also applicable in the city state of Berlin.

Article 8

Coming into Force

With the exception of Article 5, this Regulation shall come into force on the first day of third month following promulgation. Article 5 shall come into force on the first day of the sixth month following promulgation.

The *Bundesrat* (upper chamber) has approved this Regulation
Bonn, 23 October 1989

Federal Chancellor
Dr. Helmut Kohl

The Federal Minister for the Environment, Nature
Conservation and Reactor Safety
Klaus Töpfer

Declaration on the Type and Use of Solvents

Type of Solvent

.....
.....
.....

The above-listed solvent was used for the following purposes as stated in Article 1, Sections 1 to 4 (see over)

1.
2.
3.
4.
5.

No further solvents, substances or residues were added to the solvent after use.

.....
(company/address) (date) (signature/stamp)

(other side)

Article 1

Scope

(1) This regulation shall apply to solvents which must be recycled or disposed of properly after use and which are used in installations in which:

1. The surface of objects or materials, particularly those made of metal, glass, ceramics or plastic, is cleaned, greased, de-greased, coated, "de-coated", developed, phosphated, dried or subjected to similar treatment.
2. Materials to be processed, particularly textiles, leather, furs, skins, fibres, feathers or wool are cleaned, de-greased, finished, dried or treated in a similar way.
3. Aromas, oils, fats or other substances made from plants, parts of plants, animals or parts of animals, are extracted.
4. Substances, preparations or products are extracted or produced with the help of these solvents.

Need for Extensive Investments in Logistics and Processing Technology in the Near Future

Re-Cycling Halogenated Solvents

Due to limited disposal capacities and rising costs, increasing attention is being paid to recycling of solvents. This aim is promoted in the Waste and Environmental Quality Acts through mandatory recycling regulations. Dr. Wolf Drechsler, Berlin, provides an overview of the current situation.

Due to their suitability for the removal of dirt and their low flammability, volatility and good redistillation properties, halogenated solvents and particularly the volatile chlorinated hydrocarbons (halogenated hydrocarbons - HHC) such as per- and trichloroethylene are used as process substances in almost all industrial and commercial sectors. Important areas of use include the metal-processing and electrical engineering industries where after every stage of processing the surfaces must be cleaned, degreased and dried for further phases of processing and assembly.

Reduction in Volumes of Solvent Used

In 1987 approximately 165,000 tonnes of HHC solvents were used in the Federal Republic of Germany: the results of a survey undertaken by the Federal Environment Agency concerning the areas solvents were used in are shown in the table. Due to cost factors, caused mainly by stricter environmental and labour law requirements concerning the use of HHC solvents, it is expected that there will be a reduction in the amount of solvents used.

In most areas of application the solvents are not part of the product but are used as process substances. After use they become impure solvents, and due to their volatility are at least partially emitted into the environment. A survey of declaration forms for waste subject to registration in the Federal Republic of Germany in 1985 showed that approximately 185,700 tonnes of waste HHC solvents and compounds were produced. In addition to this, a further 80,300 tonnes of distillation residues and sludge containing halogen following secondary treatment were also registered. Some of the solvent waste which can be recycled is not included in these figures, as this has commercial value and is directly reintegrated into the production process.

In-house and External Distillation

The most important method of recycling impure HHC solvents is distillation and this has been undertaken for many years on a commercial scale, both within plants and by external processing companies. For reasons of economic viability, in addition to a minimum volume, plant-intern processing of

solvent also requires that the composition of the solvent and its impurities remain largely consistent so that high-quality regenerated solvent is obtained which can be directly reintegrated into the cleaning process without having to undergo complex separation processes.

In in-house processing the distillation equipment is often integrated into the cleaning installation, and for this reason a straightforward method of atmospheric distillation is usually used. The distillation residues contain an average of 50% HHC solvents.

Due to the repetition of this cycle within the plant, with time the quality of the solvent becomes impaired. Solvents must be tested regularly and stabilisation measures carried out to avoid damage to the cleaning installation.

For external processing the used solvent baths must be changed in good time. External processing is usually undertaken by larger redistillation plants, in part under processing contract, which have a co-ordinated system with separate collection and storage, preliminary cleaning, vacuum (azeotropic) distillation, thin-film evaporation and subsequent rectification (cf. flow chart). Working with high-quality waste input and regeneration analysis, it is possible to produce redistilled solvents (e.g. per) with 99.5% purity compared to the pure product.

Only Half of the Regeneration Capacity Used

Only half of the approximate 100,000 t/per annum regeneration capacity in the Federal Republic of Germany is currently being used; due to the extensive contamination, yields from solvent processing are very low. The measures prescribed by the Regulation on Used Halogenated Solvents - separate storage according to solvent type, the ban on mixing and the obligation for suppliers to take back used solvents - which has been operational since the beginning of 1990 will bring about a considerable increase in the volume of solvents recycled and at the same time relieve the burden on incineration plants for hazardous waste.

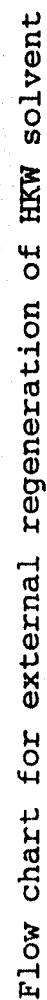
A comprehensive processing concept must also include the recycling of distillation residues with low halogen content and halogen-free solvents, oils and fats. Possibilities here include energy or material recovery, for example in industrial furnaces or hydrogenation installations licensed for this purpose. In the chemicals industry, for example, HHCs with low boiling points recovered from rectification could, due to their high chlorine content, be recycling to produce chlorine or hydrogen chloride as a starting product.

As until autumn 1989 much of the waste halogenated solvent produced in the Federal Republic was incinerated on the North Sea, and the hazardous waste incineration plants currently operational or being planned play a minimal role

in the disposal of these products, a further increase in the volume of HHC solvents recycled can be expected. From an administrative perspective also, the technical requirements concerning the recycling of halogenated solvent residues and waste are currently being standardised for the whole of the Federal Republic of Germany. To this end an administrative regulation on HHC recycling in line with state-of-the-art technology is currently being prepared using information from the individual areas where HHCs are used. The legal basis for this is provided by the Federal Environmental Quality and Waste Acts. These administrative regulations could also provide a technical and legal framework for HHC solvent recycling in the European Community.

Table: Use of HHC solvents according to sectors (1987)

Area of Application	(t/year)	(%)
Metal Greasing and De-greasing	67 150	40.8
Chemical Industry	26 930	16.4
Pharmaceuticals Industry	4 720	2.9
Dry Cleaning	15 420	9.4
Textile Processing	1 720	1.0
Adhesives, Plastics Processing	11 950	7.3
Extraction of Natural Substances	2 940	1.8
Product, Aerosol Formulation	5 440	3.3
Paint Strippers, Removers	13 200	8.0
Other	15 150	9.1
Total	164 620	100.0



Translation from German

AVOIDANCE AND / OR RECYCLING OF

ALUMINUM SALT SLAG (NO. 312 11)

ALUMINUM DROSS (NO. 312 05)

DROSS FINES (NO. 353 17)

1. Sections affected
2. Origin of the residues
 - 2.1. Aluminum salt slag / salt cake
 - 2.1.1. Origin
 - 2.1.2. Quantities and characteristic features
 - 2.2. Aluminum dross
 - 2.2.1. Origin
 - 2.2.2. Quantities and characteristic features
 - 2.3. Dross fines
 - 2.3.1. Origin
 - 2.3.2. Quantities and characteristic features
3. Ways of avoidance and recycling
 - 3.1. Processes Producing minor quantities of Salt Slag
 - 3.1.1. Description and application of the processes
 - 3.2. Internal reprocessing
 - 3.3. External reprocessing
 - 3.3.1. Description of the process
 - 3.3.2. State of art and application
 - 3.3.3. Economic aspects
 - 3.4. Ecological aspects
4. Annex

1. Sections Affected

In the Federal Republic of Germany aluminum is to an increasing extent produced by means of aluminum scrap (secondary aluminum), as this requires much less energy than the production of aluminum on the basis of bauxite. The production of secondary aluminum leads to the residue/toxic waste of aluminum salt slag.

When melting aluminum and aluminum alloys in the course of primary and secondary production as well as processing, e.g. in aluminum foundries, the residues/hazardous wastes of dross and fines containing aluminum are formed.

Unless such residues are utilized due to their high content of metal, they are either stored provisionally in order to reprocess them later, or they are deposited on specialized dumping grounds.

Diagram 1 shows the the quantities of residues in the areas affected, diagram 2 shows the location of major producers of primary and secondary aluminum in the Federal Republic of Germany.

2. Origin of the Residues

2.1. Aluminum Salt Slag/Salt Cake

2.1.1. Origin

For the production of aluminum in refineries scrap is used, that, as a rule, is rendered impure by varnish, plastics, lubricants, etc.. In order to avoid metal oxidation and to absorb impurities, scrap is melted in

rotary furnaces under a molten salt cover. Two thirds of said salt cover are sodium chloride (NaCl) and one third potassium chloride (KCl), its flux additament is fluoride (CaF_2). After the liquid aluminum has been run off from the melter, the molten salt now containing impurities and metallic aluminum - the salt drawn off into steel tubs. After its tapping aluminum salt slag cools down to form ingots. During this process the droplets of metallic aluminum converge to form small or larger lumps.

2.1.2. Quantities and Characteristic Features

The quantity of salt cake formed amounts to about 0.5 t per ton of secondary aluminum produced. Given a present production of about 500,000 t/a of secondary aluminum, this corresponds to an annual quantity of 220,000 to 240,000 t of aluminum salt slag.

Usually 55 - 70 per cent of the salt cake consist of the above-mentioned salt mass, 21 - 40 per cent of oxides, mainly aluminum oxide (Al_2O_3), and 5 - 9 per cent of metallic aluminum. In addition it contains minor shares of other oxides as well as nitrides, phosphides, fluorides, chlorides, and sulphides. The piled weight of fresh lumps approximately amounts to 1.2 t/m^3 . Due to the high content of freely soluble chlorides, the slags are well water-soluble. According to the aluminum content and the impurities absorbed, hydrogen (H_2), methane (CH_4), hydrogen sulphide (H_2S), ammonia (NH_3), and hydrogen phosphide (PH_3) may form, when the slags are dissolved in water.

2.2. Aluminum Dross

2.2.1. Origin

When melting and refining aluminum and aluminum alloys, there are solid to pasty masses of metallic and non-metallic composition assembling on the surface of the molten metal. Their formation is due to the oxidation at the surface and to the precipitation of raffinates, after suitable reagents, e.g. chlorine, have been added to the metal. Such masses are called dross.

2.2.2. Quantities and Characteristic Features

The quantity of aluminum dross varies considerably as a function of the surface oxydation of the molten metals or alloys and the operating conditions. Accordingly, the content of metallic aluminum varies also between 20 and more than 70 percent in weight. So does the composition of oxides and metals as well as small portions of halogenides, nitrides, carbides, etc.. The structure of the dross varies from fine grained/pulverized to solid blocks.

The 40,000 to 80,000 tons of dross containing aluminum, that are annually produced in the Federal Republic of Germany, are valuated according to its content of metal, that may be gained. As a function of the aluminum price there is a market for dross containing about 30 - 35 per cent or more metallic aluminum, that may be recovered. Such dross ranks among typical secondary raw materials with an established import/export market. During the last few years the dross imported amounted to 50,000 to 60,000 t/a, the dross exported to about 10,000 t/a.

The aluminum dross not utilized is at present deposited on dumping grounds.

2.3. Dross Fines

2.3.1. Origin

Major quantities of fines containing aluminum are produced, when dross is reprocessed, i.e. when it has been ground and the metallic aluminum has been screened out. The remainders of this process are then called 'dross fines' or 'ball mill dust'.

Further fines may be produced in the course of processing, grinding, and transporting procedures, as well as in dedusting plants of the aluminum production.

2.3.2. Quantities and characteristic features

The major part of the fines containing aluminum, i.e. the dross fines, consist mainly of aluminum oxide. In addition, they contain, however, salts of cover slags (see 2.1.1.) and refining reagents (see 2.2.1.), and as a rule about 10 per cent of metallic aluminum.

At present they may, to a limited extent, be recycled, e.g. together with aluminum salt slag (see 3.3.1.). The rest is dumped.

3. Ways of Avoidance and Recycling

3.1. Processes Producing Minor Quantities of Salt Slag

3.1.1. Description and Application of the Processes

a) Pretreatment

The quantity of aluminum salt cake and aluminum dross

depends mainly on the impurities contained in the aluminum scrap and the meltings to be refined. The impurities determine substantially the consumption of cover and refining salts, and thus the quantity of residues.

The consumption of molten salts and thus the quantity of residues depend also on the specific surface of the aluminum materials used.

Different salt mixtures - if possible at all - do not result in substantial changes in the salt cake quantities, they may, however, lead to problems, when salt slags are recycled. Appropriate procedures of scrap preparation make it possible to reduce the quantity of salt cake related to a ton of secondary aluminum produced.

At present this is mainly considered for reprocessing chips. Adherent oils are removed either thermally or by washing, before the chips are fed into the rotary furnace. Other impurities of shredder scrap may be separated by adequate float-and-sink stages.

In the case of thermal pretreatment, it is necessary to afterburn the off-gases. When chips are washed, the water should flow in a closed circulation, the oils being separated by means of skimming stages. The oil sludges formed in this process must then be deposited.

There are no pretreatment processes for removing the oxide film from metallic aluminum.

b) Melting Processes Producing Small Quantities of Salt Slag

In the Federal Republic of Germany the secondary aluminum

industry prefers rotary furnaces for melting, as they accept materials with a high degree of impurities under molten salt. In the future it may be possible to apply other melting processes in certain circumstances, namely for the best scrap qualities with little or no impurities.

Induction Furnaces

Chips without impurities which may result from aluminum wrought production are at present melted down without any salt cover in induction furnaces. As a rule crucible furnaces on a power frequency basis are used for this process. Due to their strong circulation of the electrolyte, the scrap is quickly immersed in the melting and is melted down with only minor oxidation losses. Sometimes other types of induction furnaces are used. In that case the scrap must be dipped mechanically, due to only minor circulation of the electrolyte. It seems to be feasible to use such melting processes for scrap with minor impurities, so that only insignificant quantities of molten salt are to be added. There are, however, problems to be expected, as regards the durability of the furnace's preparation. An operation under inert gas cover should also be possible, in order to reduce the oxidation losses.

Open-hearth Furnaces

In the primary aluminum and wrought products industries, too, larger pieces of scrap, mischarges, blocks, and coils, etc., are directly melted down without any addition of melting auxiliaries in fuel-heated open-hearth furnaces. Open-well furnaces or side-well furnaces are mainly used in the U.S.A., in some cases also in the Federal Republic of Germany, for melting down scrap

with insignificant or no impurities, adding only minor quantities of salt. In the case of these open-well or side-well furnaces, the scrap is charged into the open fore-hearth, is then mechanically dipped and melted down. In order to accelerate the melting process, i.e. to reduce the oxidation loss, there are construction methods, which produce a forced circulation between the fore-hearth and the furnace by means of an integrated agitator in the fore-hearth or a liquid metal pump. In the U.S.A. reprocessed and at low temperature carbonized UBC scrap (UBC = used beverage cans) is melted down in such furnaces with minor additions of salt.

Special Processes

Even based on the latest technological developments, it is impossible to do without molten salt, when scrap with a high degree of impurities, especially granules (metal coming from dross reprocessing) with a high content of oxides, is remelted. In the long run the application of modern melting technologies, e.g. plasma melting, may be considered.

There is, however, still much research and development work to be done, as regards the remelting of materials with impurities with minor salt additions.

3.2. Internal Reprocessing

In principle, the salt slag dissolving and crystallization process may be realized by the secondary smelters internally and externally in centralized recycling plants.

3.3. External Reprocessing

3.3.1. Description of the Process

The dissolving and crystallization process is the latest and most advanced process for reprocessing the wastes mentioned above under chapter 2. Aluminum salt slag, poor-grade dross, and dross fines are reprocessed to gain the final products of granulated aluminum, mixed salt, and alumina. Diagram 3 shows the flow chart of the process. The process comprises a 'dry' and a 'wet' stage. In the dry stage the materials are crushed and ground to a grain size of about 1 mm by means of a 7-stage crushing and screening station. The ductile metallic aluminum is only deformed by such measures and may be screened out of the finer slag after each crushing and grinding stage. It is then delivered back to the refineries. In the subsequent part the fine-grained material is leached with warm water of about 65°C in the leaching station. The gases forming in the course of this process must be led to the waste gas purification plant. There are waste gas purification methods available for the dry and wet stages, so that the figures provided by the German regulations of keeping the air clean are complied with. The filter dusts separated by the dedusting devices of the dry stage are again led to the dissolving station together with the sludges from the waste gas washing station in the wet stage. If activated carbon filters are used to purify the waste gases of the wet stage, the filter mass used may be taken back by the manufacturer for regeneration.

The alumina insoluble in the brine may, after the addition of flocculents, be dehydrated, e.g. by means of filter presses, be stripped of rests of the brine by rewashing and separated as a semi-dry material.

The mixed salt is then crystallized from the brine and thereafter dehydrated. 1 to 3 per cent of calcium fluoride is added, if necessary, and the mixed salt is then available for reuse by the secondary smelters.

This process does not produce any sewages.

3.3.2. State of Art and Application

The salt slag dissolving and crystallization process is the latest and most advanced process in this field and is applied on an industrial scale in the Federal Republic of Germany.

The alumina residue produced in the course of salt slag reprocessing has a residual moisture of 25 - 30 per cent and is composed as follows:

Al_2O_3 :	55 - 65 per cent	Fe_2O_3 :	2 per cent
SiO_2 :	8 - 15 per cent	MgO :	4 - 8 per cent
CaO :	1 per cent	TiO_2 :	1 per cent
CaF_2 :	2 - 5 per cent		

99 per cent of it are insoluble in water. Its content of metallic aluminum amounts to a maximum of 1 per cent. The total content of heavy metals relevant to the environment (Cr, Mn, Co, Ni, Cu, Zn, Cd, Pb, As) is 1 - 2 per cent. As elution analyses have shown, the major part of them are, however, in the shape of oxides and thus are insoluble in water.

The alumina residue is at present deposited on dumping grounds. In principle it is possible to recycle it, up to now, however, this has not been realized for economic reasons. Its use in the following fields was examined:

Use for the manufacture of cement products, as addition for the manufacture of ready-mix concrete units, in the heavy clay industry (clay pipes, etc.), in the abrasive industry (aluminum oxide abrasive).

In the Bayer process, it is impossible to use the aluminum residue as a resource for the production of pure aluminum hydroxide, as it contains metallic aluminum and a large amount of calcium fluoride and silicic acid. But if the alumina residue is pretreated, recycling appears to be possible.

Industries requiring very pure alumina, e.g. for the manufacture of highly refractory products and materials of heat insulation, for activated alumina, etc., cannot be taken into consideration, as the alumina residue is not pure enough.

3.3.3. Economic Aspects

a) Recycling Costs

Aluminum salt slags, aluminum dross and dross fines containing aluminum which are not recycled, are to be regarded as hazardous/toxic waste. According to the catalogue of waste categories, salt slags are preferably deposited on underground dumping grounds, dross and dross fines on dumping grounds for hazardous wastes. At present the costs involved exceed already those of recycling according to the latest and most advanced technology. Recycling will become more and more profitable.

b) Market

Thus far recycled products are mixed salt and granulated aluminum. As regards the mixed salt, it is primarily reused in refineries. There is an established market for granulated aluminum.

3.3.4. Ecological Aspects

When getting in contact with water or moist materials, salt slags react by forming gases, mainly hydrogen, but also ammonia, hydrogen sulphide, and hydrogen phosphide. This shows clearly the problems caused by dumping salt slags. In addition, part of the salt content of the slags is dissolved by precipitation, thus increasing the salt content of percolating waters considerably.

Such emissions do not arise when salt slags are re-processed. In addition, the recycling of salt slags saves a lot of valuable room on dumping grounds and also raw materials by recovering molten salt and aluminum making it again available for economic use. Recycling in line with the latest technological process achieves the following targets:

1. Reduction of water-soluble salts (NaCl, KCl) in the rest of the alumina to less than 1 per cent
2. Adherence to the German provisions of keeping the air clean in all reprocessing stages
3. Operation without producing any sewages.

For German secondary smelters foreign recycling alternatives should at least come up to the technology described.

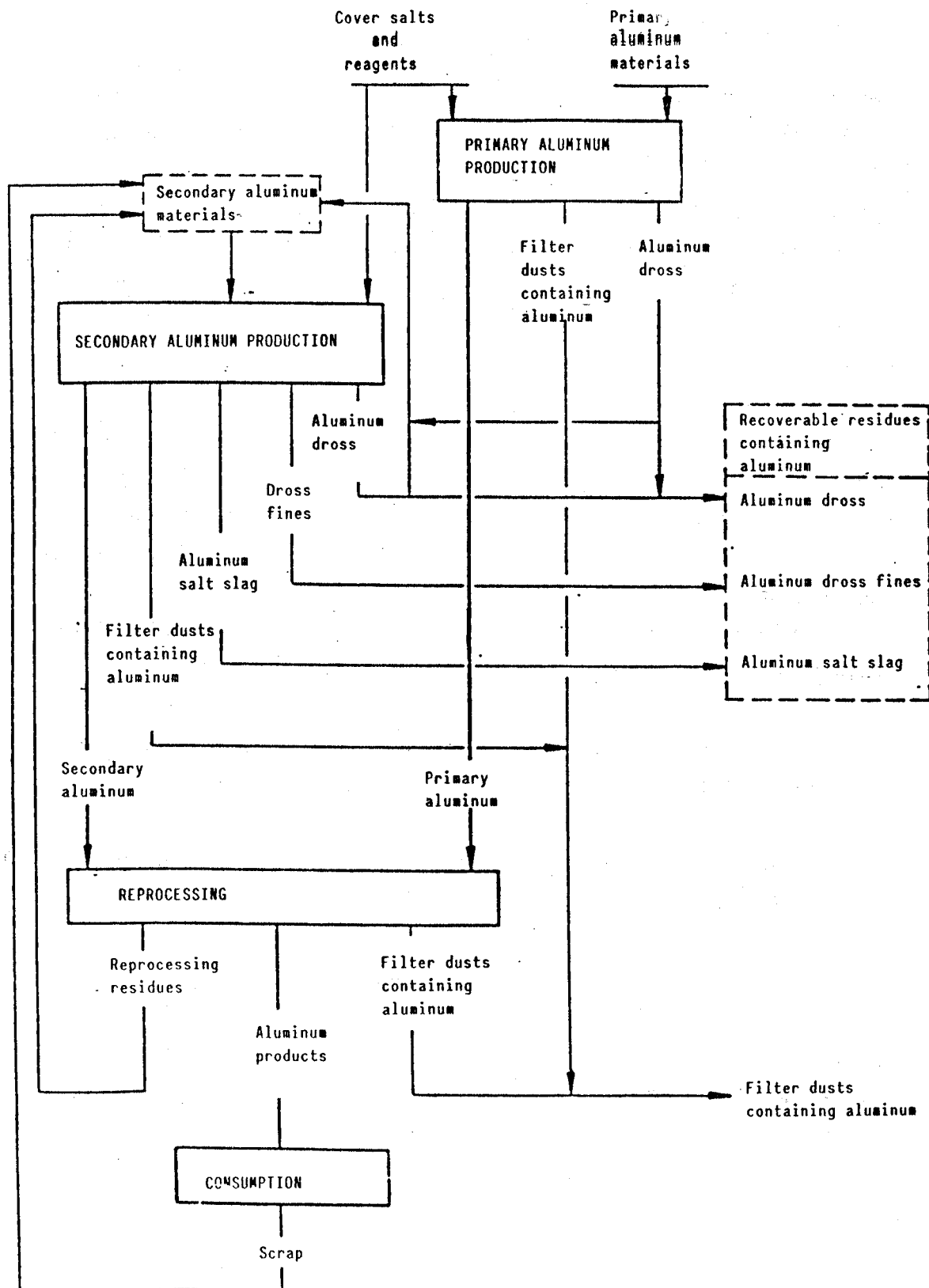
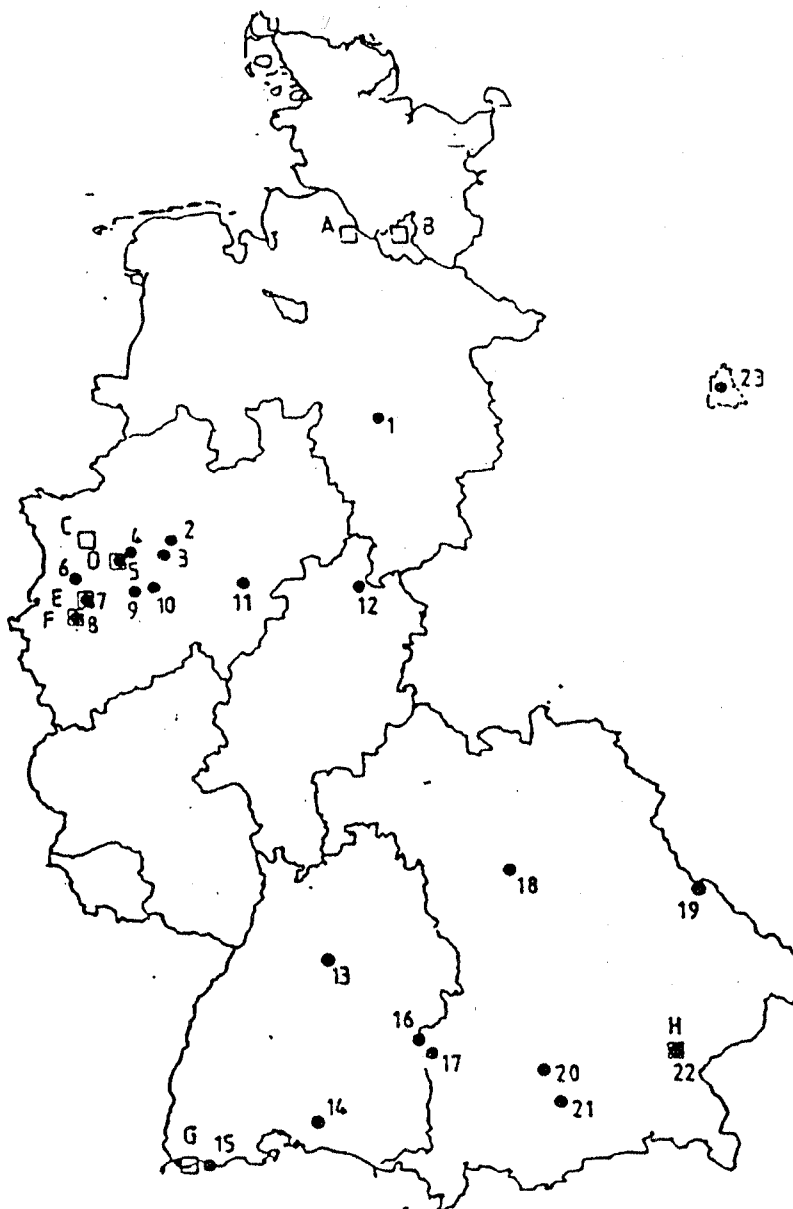


Diagram 1:

ORIGIN OF RESIDUES CONTAINING ALUMINUM



Primary aluminum producers □

A. Stade	C. Voerde	E. Neuss	G. Rheinfelden
B. Hamburg	D. Essen	F. Grevenbroich	H. Töging

Secondary smelters ●

1. Hannover	8. Grevenbroich	15. Bad Säckingen	22. Töging
2. Lünen	9. Wuppertal	16. Neu-Ulm	23. Berlin
3. Dortmund	10. Ennepetal	17. Weißenhorn	
4. Gelsenkirchen	11. Metschede	18. Nürnberg-Fürth	
5. Essen	12. Kassel	19. Fürth i. W.	
6. Krefeld	13. Asperg	20. Fürstfeldbruck	
7. Neuss	14. Stockach	21. Neufahrn	

Diagram 2: Location of major primary aluminum producers and secondary aluminum smelters in the Federal Republic of Germany

May 1989

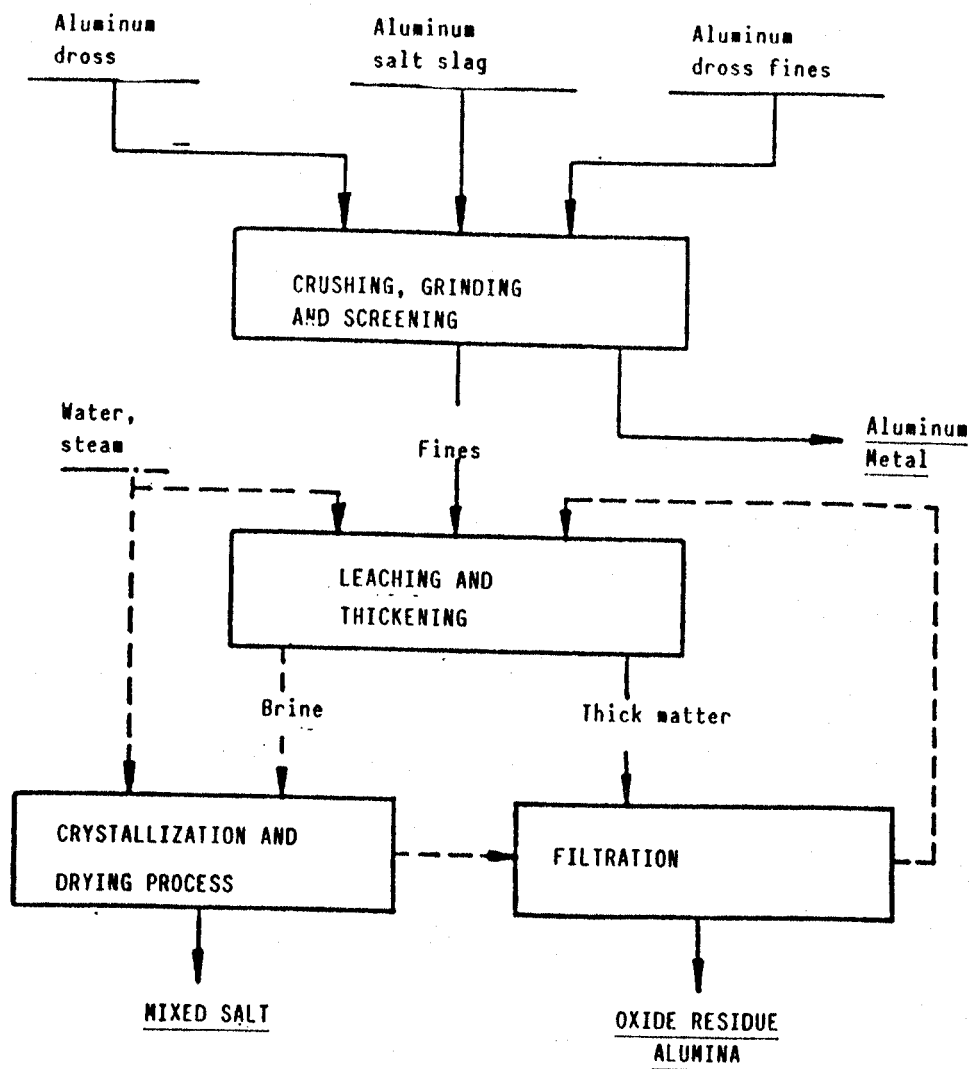


Diagram 3: FLOW CHART OF THE
SALT SLAG DISSOLVING AND CRYSTALLIZATION PROCESS

May 1989

Regulation on the Avoidance of Packaging Waste (Packaging Regulation)

The draft Packaging Regulation, which was passed by the cabinet on 14 November 1990, makes deposits and right of return for packaging mandatory. From 1 January 1993 retail outlets must accept the return of used packaging from retail goods, drinks, washing and cleaning agents and emulsion paint. The retail sector and industry will only be freed from this obligation if they provide facilities for accepting returned packaging and for recycling outside of the public waste disposal services (so-called "dual system of waste management"). Details and criteria for the efficiency of the dual system of waste management are outlined in an annex to the Packaging Regulation. Only when the relevant authorities have established that the requirements concerning the registration and material recycling of packaging set down in the regulation are fulfilled, will an exemption from the obligation to provide deposit and return services be granted for the region in question (*Bundesland* - federal state).

From 1 December 1991 the obligation to accept returns will apply without exemption for transport packaging and from 1 April 1992 for outer packaging.

The following regulations receive individual treatment in the annex to the Packaging Regulation:

- . Energy conversion/recovery will not be allowed as part of the dual system of waste disposal. All substances which are not used for material recycling must be passed on to the responsible disposal authority to be dealt with as commercial waste.
- . From 1 January 1993 to 30 June 1995 a minimum of 50% of all packaging shall be covered by collection and/or return systems. From 1 July 1985 at least 80% will be covered, depending on the material in question.
- . From 1 January 1993 until 30 June 1995, the following minimum sorting quotas must be attained within the dual system of waste disposal: 30% for paper, plastics and laminated material, 60% for aluminium, card and cardboard, 65% for tin plate and 70% for glass. From 1 July 1985 minimum quotas of 90% for glass, tin and aluminium and 80% for the other packaging materials must be reached. The efficiency of material recycling must be demonstrated.

Not unimportant in relation to these quotas is the fact that from 1 July 1995 exemption from the obligation to accept returns will be regulated according to the substance for recycling in question. This means, for example, that if

quotas are not adhered to in the plastics sector, only this sector will face a general obligation to accept returns and it will not apply for the other packaging materials if the relevant quotas are respected.

To protect the existing deposit and return systems it has been laid down that the packaging of beverages will be excluded from this dual system of waste management and the deposit and return system reintroduced if there is a reduction in the current quotas of 17% for milk and an average 72% for beer, non-alcoholic beverages, juices, wine, carbonated and non-carbonated mineral water.

The strict application of the Packaging Regulation and the dual system of waste management will mean that almost all packaging will be removed from household waste and commercial waste which is similar in composition to household waste. Ideally household waste would no longer contain glass, laminated packaging (fibres, aluminium and plastics), tin plate, aluminium, paper, card and plastics. Thus, waste coming from private households will above all contain printed papers (newspapers, magazines), which will also be subject to control under a paper regulation currently being prepared, and household waste suited for compost to which the regulations outlined in the Technical Instructions for Household and Commercial Waste (TA Siedlungsabfall) are to be applied.

German Packaging Decree

(excerpts concerning alternate collection system)

November 14, 1990

Annex to § 6, para. 3

The competent authority shall deliver the confirmation referred to in § 6, para. 3 if the following requirements are satisfied:

I. General requirements

It must be ensured by means of appropriate systems that packaging is collected from households (collection systems) or is collected in the vicinity of households using skips or other suitable receptacles (bring-and-leave systems) or by a combination of both systems, and is then sorted and the materials recycled. The following quotas must be achieved:

- the collection quotas specified in Section II
- the sorting quotas specified in Section III
- the recycling quotas specified in Section IV.

Sorting residues which are unsuitable for materials recycling are to be handed over to the public waste disposal utility as trade waste.

Only materials which

- cannot be separated into materials recycling fractions by manual or mechanical sorting methods,
- are soiled or contaminated by substances other than the original package contents or by foreign substances,
- are not packaging components

shall be regarded as sorting residues which are unsuitable for materials recycling.

II. Quantitative targets for collection systems

Evidence must be produced that, as an annualised average, within the catchment area (§ 3, para. 4) of the applicant, at least the following percentages of the total volume of packaging materials generated within the catchment area, expressed in % by weight, have actually been collected:

On 1 January 1993

Material

Glass	60%
Tinplate	40%
Aluminium	30%
Board	30%
Paper	30%
Plastics	30%
Composites	20%

In the period between 1 January 1993 and 30 June 1995 the quotas specified for the individual packaging materials shall be deemed to have been met if at least 50% of the total volume of packaging materials generated is actually collected.

After 1 July 1995 evidence must be produced that the following percentages are being achieved:

Material

Glass	80%
Tinplate	80%
Aluminium	80%
Board	80%
Paper	80%
Plastics	80%
Composites	80%

At three yearly intervals, commencing not later than 31 August 1991, the Federal Government shall publish in the *Bundesanzeiger* [Federal Gazette] the average volume of used packaging per inhabitant, based on appropriate data, broken down by packaging materials and per capita consumption.

Evidence of the percentages actually collected is to be provided by the applicant by 1 March in 1993 and 1994 and by 31 December of each year from 1995 onwards, on the basis of the population statistics for the catchment area (§ 3, para. 4) and the per capita volume of used packaging published by the Federal Government.

III. Quantitative targets for sorting plants

At least the following percentages by weight of the undermentioned materials, of materials recycling quality, must be recovered, on annual average, from the packaging collected in the catchment area (§ 6, para. 4):

Material	on 1 January 1993	on 1 January 1995
Glass	70%	90%
Tinplate	65%	90%
Aluminium	60%	90%
Board	60%	80%
Paper	60%	80%
Plastics	30%	80%
Composites	30%	80%

Evidence, in a form capable of verification, of the achievement of the recovery targets is to be provided by the applicant by the dates specified in Section II.

IV. Materials recycling targets

The materials recovered in accordance with Section II are to be recycled. The applicant must provide evidence, in a form capable of verification, by the dates specified in Section II, that the recovered materials are being recycled to the greatest possible extent.

Contract Between Duales System Deutschland and
Users of the Green Dot Symbol

**CONTRACT CONCERNING THE USE OF
THE "GREEN DOT" SYMBOL**

between

Duales System Deutschland
Gesellschaft für Abfallvermeidung und Sekundärrohstoff-
gewinnung mbH (hereinafter referred to as "Duales System
Deutschland GmbH")

and

.....
(hereinafter referred to as the "Symbol User")

In order to realize the government's aims as regards the avoidance and minimization of refuse, the firm of Duales System Deutschland GmbH is organizing the establishment and operation of the private-enterprise sector of the "Dual Refuse Disposal System" in the Federal Republic of Germany. The sales of packaging materials covered by this Dual System are to be identified by the "Green Dot" Symbol.

The firm of Duales System Deutschland GmbH holds the exclusive rights to the use of the "Green Dot" Symbol. The Symbol User is interested in incorporating particular sales of packaging materials into the Dual System and, for this reason, wishes to acquire the right to use the "Green Dot" Symbol.

To this end, the contracting parties conclude the following Contract for use of the Symbol :

1. Use of the Symbol

- a) The Symbol User is entitled to use the "Green Dot" Symbol shown in Appendix 1 to this Contract to identify, on the sales of packaging described, the product described below. Through this agreement, the sales of packaging concerned is incorporated into the system for collecting used packaging materials at or near the household, which is to be established and organized by Duales System Deutschland GmbH.
- b) The Symbol User is not entitled to transfer the right granted to it for use of the Symbol to a third party, without the prior consent in writing of Duales System Deutschland GmbH.

c) Description of the product, including the sales packaging :

(1) Brand name / trade name of the product :
.....

(or list of products as Appendix 2 or data carrier
3.5" Lotus 1-2-3 Version 2.2 or higher)

(2) Product description of good contained in packaging
.....

(3) Volume of filled packaging : Pfennig/piece

() under 50 ml / under 3 g	0
() 50 - 200 ml	1
() over 200 ml - 3 l	2
() 3 l - 30 l	5
() over 30 l	20

(4) Packaging group :

() glass
() tinfoil
() aluminium
() cardboard, pasteboard, paper
() plastic
(tick as appropriate, with material combinations
tick more than once)

(5) Type of closure (if of different material group to
rest of packaging) :
.....

d) The Symbol User undertakes to provide on demand three
specimen copies of the sales packaging described.

2. Guarantee of collection and recycling

It is hereby guaranteed that, for the period of validity of
this Agreement, the packaging materials designated above
will be collected from the sorting and/or collecting points
which Duales System Deutschland GmbH appoints, and that the
packaging materials thus collected will be recycled in
accordance with the legal provisions regarding
environmental protection. This guarantee is confirmed by
the declaration

of

(Written declaration of firm giving guarantee as Appendix
3, if not already presented to Duales System Deutschland
GmbH)

3. Use of the "Green Dot" Symbol

- a) The Symbol must be displayed on the sales packaging in such a way it is clearly visible to the ultimate consumer, in accordance with the specimen (Appendix 1). The colour "green" must be used and the diameter of the Symbol must be at least 10 mm. The Symbol can be displayed additionally in another colour or imprint.
- b) The Symbol may be used only for the product described above, including the sales packaging concerned. If the Symbol is used for advertising or other purposes, the Symbol User must ensure that it is employed only in connection with the product which is the subject of this Contract.

4. Declaration of number of pieces

- a) In the first accounting year beginning on (date), the Symbol User intends to display the Symbol on (number of pieces) pieces of sales packaging (finished packaging) of the type described above and to sell them in the territory of the Federal Republic of Germany.
- b) The Symbol User undertakes to inform Duales System Deutschland GmbH, within six months from the end of the accounting year, of the number of pieces of the sales packaging concerned that were actually sold in the territory of the Federal Republic of Germany and of the number of pieces of sales packaging expected to be sold in the following year. The figures regarding the number of pieces actually sold can be given within a tolerance of 5 %.
- c) If there is reasonable ground to doubt the reliability of the figures given for the actual number of pieces of sales packaging sold, documentary proof of the figures given must be provided on the demand of Duales System Deutschland GmbH. The Symbol User promises that it will enable suitable checks to be carried out by a firm of auditors retained by Duales System Deutschland GmbH.

5. Financing fee

- a) For the period of validity of this Contract, the Symbol User will pay to Duales System Deutschland GmbH, in accordance with the Fee Table (1 c3), a fee of DM, plus Value Added Tax, for the number of pieces of sales packaging (finished packaging) expected to be sold according to the figures given under Clause 4 a) and b) of this Contract. This results in an annual fee of
.....DM plus VAT

- b) If the annual fee amounts to less than 10 000 (ten thousand) DM, it must be paid in full on the first day of the seventh month after the coming into force of this Contract.
- c) If the annual fee amounts to less than 120 000 (one hundred and twenty thousand) DM, one quarter of the total amount must be paid on the first day of the second, fifth, eighth and eleventh months after the coming into force of this Contract.
- d) If the annual fee amounts to 120 000 (one hundred and twenty thousand) DM or more, one twelfth of the total amount must be paid on the 15th day of each month.

6. Accounting

- a) If, during the accounting year, the Symbol User has sold in the territory of the Federal Republic of Germany a larger number of pieces of the product designated above than is indicated under Clause 4 of this Contract, the Symbol User must settle the outstanding fees with six months from the end of the accounting year.
- b) If the Symbol User informs Duales System Deutschland GmbH that during the accounting year it has sold, in the territory of the Federal Republic of Germany, a lower number of pieces of the product designated above than is indicated under Clause 4 a) and b) of this Contract, Duales System Deutschland GmbH will deduct the overpayment from the fee payable for the following year or will repay the amount overpaid within six months of receiving the information.

7. Use of the fees

Duales System Deutschland GmbH will use the fees levied exclusively and directly for the purposes laid down in the Partnership Contract, in particular for the organization and operation of the privately financed sector of the dual refuse disposal system in the Federal Republic of Germany.

8. Period of validity and termination of the contract

- a) The Contract is valid for a period of one year, beginning on The Contract is automatically extended for further one-year periods if it is not terminated in writing at least two months before the end of the period of validity.

- b) Duales System Deutschland GmbH undertakes to give notice of any change in the fee rates for the subsequent year at least three months before the end of the period of validity of the Contract. If the Symbol User, after having been punctually informed of the change in fee rates, does not terminate the Contract, the changed fee rates become part of this Contract.
- c) The Symbol User is entitled to an extraordinary termination of the Contract if it ceases to sell the product concerned in the territory of the Federal Republic of Germany.
- d) Duales Ssystem Deutschland GmbH is entitled to an extraordinary termination of the Contract if the Symbol User, despite having been warned, fails to pay the fees to which it is contractually obliged ; or if it can be shown that the Symbol User has deliberately made untrue statements regarding the actual number of pieces of sales packaging sold ; or if the collection and recycling guarantee for the packaging material concerned has been breached in a serious manner.
- e) Duales System Deutschland GmbH is also entitled to an extraordinary termination of the Contract if the packaging concerned, as a result of adhering remnants of the good contained, causes serious disruption to the operation of the collecting or sorting system.
- f) After termination of the Contract, the continued use of the Symbol is not permitted, either for identification or for advertising. This does not apply to products still on sale.

9. Confidentiality

Duales System Deutschland GmbH undertakes to treat the information communicated to it during the performance of this Contract as confidential and to pass it on to third parties only where this is absolutely necessary for legal reasons.

10. Seat of the court having jurisdiction

For all disputes arising out of this Contract the seat of the court having jurisdiction shall be the city of Bonn.

Symbol User

Duales System Deutschland GmbH

.....
(place, te, signature)

.....
(place, date, signature)

**COMPARISON OF GOVERNMENT ACTION WITH RESPECT TO PACKAGING
WASTE IN 16 EUROPEAN COUNTRIES**

A brief literature study

**DHV Environment and Infrastructure
Amersfoort, The Netherlands
April 1991**

INTRODUCTION

In this desk study, a brief inventory is made of current policy and measures with respect to reduction of packaging waste in 16 European countries (all EC countries and Austria, Switzerland, Norway and Sweden). The aim was to give a representative overview of relevant policy data, not to be as exhaustive as possible. All 16 countries are described in a sheet (except Luxembourg where no information was available). Also, two tables are included with summary information on 1) applied policy instruments and 2) reuse/recycling.

The following remarks apply:

- Only recent information is consulted. However, since developments are rapid, some data may already be outdated. No additional information by oral consultation of civil servants could be gathered within the very limited time.
- National statements and measures with an official status (i.e. legislation, nation-wide voluntary agreements) are included, as well as decisions recommendations of the Nordic Council. Inofficial policy intentions are also included where information available. Unilateral initiatives have been left out.
- Measures such as subsidized actions, public information, setting up of waste statistics are not included, as well as measures that are in study but have not been officially proposed.

Sheets of all countries are divided in the following sections.

Bans and obligations:

Bans of products and materials according to national legislation and voluntary agreements. Obligations for activities of economic operators with respect to packaging waste. (Bans with respect to recyclability are usually included at "hazardous substances").

Deposits:

Several systems of mandatory deposit-return systems are included.

Recycling and re-use:

Additional information on national measures with the purpose to encourage or enforce reuse of complete packagings and recycling of packaging materials. Re-use is understood as the re-application of materials in the same function. Energy recycling is usually not included in "recycling".

Taxes:

Included are government taxes (charges) on packagings or on other unities with the principle aim to finance packaging waste reduction and to discourage waste production. Not included are taxes on general waste production and on the use of virgin materials. Regulatory levies are introduced with the specific intention to discourage certain packagings or materials (all funds are returned to the economic sector).

Prevention:

Measures with the aim to reduce the amount of packaging per amount of product.

Hazardous substances:

Standardization of packagings and materials are an important issue in this context. No standardization agreements are yet found, however, except in Denmark. However, measures to reduce toxic substances in packaging with the aim to enhance the possibilities of collective collection systems and re-use or recycling systems, or to guarantee safe disposal, are often under consideration.

Legal framework:

Laws and other formalized agreements of the government with operators.

Official targets:

Quantitative national policy declarations, with and without final parliament confirmation. However, the data must be looked upon with care, since they may be based on different statistical methods.

As far as the organizational aspect of collection and reuse/recycling of packaging waste, some countries (Netherlands, Germany, France) consider the introduction of obligatory taking-back of used packagings by retailers. Reactions of industry however seem negative on this point. In Germany, where the Bundesrat agreed with the "Verpackungsverordnung" on 19 April, industries are on their own initiative setting up a separate collection system. Also different strategies are applied on the choice of separate collection or sorting of mixed wastes.

COUNTRY:

AUSTRIA

- BANS AND OBLIGATIONS:** - under consideration: labelling system of food packaging
- DEPOSITS:** - mandatory deposit system for refillable beverage packagings made out of plastics (4 shillings (US\$ 0.37))
- RECYCLING AND RE-USE:**
- TAXES:**
- PREVENTION:**
- HAZARDOUS SUBSTANCES:** - under consideration: classification system of problematic substances
- under consideration: ban on PVC in packaging
- LEGAL FRAMEWORK:** - under the Federal Waste Management Law (1990), the government may issue decrees (ordinances) in the areas of waste minimization and recycling. Two are now issued on packaging waste
- OFFICIAL TARGETS:** - beverage packagings, ultimately by: dec 31, 1993: 90% for beer and mineral water, 80% for non-alcoholic beverages, 40% for fruit juice and fruit drinks.

COUNTRY:	DENMARK¹
BANS AND OBLIGATIONS:	- ban on non-refillable packagings for beer and soft drinks. Containers must be officially approved. Non-refillable non-metal containers exceeding a limit of 300,000 l per manufacturer per annum are excluded, as well as in the context of operations carried out by foreign manufacturers, in order to test the market
DEPOSITS:	- mandatory deposit for beer and soft drink packagings and some alcoholic drinks such as wine
RECYCLING AND RE-USE:	- only refillable containers are permitted which have a planned return system that guarantees efficient re-use - Nordic Council: possible development of an inter-Nordic return system for packaging materials
TAXES:	- regulatory levy on beverage containers (DKK per container: bottles and containers of glass and plastic 10-60 cl: 0.50; id. 60-106 cl: 1.62; id. larger: 2.24; metal cans: 0.80; folding boxes 10-60 cl: 1.90; id. larger: 1.90; milk cartons larger than 10 cl: 0.10) (1977, 1988) - charges on beverage containers are levied at the producer and therefore a reusable packaging is charged only once (effectiveness under investigation)
PREVENTION:	- Nordic Council: reduction in the volume of packaging to be marketed by 15% in 2000
HAZARDOUS SUBSTANCES:	- elimination of PVC and other harmful materials
LEGAL FRAMEWORK:	- statutory orders on beverage packaging (1977, 1982) - under consideration Nordic Council: development of guidelines for environmental assessment of packaging
OFFICIAL TARGETS:	- action programme Nordic Council of Ministers is being prepared, with possibly: 1) reduction of volume packaging waste of 15% by 2000; 2) an increase in the rate of recyclable packaging to 75% in the field of beverage containers, and to 25% in the field of detergent packaging by the year 2000; 3) a target of 80% for recovery of packaging materials by 2000

¹N.B. Formally the Danish government is free to have other views than the Nordic Council

COUNTRY:	BELGIUM
BANS AND OBLIGATIONS:	- Brussels region: under consideration: labelling of refillable packagings; ban on commercials for packaging that is not recyclable
DEPOSITS:	- glass bottles of beer and drinks
RECYCLING AND RE-USE:	- Flemish region: a general voluntary agreement is in force with industries to set-up a private company for the collection, sorting and recycling of all packaging wastes - Wallonia: collection and recycling of plastic waste and aluminium cans is being set up - introduction of an identification method for recyclable wastes
TAXES:	- financial contributions of industries to recycling
PREVENTION:	- first priority official policy Flemish region
HAZARDOUS SUBSTANCES:	- maximal reduction of harmful metals and other substances within 5 years
LEGAL FRAMEWORK:	- voluntary agreement Flemish region: Basic Agreement on Prevention, Re-use and recycling of packaging waste (Agreement of public and private sector, 1990), (on financial contributions of industries for re-use and recycling measures of packaging)
OFFICIAL TARGETS:	- all packagings reduction up to 25%

COUNTRY:

GERMANY

BANS AND OBLIGATIONS:

- obligation for retailers to accept returned packaging (unless industry establishes alternative systems). Categories: packaging used in transportation (pallets, corrugated containers, etc.) (effective: December 1, 1991), secondary packaging (blister packs, tamperproof packaging, films, exterior cartons) (effective: April 1, 1992), and primary packaging (effective: January 1, 1993)

DEPOSITS:

- 0.50 DM on plastic beverage containers (a.o. PET bottles) (temporarily voluntary deposit)
- mandatory deposit on glass beverage containers
- under consideration: deposits of 0.50 DM for virtually all containers for liquids (beverages, soaps, detergents, paints)

RECYCLING AND RE-USE:

- industry required to use at least the current level of returnable (refillable) containers. (For beer, carbonated and non-carbonated water, soft drinks, fruit juice, and wine, this level is 72%. For milk, it is 17%) Industrial collection systems required to actually sort and recycle at least the above mentioned percentage, if not successful with "penalties" like deposits and an acceptance obligation
- a scheme is being established by the packaging industry ("Dual System", a private corporation: collection of packaging marked with a green dot is assured. Financing will be provided by licensing fees that permit use of the green dot. Recycling is assured within requirements of the government decree)

TAXES:

- contributions of industries are asked in the "Dual system", average 0.02 DM per packaging unit (collection). Recycling will be financed by the relevant economic sector itself

PREVENTION:

- first policy priority (refilling second, recycling third)

HAZARDOUS SUBSTANCES:

LEGAL FRAMEWORK:

- a regulation is proposed for the reduction of all packaging waste (Verordnung über die Vermeidung von Verpackungsabfällen)

OFFICIAL TARGETS:

- 1993: at least 50% of all packagings must be recovered; 1995: 80% of all glass, paper, metals, plastic and mixed packagings must be recovered.

COUNTRY:

FRANCE

BANS AND OBLIGATIONS:

- special arrangements are required of large consumers of beverages only to be supplied with returnable containers (1979; successful)

under consideration:

- a prohibition of landfilling or incineration of non-domestic packaging without energy-recovery
- ban on landfilling or destroying of secondary packaging
- importers, producers and distributors to assure recycling of printed materials and packaging in domestic waste, either directly or by paying municipalities to collect and sort the material
- obligatory taking-back of food packaging (not included collection systems and recovery set up by industry on its own initiative)

DEPOSITS:

- glass containers for beer and soft drinks

RECYCLING AND RE-USE:

- efforts directed towards recycling of all containers of wine, milk, water, beer, soft drinks, edible oils, alcoholic beverages, fruit juices: voluntary measures.
- the wine and spirit packaging industry has warned that use of refillable packagings should not be forgotten

TAXES:

PREVENTION:

HAZARDOUS SUBSTANCES:

LEGAL FRAMEWORK:

- five voluntary agreements with operators concerning containers made from glass, plastic, cardboard, aluminium and tinfoil, lastly renewed in 1988, involving voluntary measures to be established by economic operators for each material in cooperation with local authorities

OFFICIAL TARGETS:

- the products mentioned at 're-use and recycling' should have decreased by 40% as percentage of domestic waste from 1979 to 1984. Targets for recycling were: 45,000 tonnes per year of glass, 10,000 tonnes per year PVC. These goals have largely been met and no new targets are set, although only 38% of all glass containers (and almost no other materials) are recovered. No new targets have yet been set

COUNTRY:

IRELAND

BANS AND OBLIGATIONS:

- under consideration: banning of the sale of beer in metal cans. Objections by the EC have however retarded developments

DEPOSITS:

RECYCLING AND RE-USE:

TAXES:

PREVENTION:

HAZARDOUS SUBSTANCES:

LEGAL FRAMEWORK:

OFFICIAL TARGETS:

COUNTRY:

GREECE

BANS AND OBLIGATIONS:

DEPOSITS:

RECYCLING AND RE-USE:

- pilot project for collecting and recycling aluminium containers is carried out successfully by the concerned economic sectors

TAXES:

PREVENTION:

HAZARDOUS SUBSTANCES:

LEGAL FRAMEWORK:

- intentions are declared of a programme to increase overall public awareness

OFFICIAL TARGETS:

- a programme has been set up in response to the EC directive of June 1985

COUNTRY: NETHERLANDS

BANS AND OBLIGATIONS: - under consideration: pictogram for refillable containers and taking-back obligation of packaging industry with a view at separate collection/sorting

DEPOSITS: - under consideration: mandatory deposit for glass beverage containers
 - mandatory deposit of Dfl 1 on refillable PET
 - "return premiums" of Dfl 1 (US\$ 0.6) on non-refillable PET (mineral water, other soft drinks)
 - under consideration: "return premium" on plastic shopping bags

RECYCLING AND RE-USE: - projects are directed toward plastics, metals, paper/wood, glass, and an integration subproject. Discussions are continuing with concerned parties with respect to these five groups
 - PET bottles are returned with a high return rate. The PET one way bottle has virtually disappeared
 - DSM corporation will recycle plastics as a.o. food containers and other purposes (drink containers not allowed yet)

TAXES: - a regulatory levy on non-recyclable packaging materials is in study.

PREVENTION: - main official policy target (recycling second). Industrial efforts are under consideration to reduce unnecessary (secondary) packaging and harmful substances

HAZARDOUS SUBSTANCES: - PVC as a component of packaging materials is largely being replaced on a voluntary basis
 - a voluntary agreement is prepared to ban all harmful materials. A catalogue of measures is being prepared

LEGAL FRAMEWORK: - several voluntary agreements in preparation. If necessary other legislation will be introduced

OFFICIAL TARGETS: - decrease of total annually packaging waste from 2 million tons (1986) to 1.8 million tons (2000)
 - recycling rate remaining packagings from 25% (1986) to 60% (2000)
 - removing harmful materials such as heavy metals and PVC in packagings
 - no packaging waste landfilled in 2000

COUNTRY:

ITALY

BANS AND OBLIGATIONS:

- plastic bags must be of a dimension enabling it to be used subsequently as a garbage bag and must carry a statement indicating this possibility

DEPOSITS:

RECYCLING AND RE-USE:

- beverage packaging industry is officially required to create 'consortiums' for the recycling of glass, metal and plastic containers

TAXES:

- tax of 100 lira (US\$ 0.09) on plastic shopping bags (1989). An EC study pointed out that the price of plastic bags tripled and consumption fell 40%
- industries are required to pay for separate collection of beverage containers
- under consideration: taxes on materials used in the manufacture of containers (10% for bottle resins)
- if recycling targets are not successful (40% end '92) a tax will be introduced (100 lira/l)

PREVENTION:

HAZARDOUS SUBSTANCES:

- efforts at harmonization are organized by consortia which specialize in materials and group together all economic operators involved from producers to authorities and recyclers

LEGAL FRAMEWORK:

- several measures with respect to packaging waste, a.o. the recycling of beverage containers (law no. 475 (in force 1988)

OFFICIAL TARGETS:

- targets for recycling of beverage containers in 1993 (ranging from 40% for plastic containers and laminated board to 60% for glass and metal). Energy recovery is allowed up to 50% of total recovery

COUNTRY:

PORTUGAL

BANS AND OBLIGATION:

DEPOSITS:

- a deposit-refund system is applied to glass beverage containers and is under consideration for metal cans

RECYCLING AND RE-USE:

TAXES:

PREVENTION:

HAZARDOUS SUBSTANCES:

LEGAL FRAMEWORK:

OFFICIAL TARGETS:

- a programme is prepared in response to the EC directive of june 1985 but no firm objectives are set yet

COUNTRY:	NORWAY²
BANS AND OBLIGATIONS:	
DEPOSITS:	- mandatory deposit and refund system on beverage packaging (beer, other alcoholic beverages and soft drinks)
RECYCLING AND RE-USE:	- under consideration Nordic Council; development of an inter-Nordic return system for packaging materials
TAXES:	- charge on all disposable containers of carbonated drinks and all glass bottles (3.5 Krone per container) except cardboard and milk packaging - a levy on plastic beverage containers of fizzy drinks (3.15 Krone) has not been very successful in reduction of their share in the market
PREVENTION:	- Nordic Council; reduction in the volume of packaging by 15% in 2000
HAZARDOUS SUBSTANCES:	- elimination of PVC and other harmful materials
LEGAL FRAMEWORK:	- under consideration Nordic Council; development of guidelines for environmental assessment of packaging
OFFICIAL TARGETS:	- action programme Nordic Council of Ministers is being prepared, with possibly: 1) reduction of volume packaging waste of 15% by 2000; 2) an increase in the rate of recyclable packaging to 75% in the field of beverage containers, and to 25% in the field of detergent packaging by the year 2000; 3) a target of 80% for recovery of packaging materials by 2000

²N.B. Formally the Norwegian government is free to have other views than the Nordic Council

COUNTRY:	SWEDEN³
BANS AND OBLIGATIONS:	<ul style="list-style-type: none"> - a ban on PVC is under consideration - retainers require legal permit in order to sell returnable PET bottles
DEPOSITS:	<ul style="list-style-type: none"> - mandatory deposit on beverage packaging (metal and glass, beer and soft drinks, and 75% of all wine and liquor containers (1 SKr)). Also on crates - deposit-refund system experiment for metal containers and PET bottles successful in Gotland
RECYCLING AND RE-USE:	<ul style="list-style-type: none"> - bottles are returned to redemption centres, not to retailers. Despite a relatively low deposit, and a small number of redemption centres, a return rate of 79% was achieved in 1988 - Under consideration Nordic Council: development of an inter-Nordic return system for packaging materials - under consideration: re-use of all beverage containers
TAXES:	<ul style="list-style-type: none"> - charge on disposable containers of carbonated drinks (3.5 Krone per container)
PREVENTION:	<ul style="list-style-type: none"> - Nordic Council: reduction in the amount of packaging by 15% in 2000
HAZARDOUS SUBSTANCES:	<ul style="list-style-type: none"> - under consideration Nordic Council: banning of PVC and other harmful materials
LEGAL FRAMEWORK:	<ul style="list-style-type: none"> - Nordic Council: possible development of guidelines for environmental assessment of packaging - voluntary agreement of government and packaging industry to cease applying PVC for packaging manufactured in Sweden (70% of sold PVC packaging) - draft law for re-use of all beverage containers (in force June 1991) - regulatory instruments are being prepared to encourage return systems and recycling
OFFICIAL TARGETS:	<ul style="list-style-type: none"> - action programme Nordic Council of Ministers is being prepared, with possibly: <ol style="list-style-type: none"> 1) reduction of volume packaging waste of 15% by 2000; 2) an increase in the rate of recyclable packaging to 75% in the field of beverage containers, and to 25% in the field of detergent packaging by the year 2000; 3) a target of 80% for recovery of packaging materials by 2000

³N.B. Formally the Swedish government is free to have other views than the Nordic Council

COUNTRY:

SPAIN

BANS AND OBLIGATIONS:

DEPOSITS:

RECYCLING AND RE-USE:

TAXES:

PREVENTION:

HAZARDOUS SUBSTANCES:

LEGAL FRAMEWORK:

OFFICIAL TARGETS:

- Spain has in response to the EC directive of June 1985 drafted a programme of measures relating to the various container materials, but no fixed targets are set

COUNTRY: SWITZERLAND

BANS AND OBLIGATIONS:

- bans on plastic containers that do not meet standards for five hazardous substances
- all beverage containers must be either refillable or recyclable
- under consideration: ban on all PVC in packaging, to be in force November 1991

DEPOSITS:

- if recycling targets are not met in 1993, deposits will be introduced of at least 20 centimes for small containers and at least 50 centimes for containers larger than 0.61 litres

RECYCLING AND RE-USE:

TAXES:

- a tax for the financing of the anticipated disposal of waste is proposed on a.o. disposable beverage cans
- a regulatory levy on all PET bottles

PREVENTION:

HAZARDOUS SUBSTANCES:

- bans on plastic containers that do not meet standards for five hazardous substances (lead, cadmium, bromine, fluorine and chlorine)

LEGAL FRAMEWORK:

OFFICIAL TARGETS:

- recycling rates of about 90% for glass, metal and plastic beverage containers in 1993

COUNTRY: UNITED KINGDOM

BANS AND OBLIGATIONS:

DEPOSITS:

RECYCLING AND RE-USE:

TAXES:

PREVENTION:

HAZARDOUS SUBSTANCES:

LEGAL FRAMEWORK:

- a programme of measures was proposed by the government which encompasses glass, plastic, cardboard and metal containers. This action programme does not entail any formal commitment

OFFICIAL TARGETS: