ELSEVIER

Journal of Power Sources 59 (1996) 1–7

JOURNAL OF POWER SOURCES

The Basel Convention: effect on the Asian secondary lead industry

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Received 9 October 1995; accepted 13 November 1995

Abstract

The Basel Convention has had a dramatic effect on the world trade in scrap materials. The scope of implementation is broader than was originally intended. This is due mainly to uncertainties created by a failure to distinguish between waste for disposal and waste destined for recycling. Spent lead/acid batteries and other lead scrap flows from OECD to non-OECD countries have been restricted to the point where secondary lead production is being affected. Export–import flows between OECD members have also changed as recycling is being contained within those countries. The economics of recycling in OECD countries may result in a smaller percentage of scrap being recycled. The established lead/acid battery industry in the Asian region, which relies heavily on imported scrap, will now be forced to import more finished metal, to maintain output. With strong economic growth forecast for the region, and no substitute for the lead-based battery, the supply situation is unlikely to ease.

Keywords: Basel Convention; Recycling; Disposal; Lead; Lead/acid batteries

1. Introduction

The adoption of the Basel Convention by more than 80 countries, both OECD and non-OECD (Table 1), around the world has created a most complex and confusing situation with respect to international trade in waste materials. Interpretations and opinions range from those who would have a total ban on all waste exchange, to others who would have every conceivable waste product, no matter how insignificant, classified according to its perceived toxicity, and assigned a specified handling and treatment regime. This confusion has created uncertainties for both the suppliers and consumers of waste materials, as well as those who rely on the final product of the recycling process. Given that the economic effects of adopting the Convention are likely to be significant, it is appropriate that we consider its origins to understand better the intent of those who formulated the guidelines. We might then be in a position to make some predictions of eventual outcomes.

Table 1
Organization for Economic Cooperation and Development (OECD)

Member countries				
USA	Japan	Germany	France	Italy
UK	Canada	Australia	Austria	Belgium
Denmark	Finland	Greece	Iceland	Ireland
Luxembourg	Mexico	Netherlands	New Zealand	Norway
Portugal	Spain	Sweden	Switzerland	Turkey

2. Origins of the Basel Convention

In 1988, the OECD adopted uniform definitions of hazardous wastes, based on known toxicological evidence and, in part, on existing definitions used in national legislation in the USA. These definitions, after only minor changes, were adopted by the Basel Convention under the auspices of the United Nations Environment Programme (UNEP), as a result of the increase in waste exports from industrialized to developing countries. The agreement was signed by 106 countries in March 1989 [1]. It was brought into force in May 1992 and as at July 1995, 88 countries had ratified the Convention (Table 2, [2]). The stimulus that led to the Convention was the perception that developing countries were being used as dumping grounds for waste products that, due to stringent environmental standards, could not be recycled or, at least stabilized, in their country of origin. The legislative process derived much impetus from developing countries that were seeking to end uncontrolled dumping of hazardous wastes on their territories. Decision II/12 — a formal decision, but not then an amendment to the Convention — was reached in March 1994 at the second meeting of the parties to the Convention in Geneva. It calls for an immediate ban

SSDI 0378-7753(95)02294-5

Table 2
Status (dates) of ratifications. The 88 parties to the Basel Convention; July 1995 [2]

Antigua, Barbuda	5/4/93	Argentina	27/6/91
Australia	5/2/92	Austria	12/1/93
Bahamas	12/8/92	Bahrain	15/10/92
Bangladesh	1/4/93	Belgium	1/11/93
Brazil	1/10/92	Canada	28/8/92
Chile	11/8/92	China	17/12/92
Comoros	31/10/94	Costa Rica	4/7/95
Cote d'Ivoire	1/12/94	Croatia	9/5/94
Cuba	3/10/94	Cyprus	17/9/92
Czech Republic	24/7/91	Denmark	6/2/94
Ecuador	23/3/93	Egypt	8/1/93
El Salvador	13/12/92	Estonia	21/7/92
EEC	7/2/94	Finland	19/11/91
France	7/1/91	Greece	4/8/94
Guatemala	4/7/95	Guinea	4/7/95
Hungary	21/5/90	Iceland	4/7/95
India	24/6/92	Indonesia	21/9/93
Iran	5/1/93	Ireland	7/2/94
Israel	14/12/94	Italy	7/2/94
Japan	17/9/93	Jordan	22/6/89
Kuwait	11/10/93	Latvia	14/4/92
Lebanon	21/12/94	Liechtenstein	27/1/92
Luxembourg	7/2/94	Malawi	21/4/94
Malaysia	8/10/93	Maldives	28/4/92
Mauritius	24/11/92	Mexico	22/2/91
Monaco	31/8/92	Namibia	4/7/95
Netherlands	16/4/93	New Zealand	20/12/94
Nigeria	13/3/91	Norway	2/7/90
Oman	8/2/95	Pakistan	26/7/94
Panama	22/2/91	Peru	23/11/93
Philippines	21/9/93	Poland	20/3/92
Portugal	26/1/94	Republic of Korea	28/2/94
Romania	27/2/91	Russian Federation	31/1/95
St Kitts and Nevis	7/9/94	St Lucia	9/12/93
Saudi Arabia	7/3/90	Senegal	10/11/92
Seychelles	11/5/93	Slovak Republic	24/7/91
Slovenia	7/10/93	South Africa	5/5/94
Spain	7/2/94	Sri Lanka	28/8/92
Sweden	2/8/91	Switzerland	31/1/90
Syria	22/1/92	Tanzania	7/4/93
Trinidad, Tobago	18/2/94	Turkey	22/6/94
UAE	17/11/92	UK	7/2/94
Uruguay	22/10/91	Vietnam	13/3/95
Zaire	6/10/94	Zambia	15/11/94

on the export of all wastes destined for disposal from OECD to non-OECD countries, and a ban on the export of hazardous wastes destined for recovery between such countries, with effect from 31 December 1997. While this has not yet been implemented in full, international movements of secondary raw materials (including lead scrap) face more stringent controls. They now require prior notification and approval from the authorities in exporting, receiving and transit countries. There are some concessions that recognize the particular needs of the recycling industry, but this legislation will inevitably raise the cost and complicate international movements of secondary materials for recycling. Technically, the Convention immediately precluded scrap movements between signatory and non-signatory nations (which at the time included most of the EEC and the USA) [3].

A major problem associated with the Convention is the poor definition of waste materials. It is not clear which materials or substances are covered by the shipping ban decision. Many countries have used the lists of wastes compiled by the OECD as an indication of the hazardous wastes subject to the Basel Convention. In 1990, the OECD also launched a programme to examine the appropriateness of concerted international action to address the environmental and health issues associated with lead and lead-based products.

The OECD Council Decision C(92)39 lists hazardous wastes destined for recycling, and assigns these to one of three lists (Table 3). Each list has been designated red, amber or green according to the degree of health and environmental hazard. The red list contains highly dangerous materials. The amber list contains a large number of materials, including metal-bearing wastes. The green list contains materials such as uncontaminated scrap iron, and waste paper and plastic which OECD nations have agreed will not be regarded as hazardous waste.

3. Impact on lead

Lead/acid batteries are on the OECD amber list of wastes and, therefore, require notification before they can be moved between OECD countries, but will not be able to be transported to non-OECD countries after 1997.

In addition to the broad ramifications of the Basel Convention, attempts to develop a programme on risk reduction for lead have been pursued within the Joint Chemicals Group and Management Committee of the Environment Directorate of the OECD, since the beginning of 1990. At that time, a

Table 3
OECD waste classification system: lead products

Green list	No risk during normal handling and transport. May be traded freely between OECD countries; treated as normal commercial transaction. Lead waste and scrap in non-dispersible form, e.g., not powders, sludges, dusts or solids containing encased hazardous waste liquids.
Amber list	Low risk potential, but subject to notification and approval before shipment. Procedure simplified for waste movements to specific recovery plants and for regular shipments of similar material. Lead/acid batteries, whole or crushed, and waste/scrap from battery production. Leaded petrol (gasoline sludges). Lead ash and residues (includes slags, drosses, skimmings, schillings, dusts, sludges and cakes).
Red list	Intrinsically hazardous, requiring strict control over movements. Prior written consent required from receiving country. Leaded anti-knock compound sludges.

proposal was advanced by Sweden for a programme on the future treatment of 'sunset chemicals' — a title which clearly indicated the notion that the chemicals in question had reached the end of their useful life in modern society. This proposal encountered considerable opposition from many countries and was subsequently withdrawn. It has since been pursued within the OECD's High Production Volume Chemicals (HPVC) Programme but, as at May 1995, no final papers have been put in place.

Despite the seemingly diverse and lethargic processes being undertaken, there is no doubt that the lead industry as a whole, and recycling in particular, will be subject to increasing scrutiny and pressures on a global basis. The more radical critics of the industry would like to see the eventual phasing out of lead use in any application. With little likelihood of significant substitution in the future, however, lead will retain its position as the predominant component in battery manufacture.

4. Demand

The use of lead is forecast to grow globally at a rate of slightly less than 3% over the next ten years. With primary production remaining constant, secondary output is expected to grow at a rate approaching 6% over the same period (Table 4), [4]. As the effects of the Basel Convention are realized and secondary feedstock decreases, this growth rate may not be sustainable. Any reduction in the supply of scrap will be particularly important to Asian battery manufacturers, as their local secondary smelters are heavily dependent on imported scrap.

Batteries constitute the fastest growing sector of the market and are expected to consume 73% of total demand by the year 2005. The car and motorcycle battery replacement market in Asia will have grown to almost 40 million units, double the current market, and equivalent to an increase of 240 000 t of lead consumption. Industrial batteries will out-perform the SLI (starting, lighting, ignition) sector, but due to their much longer life, will not affect significantly the secondary lead industry, at least in the medium term. With forecasts of such dramatic growth, demand for primary lead will increase. With primary production forecast to remain static, secondary producers will come under pressure to produce lead of equivalent quality, which will increase their cost of production.

Consumption in other non-dispersive applications is forecast to remain static. The decline in usage of lead alloys for telecommunication and medium-voltage cables is now being offset by high voltage and undersea applications where there is, as yet, no suitable alternative to lead. Experience gained in the use of alternative sheathings has revealed some disadvantages in durability and resistance to various forms of attack whilst in service. This has resulted in some limited reversal to the (decreasing) use of lead in such applications [5].

Table 4
Growth in lead production

Year	Production ($\times 10^3$ t per annum)		
	Primary	Secondary	Total
1995	2232	2297	4529
1996	2348	2394	4742
1997	2300	2660	4960
1998	2300	2900	5200
1999	2300	3025	5325
2000	2300	3050	5350
2001	2300	3050	5350
2002	2300	3100	5400
2003	2300	3200	5500
2004	2300	3250	5550
2005	2300	3425	5725

5. Lead recycling industry in Asia

There are well-established lead-recycling facilities in most countries in the world. Because of internal cost structures and rigorous environmental controls in most OECD countries, it has not been economic to expand recycling facilities to cater for increased lead consumption. As a consequence, excess scrap, produced mainly in the form of lead/acid batteries, has been exported to developing countries — particularly in Asia, where lower labour and infrastructure costs, allow expansion of treatment facilities into viable economic operations. Total Asian secondary lead capacity has now grown to 428 000 t per annum, although utilization is only around 78% (Table 5, [6]).

These figures are estimates of only the organized sector of the industry. Thus, actual capacity may be quite different in some countries since there are large numbers of small recyclers operating in all of the developing countries. The actual tonnages involved are impossible to determine accurately, but are thought to be considerable. In India, for example, 26 plants are operating in the organized sector and produce around 28 000 t per annum, but there is estimated to be between 200 and 225 backyard smelters that operate on a

Table 5
Capacity of secondary lead refineries in Asia in 1995 [6]

Country	Capacity ($\times 10^3$ t per annum)
India	37
Indonesia	34
Japan	136
Iran	15
Malaysia	30
Philippines	40
Taiwan	32
Thailand	30
Others	74
Total	428

consistent basis [7]. In most countries in the area, the organized sector is heavily dependent on imported raw material. The small backyard smelters consume locally-collected scrap so that any reduction in the availability of imported scrap will impact disproportionately on the organized sector. In Indonesia, for example, secondary lead production has decreased by over 40% in the past year due to insufficient imported scrap.

6. Scrap lead trade

International trade in scrap lead has continued largely unabated since the Basel Convention was adopted, at least as far as tonnages are involved. There has been, however, a significant change in the export destinations from some countries as they have been forced to seek suitable countries with underutilized secondary capacity.

6.1. Australia

In Australia, the quantity of battery scrap exported between 1993 and 1995 has dropped by only 20% to 12 000 t, but the destinations have changed dramatically (Table 6, [8]). By contrast, exports of lead waste and scrap, other than from batteries, have fallen by 74% to 2200 t during the same period. In the main part, this reduction has been due to the cessation by Pasminco Ltd. of exports of lead residues and smelter slags. The major changes in battery-scrap flows have been a reduction in exports to Indonesia with commensurate increases in exports to New Zealand and India. Exports to the Philippines have remained unchanged but are likely to drop substantially as the OECD compliance date draws near.

Table 6
Exports of lead scrap from Australia [8]

Destination	Battery scrap (t)		Non-battery scrap (t)	
	1993	1995	1993	1995
China	0	0	237	0
Germany	0	0	5500	0
Hong Kong	36	0	82	82
Indonesia	8139	309	1527	0
India	300	1956	189	1340
Malaysia	0	0	185	42
New Zealand	1360	4509	97	287
Philippines	4216	4490	225	40
South Korea	0	0	736	71
Thailand	243	20	493	240
Japan	346	139	0	0
Taiwan	181	122	0	0
Singapore	0	438	0	0
Others	21	21	24	106
Total	14642	12004	9325	2208

6.2. USA

Despite not having ratified the Basel Convention, the USA is committed to the OECD decision and is changing its export destinations in accordance with the guidelines (Table 7, [9]). Between 1990 and 1994, lead content of scrap exports has increased by 15% to over 90 000 short tons, but exports to developing countries have reduced by 78% to 4000 short tons. Historically, the USA has sent most of its exported lead scrap to developed countries, so it would appear that the Basel Convention will not noticeably alter disposal scenarios in this country.

6.3. Japan

As with most metal production in Japan, secondary lead smelting is going through a period of structural change 'as output from secondary materials increases while output from concentrate falls' [10]. Moreover: 'Following the closure of two primary smelters in 1994.., two other smelters have switched from treating a mix of primary and secondary materials to secondary feed only. Output from secondary materials has increased due to the start-up of a new secondary smelter in October 1994 by Toho Zinc at its Chigirishima plant' [10]. Japanese secondary output is forecast to rise by around 35 000 t this year and by a further 15 000 t in 1996. It is apparent that with Japanese difficulties in economically producing lead from imported concentrates, the secondary industry will assume far greater importance in satisfying Japan's domestic needs.

Historically, Japan has been a significant exporter of battery scrap, e.g., it exported over 13 000 t in the first half of 1991, an increase of 13.3% over the corresponding period in 1990. The destinations were mainly Taiwan and South Korea, with lesser amounts going to Indonesia, Thailand and Hong Kong. Japan no longer exports any significant quantity of lead scrap.

6.4. Malaysia

As much as any in the region, the Malaysian government is applying guidelines similar to the Convention in respect to lead scrap classified as an 'amber' category waste. They have accepted — at least, in principle — Decision II/12 as an enabling clause that provides a mechanism for the importation of lead battery scrap, but still allows tight regulation. Imports can only be approved if they are consigned direct to a smelting facility and not to a trader. Accordingly, this removes the risk of diversion to the unregulated sector. An additional condition imposed is that the final product must be used to satisfy local demand and must not be produced for export. In practice, 10 to 30% of product is exported. 'The combination of government regulations and the restriction on raw material supplies as Basel Convention takes effect is making secondary lead smelting extremely difficult' [11].

Table 7
Exports of lead from the USA. Waste and scrap: lead content (short tons) [9]

Destination	1990	1991	1992	1993	1994
Canada	38022	60479	53760	42640	75374
France	705	303	184	16	5
Germany	5015	1113	298	30	16
Spain	936	2848	345	28	0
UK	5190	1954	715	502	136
South Korea	2264	2500	1080	2797	10400
Taiwan	3711	549	629	575	275
South Africa	1694	302	0	0	0
Total developed countries	57537	70048	57011	46588	86206
Mexico	7149	3683	1290	0	0
Trinidad	320	106	0	0	0
Brazil	2770	4200	1488	5036	2492
China	3866	3599	905	1710	504
India	2192	1880	1521	1069	1037
Indonesia	1537	5249	138	0	0
Philippines	0	3464	1474	118	0
Thailand	242	1094	115	0	0
Total developing countries	18076	23275	6931	7933	4033
Total exports	75613	93323	63942	54521	90239

6.5. India

Of all the Asian countries, India and Indonesia have been the most affected by bans on the imports of scap lead materials. With overall demand growing as the country's economic situation continues to develop, India will become increasingly dependent upon imported lead, either as finished product or as scrap for secondary refining. In 1991, India imported approximately half of its required annual consumption of 80 000 t. With consumption predicted to reach 200 000 t by the year 2000 [12], any reductions in the quantity of secondary lead production will only exacerbate an already tight situation. The Middle East has been a traditional source of secondary feed, but on account of increased local requirements, this is likely to reduce to an insignificant amount. Given the sparse natural resources of lead and the anticipated growth rates, it will be essential for India to establish international credibility for environmental standards to allow adequate imports of scrap material for processing. The development of operations on an economic scale, with environmental-friendly technology, will not only increase secondary output, but may well reduce the number of unregulated 'backyard' smelters.

6.6. Indonesia

The Indonesian economy experienced a period of strong growth and structural change during the 1980s and early 1990s. The economy has maintained a 6% growth rate in the post-1985 period, with particular strength (over 10% per annum) in the manufacturing sector which is expected to be maintained into the next century. Consumption of lead in 1992 totalled 105 000 t, with approximately 43 000 t of this consumed by small-scale and largely unregistered cottage industries. Forecast growth will see lead consumption increase to around 165 000 t in the 2000. At these rates of consumption and with a projected population increase of 1.7%, usage per capita will still only increase to 0.76 kg from the current figure of 0.6 kg (Table 8).

Production of lead in Indonesia in 1992 is, contrary to a stated secondary capacity of 34 000 t per annum, estimated to have totalled just over 90 000 t. This production is sourced mainly from battery scrap; 40 000 t are produced from imported material. Increased secondary production has been driven by the need to satisfy strong growth in battery production of 24.5% (1990), 10.0% (1991), and 13.6% (1992). The secondary industry is having difficulties sourcing sufficient feed stock. 'The country's three major smelters are holding talks with the authorities in a bid to revoke the ban as they are short of feed. The three consume some 5000 t per month of scrap between them, but only about 1000 to 1500 t per month comes from domestic sources' [13]. With increasing feedstock available from a growing domestic market, Indonesia should, eventually, not need to import scrap mate-

Table 8
Per capita lead consumption in 1994

Country	Consumption (kg per annum)
USA	5.0
Japan	3.3
South Korea	3.7
Mexico	1.9
Thailand	0.8
Indonesia	0.6

rials for lead production. Since battery manufacture is forecast to grow, however, there will still be a requirement to import sufficient quantities of primary lead for oxide production to satisfy that need. In fact, Indonesia may well be in a position to export secondary lead alloys that are excess to their requirements to other Asian battery-manufacturing countries.

7. Reactions to the Basel Convention

The Basel Convention and other legislative constraints have created major uncertainties in the scrap and waste trade industry. 'There is so much confusion and misunderstanding about what is supposed to be regulated... that no secondary raw material can be regarded as beyond the scope of individual interpretation' [14]. Opinion is unanimous that a more accurate definition of scrap is required, i.e., one that categorizes scraps as economically valuable commodities that are quite distinct from waste products. Environmental obligations will provide motivation for reducing the amount of waste generated although, in most cases, waste-reduction is sound economic practice and should not require some external stimulus. In any event, waste reduction strategies will further restrict the supply of scrap and wastes for reprocessing. Many governments are already establishing statutory bodies to: 'give priority to reducing the amount of waste generated. Much can be done by harnessing the power of the market to encourage more environmental-friendly waste management' [15].

It would appear that most governments agree with the intent of the Basel Convention, but due to the poor definitions of materials, many are taking a conservative approach and restricting the flows of any products that are in doubt. The Indian government, for example, placed bans on the imports of amber- and green-listed materials early in the year by declaring that they would be treated as if they were red-listed, hazardous substances. Short-term confusion was cleared up when it was explained that the ban referred only to waste containing water-soluble chemical compounds. This type of situation is not unique to India and further illustrates the confusion in the industry at present.

8. Effects of the Basel Convention

If Decision II/12 is implemented as intended, there will be a significant reduction — if not a total ban — on the export of scrap lead/acid batteries after 31 December 1997. A recent report by the Australian Bureau of Industry Economics (BIE) has determined the possible effects on battery recycling in Australia. There is nothing to suppose that these findings do not apply to most other OECD countries. The report found that: 'The number of used batteries going into landfill, or being illegally dumped in Australia, could increase substantially... the Basel ban could reduce annual exports of used lead/acid batteries by nearly 30% and raise the number of batteries not collected by about 80%, adding to environmental problems'. The ban will force many OECD countries to increase their own recycling facilities and collection mechanisms. As in Italy and Sweden, for example, financial incentives may need to be put in place to ensure that collection rates are maintained at an acceptable level. The report also stresses that: 'In many non-OECD countries, used batteries are recycled in unsound facilities with considerable potential to harm the environment and public health. Environmental problems arising from unsound facilities may be more effectively addressed by transferring environmental-sound recycling technology to non-OECD countries rather than banning imports'.

In a major analysis of the 'OECD risk-reduction strategies for lead' programme, the Australian Bureau of Agriculture Resource Economics (ABARE) has evaluated [16] three policies that might be included in an OECD Council Act. These were: (i) a phase-out of lead used in non-recycleable applications in OECD countries; (ii) the introduction of compulsory recycling in OECD countries, and (iii) the introduction of a deposit-refund scheme for lead/acid batteries in OECD countries.

The risk-reduction measures considered in the study suggest that the cost of recycling scrap lead products will rise. This will occur either through government-induced collection strategies in OECD countries or through increased costs to comply with more stringent environmental standards in non-OECD countries. The report concludes [16] that: 'policies implemented to increase recycling rates within the OECD seem likely to result in a reduction in lead recycling in non-OECD countries... Such an outcome would add to lead exposure in the latter countries, many of which are less well positioned than OECD countries in terms of resources, institutional frameworks and technical capability to deal effectively with such risks' [16].

9. Summary

Estimates of the annual value of world trade in scrap metals and residues vary widely; they range up to US $50 billion depending on classifications. Approximately 70% of this trade involves metal scrap; the amount has increased by over 50% in the period from 1980 to 1993. Around 40% of the trade involves developing countries. It is not surprising, therefore, that due to the potential to alter significantly this trade, the introduction of the Basel Convention has evoked much widespread comment. Even minor changes to the cash flows will have dramatic effects on the recycling sectors of developing countries. Such is the dependence in some areas on scrap, that illegal shipments are already increasing to satisfy demand.

The Basel Convention will result in an increased proportion of all scrap materials being recycled in the country of origin, but at greater cost. In the case of lead in OECD coun-

tries, scrap-recovery systems must be put in place to prevent dumping of used lead/acid batteries as landfill when the economics of recycling are unattractive. In non-OECD countries, less economical recycling for the organized sector due to lack of feedstock will see the local 'backyard' recycler continue to operate. Paradoxically, the Basel Convention, which was designed to improve environmental standards by regulating shipments of hazardous wastes, may damage the environment in some circumstances, as legislation makes recycling more expensive. With the Basel Convention failing to define adequately the difference between waste and recyclable scrap, the confusion of this 'regulatory nightmare' will continue. There is no doubt that the Basel Convention is the first, but not the last, of a growing number of international treaties that pit environmental concerns against economic considerations.

Primary lead production is forecast to remain constant in the long term and secondary lead production to reduce, at least in the medium term. Coupled with increasing cost, and a demand for improved purity, secondary metal will not be economically attractive, nor as readily available, as it had been prior to the Basel Convention. As a result, lead consumers will be faced with uncertainties of supply that they have not had to contend with in the past. We can assume that trade balances will stabilize at some time, but there appears to be little hope of this in the foreseeable future.

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