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Journal of Power Sources 57 (1995) 23–26

JOURNAL OF POWER SOURCES

General overview of battery waste management in Japan

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Abstract

Used dry battery recycling in Japan began under the bilateral proposition issued by the Ministry of Health and Welfare. Although there is no problem even if used dry batteries are treated after being mixed with general house hold garbage, the Government takes care of establishing a system to transport and treat them. The project which was organized by the Ministry in 1986 seems to function fairly well for the time being, in spite of the criticism by the press at that time that the Ministry act was rather opportunistic. This paper outlines the brief history and the present status of the used dry battery collecting and treating system in Japan.

Keywords: Battery waste management; Japan

1. Introduction

On 23 March 1984 the Japanese Ministry of Health and Welfare released a document which was the report to the Minister by the Inquiry Committee for the Living Environment.

In short it said, "Household dry batteries are harmless even if treated as general garbage, i.e. they can be safely land-filled or incinerated together with household garbage without any special care". This document was called later on by the press 'The Ministry's Safety Declaration of Used Dry Batteries'.

In more in detail it said:

Used household batteries (UDBs) mixed in with general household garbage are not problematic in terms of living environment protection since: (i) the mercury in waste water being discarded from municipal treatment facilities (incineration plants and land-fill sites) is under the control of the 'Waste Disposal and Treatment Act' and the 'Water Contamination Prevention Law'; (ii) the mercury now being emitted from incinerator stacks is not under such circumstances a special problem in the light of its diffusion in the atmosphere.

Furthermore, taking into consideration that the mercury contained in an alkaline battery now being produced is decreasing rapidly, and the foresight that the collection of button-type mercury cells after use and treatment thereof is being conducted, the present status of affairs may further be secured. Therefore, special measures should not be necessary providing the existing rules are observed. (At the time of writing the collection rate of mercury cells is less than 10%, quite contrary to the optimistic expectation of the Battery Manufacturers Association. The collection system should have worked effectively according to their prediction in that button-type mercury cells were used in very special area such as photographic equipment and hearing aids, and it should have been quite easy to collect them if collection boxes had been installed at shops and supermarkets. The problem of button-type mercury cells, however, will become less important since all domestic manufacturers of this commodity are to cease production by the end of 1995.)

On the other hand, the committee said that it was understandable for municipalities to make a decision to implement the collection of UDBs in search for a better environment, however, these activities should then be conducted under their own judgement and responsibility. Furthermore, these activities should be understood to be a temporary measure since the effort to decrease mercury in alkaline batteries by the parties concerned was effectively in progress, this being the most effective measure.

Nevertheless, the following measures are to be taken.

(1) Using the existing facilities and technologies of the specialist parties concerned, a nationwide system is to be established for the collection and treatment of UDBs being voluntarily collected by municipalities. More than one treatment facility should preferably be installed in consideration of the nationwide characteristic of the project.

(2) All citizens and dry battery retailers should positively corporate with the municipalities in their collection effort, and manufacturers of dry batteries should assist them in terms of finance.

SSDI 0378-7753(95)02233-7

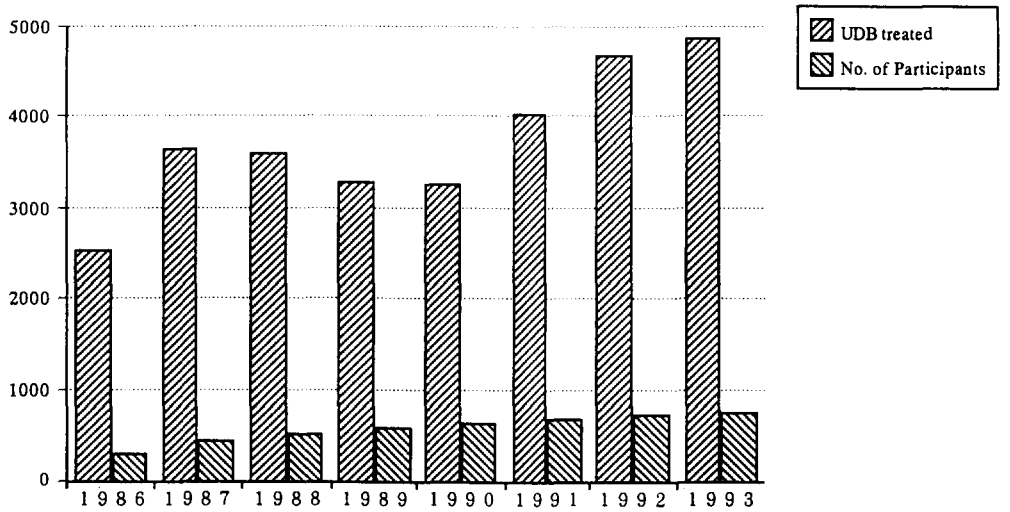

Fig. 1. UDB treatment and number of participants (complied from the data in the periodicals issued by the Waste Treatment Technology Development Center, Japan).

(3) Monitoring of the mercury released into the environment form household garbage treatment facilities should be conducted more diligently than before.

2. Battery waste management

Under such propositions the organization named 'Nationwide Conference for Collection and Treatment of Used Dry Batteries (more literally translating 'Wide Area Liaison Conference for Collection and Treatment of Used Dry Batteries') was established in March 1986 and the treatment was started. All municipalities voluntarily collecting UDBs were solicited to join the Conference.

The Itomuka Plant of Nomura Kosan Co., Ltd. located in the northern part of Hokkaido was nominated as the first treating facility in the organization. Nomura had been active as the only one private company which was able to treat mercury contaminated waste for a long time before the nomination. Furthermore, in 1984, the company was subsidized by the Clean Japan Center, an affiliate of the Ministry of International Trade and Industries when the company started a demonstration scale research and investigation of mercury contaminated wastes. The facilities having a capacity of 6000 tons per year (20 tons per day) were completed in March 1985. Later, the facilities were used for practical treatment.

Voluntary municipalities such as Hiroschima city had already sent their collected UDBs to the Itomuka Plant before this nationwide system was organized, therefore, the Nomura had a well proven technology for the purpose of the organization.

As an exclusive transportation company 'The Nittsu' was also assigned. To secure the safety of the entire organization in terms of transportation as well as treatment, the manifest system was introduced in the same manner as enforced in the 'Resource Conservation and Recovery Act' in the USA.

At the time the system started, the number of municipalities which participated in the system was 295 out of a total of 3276 municipalities at that time in Japan (the number of municipalities in 1994 was 3235). The total amount of UDBs treated in this year was 2550 ton. The total amount of treatment and the number of participant municipalities of each year since then are shown in Fig. 1.

Some of the participants are unions of small villages and towns, therefore, the real number of participant municipalities is larger than the above-mentioned number by 20–30%. Since some municipalities had already been in contract with Nomura years before the start of the organization, the total amount of UDBs treated in the plant is also 20–30% larger than the amount shown in Fig. 1. The total production and consumption of dry batteries in 1992 in Japan is shown in Table 1. Dry batteries being produced in Japan no longer contain mercury, except for mercury button cells, although some of the batteries being imported and brought into Japan attached to imported appliances still contain mercury.

The outline flow of the Nomura Kosan process is shown in Fig. 2. First the burden of UDBs is charged into the rotary

Table 1
Production and consumption of dry batteries in Japan

	Total production (P) (million)	Domestic consumption (DC) (million)	DC/P (%)	Component ratio (%)
Zinc–carbon	2479	1350	54.1	61.1
Alkaline	720	460	63.9	20.8
Alkaline button	166	27	16.3	1.2
Silver oxide	510	146	28.6	6.6
Mercury	19	10	52.6	0.5
Air button	22	16	72.7	0.7
Lithium	451	202	44.8	9.1
Total	4385	2211	50.4	100.0

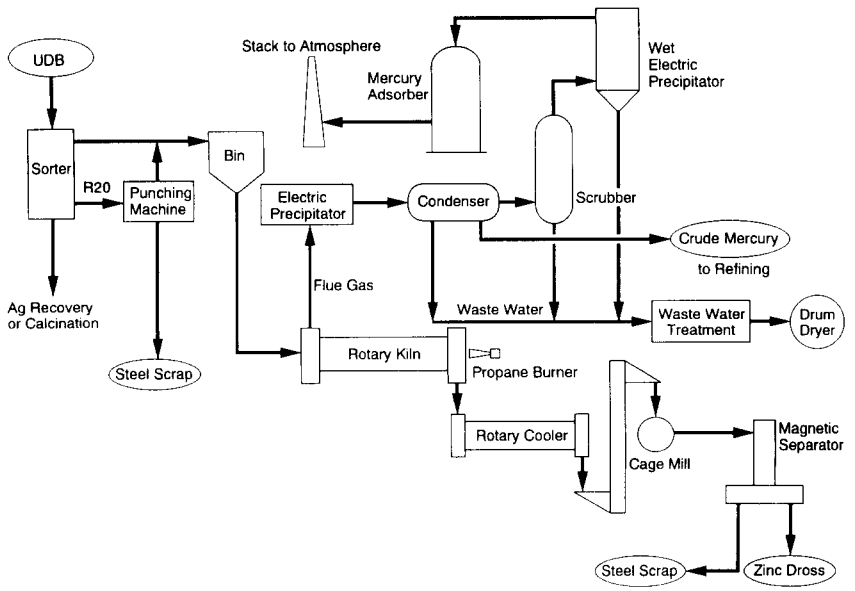

Fig. 2. Itomuka Plant flow sheet (compiled from the data in the periodicals issued by the Waste Treatment Technology Development Center, Japan).

kiln where it is heated by a propane burner up to 600–800 °C and the major part of the mercury contained in the burden is evaporated. The burden is then introduced into the rotary cooler in which it is freed of further remaining mercury with enough retention time, and cooled down. The residue solids from the cooler are dissociated by a cage mill and separated by a magnetic separator into magnetic and non-magnetic portions. The magnetic portion is then compacted into steel scrap bales and the non-magnetic solids constitute zinc scrap.

The gas coming out from the rotary furnace is first sent to an electric precipitator for the removal of solid particles while it is still hot, then it is brought into the mercury condenser. The mercury condensed there is recovered as crude mercury (soot). After the mercury removal the gas is sent to a water scrubber and then to the wet-type electric precipitator for further cleaning, and finally introduced into the mercury adsorber tower for ultimate release into the atmosphere.

The waste water coming out from the mercury condenser, the water scrubber and the wet-type electric precipitator is sent to the waste water treatment system and removed of heavy metals by the chelate method. After the treatment effluent water is sent to the dryer where all water is evaporated so that there is no water to be discarded from the plant.

At the time of the research and development mentioned above a punching machine to strip the steel jacket of R20 type (34.2 mm in diameter and 61.5 mm in height) dry batteries was specially developed. The purpose of the development was that the R20 type should be treated prior to charging into the rotary kiln facilitating easier treatment since these are the major portion of the burden weightwise. The stripped steel jackets were to be also compacted into steel scrap bales.

The treatment fee was settled at ¥75 000/ton UDB ($750/ton UDB on $1 = ¥100 basis), and the transportation

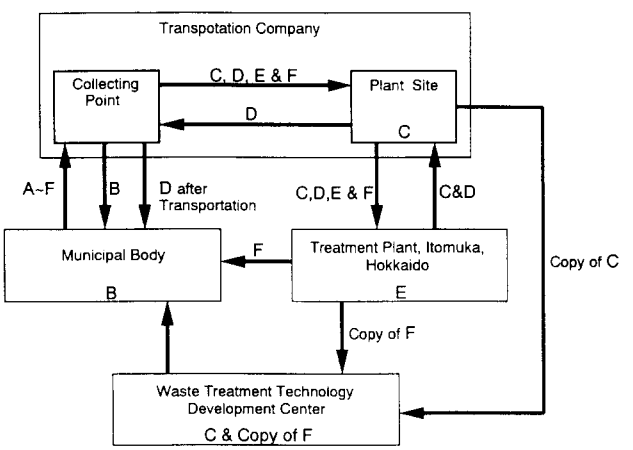

Fig. 3. Flow and keeping place of manifest.

fare was also fixed but varied depending on the location from the cheapest ¥6000/ton UDB ($60) for Obihiro, Hokkaido in summer to the most expensive ¥33 000/ton UDB ($330) for Okinawa, the utmost south island prefecture.

It is requested that UDBs collected by each municipality should first be packed in drums or in plastic bag designed specially for this purpose. The UDBs plus the documentation are then sent to 93 collection points designated nationwide by the organization. Every collection point sends 5 ton lots of UDBs in container by sea and truck to the Itomuka Plant. The document called a manifest is comprised of six slips, i.e., A, B, C, D, E and F. The flow and the keeping place of each slip as a certificate is depicted in Fig. 3. By this manifest system all parties concerned are under the control of the Waste Treatment Technology Development Center which is the originator of the entire system.

3. Summary

Thus the UDB collection and treatment system in Japan is functioning fairly well at the moment. However, since the mercury contained in dry batteries has decreased favorably as predicted by the Inquiry Committee for the Living Environment, the major aspect of the system is shifting from the environmental point of view to that of resource conservation and recovery. In this context the scale of the plant should become larger, and accordingly collection of UDBs should be more diligently implemented. The treatment rate of 6000 tons per year is too small compared to the annual consumption of 70 000 tons per year.