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THE SIGNIFICANCE OF SECONDARY LEAD

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Historical performance of secondary lead sector

The world scene (including Socialist countries) of the supply and demand for refined lead over the mid-term is summarized in Fig. 1. Over this period, mine production has remained relatively static, thus allowing the production of primary refined metal to remain constant at around 2 5 × 10^6 t per year As the data show, however, demand for lead rose very quickly in the early 1970s, and this was supplied increasingly from the recycling industry. The phenomenon that occurred in these years was that as rising incomes in western countries were manifested in new infrastructure and larger vehicle populations, the demand for lead-bearing products, and in particular for lead/acid batteries, grew dramatically.

The metal for the burgeoning demand of the 1970s was increasingly supplied from recycled products. As old cables and pipes were dug up and replaced, and as flashings and sheet lead were removed in building renovation, pools of lead scrap became available. Not to forget the SLI battery of course! Many will remember the car battery of some 10 - 15 years ago — it required a block and tackle to fit, and it seemed to have a life span of one cold winter's morning till the next! Thus, the pool of scrap available for recycling grew — almost commensurately with the demand for new fabricated products

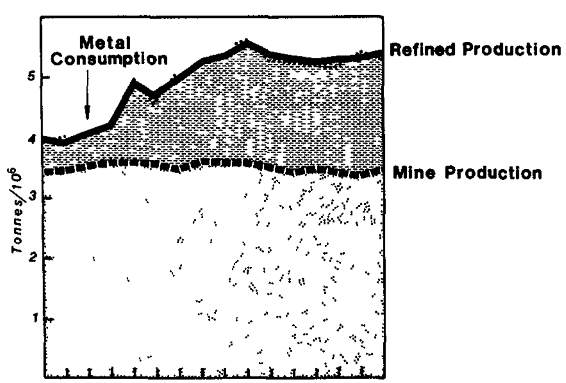

Fig 1 World (including Eastern Europe) trends in the supply and demand for refined lead (source World Bureau of Metal Statistics)

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The years between 1970 and 1979 were the halcyon years for the secondary industry With the exception of 1975, it was a decade of almost continual growth New investments in plant were planned and underwritten by firm lead prices, which also guaranteed a plentiful supply of feed By the end of the seventies, secondary refined lead production accounted for some 44% of total western world output (Fig. 2), and in 1979 just on half of the total western world consumption of lead was supplied by a combination of recycled and remelted scrap.

During the 1970s, the secondary sector tended to operate as a discrete entity, with entirely different characteristics from the primary lead sector Possibly harking back to its genesis as a collection of backyard operators — so many decades ago — it was generally regarded as the maverick of the base metals industry — tough, resilient, able to expand or contract according to fluctuations in demand, but with a basic instinct for survival

The secondary sector had certain distinct characteristics, some of which were

(i) plants were generally small — at least by comparison with some of the superstructures in the primary sector,

(ii) the sector had a differentiated product, and consequently tended to operate within a discrete market, namely, the supply of antimonial lead to battery manufacturers,

(iii) much of the sector operated at the margin and was content to make small profits when they were available This gave the impression that the secondary lead sector had an entirely different and much higher cost structure from the primary sector Certainly, at this time, it had none of the by- and co-product revenue typical of the primary industry, such as zinc, copper, silver or gold, and the cost of feed was relatively high. As a corollary, up to the early 1980s it was generally assumed that world lead prices could never fall below around 25 ¢/lb because this was thought to represent the production costs of the most efficient secondary producers

The situation is now different 1980 ushered in the cool winds of change (Fig 3) That first year of the decade saw a dramatic 8% decline in western world demand for refined lead, accompanied by a 30% decline in

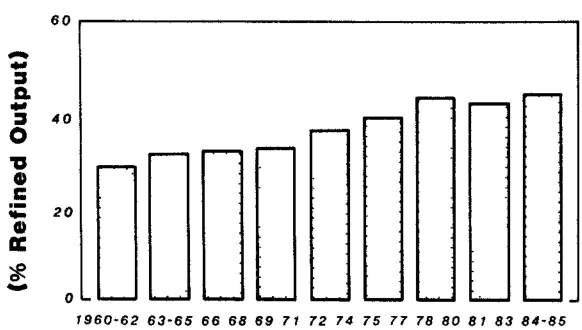

Fig 2 Western world production of secondary lead (source International Lead Zinc Study Group)

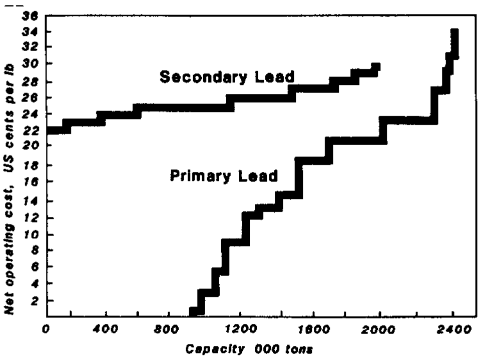

Fig 3 Conceptual ideas of production cost curves for primary and secondary lead in the early 1980s

lead prices. Each year since then has seen the gradual erosion of prices and no discernible sustained growth in demand for the commodity. At current levels of consumption, there is just too much lead smelting capacity in existence, despite years of cost-cutting and economies.

Figure 4 illustrates effective capacity compared with current rates of output. (Note, it is not implied that the excess capacity all lies in the secondary sector.) The data clearly show that the western world is awash with lead smelting capacity at a time of slowing demand, and when some of the traditional non-western regional markets are becoming self-sufficient

What has been the response of the secondary industry? Certainly there has been a rash of plant closures, particularly in the U.S.A. where the dramatic decline in consumption was most pronounced. It is understood that whereas in 1981 there were more than 40 secondary plants of any size operating in the U.S.A. with a combined capacity of 1.2×10^6 t, there are now only 12 plants in service. Combined capacity has been reduced to only ~725 000 t per annum, despite the fact that U S. secondary output has never exceeded 650 000 t annually, and is currently running at ~550 000 t per annum

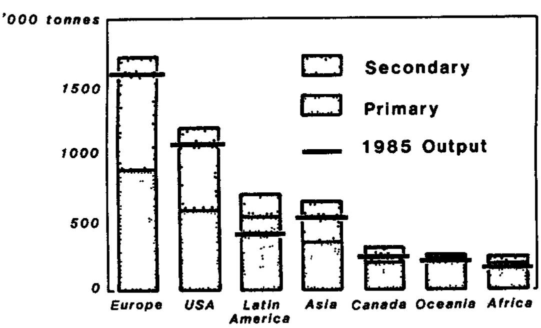

Fig 4 Lead refining capacity in western world (sources International Lead Zinc Study Group, Commodities Research Unit)

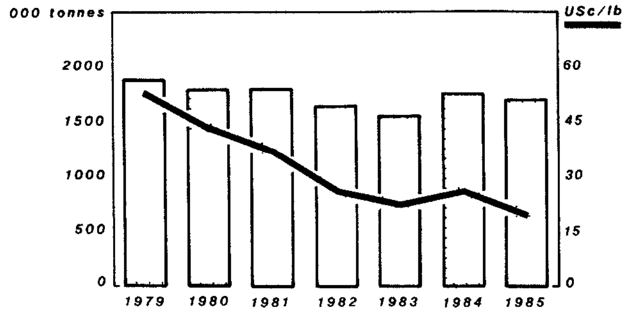

Fig 5 Secondary refined lead production in western world (source World Bureau of Metal Statistics)

The response of the secondary refined lead sector — or rather the lack of it — to the steady decline in prices is shown in Fig. 5. Not that a response should be expected. It is assumed that most recyclable lead will return to the market and should be encouraged to do so in the longer term interest of the industry The trend has been towards more efficiency, and consequently some marginal producers have gone to the wall This has happened in Asia as well. The backyard operator is disappearing, but is being replaced by newer, economically viable plants operating within more stringent pollution control requirements. The secondary lead sector may be slimmer and more efficient, but overall there has been no significant decline in its production levels Note in Fig 5 the response in 1984 to a short-lived rise in the U.S Producer Price!

The production cost curve has altered dramatically. The author estimates that western world output of secondary lead is still running at over 1.6×10^6 t in 1986, despite the fact that in the first half of the year LME cash prices averaged only 17 1 ¢/lb

Technology

The lead industry in general, and the secondary sector in particular, is at the moment trapped between the two arms of a pincer On the one hand, economic survival dictates that costs must be pared to the bone As fast as these economies are being made, however, new regulations on pollution control are being enacted, each with its attendant cost to the producer. Thus, the two basic determinants in the choice of process and associated technology today are cost effectiveness and pollution control. For the former reason, there appears to be a tendency in some regions towards the adoption of the rotary furnace The introduction of oxygen enrichment to the furnace assists in reduced cycle times and cost savings

A combination of both the above factors is also causing changes to occur in associated activities, such as battery breaking. Mechanical battery breakers are not only more efficient and labour-saving, but satisfy the requirements of operator and environmental health in force in some countries But it is pollution control alone that has necessitated expenditure on

TABLE 1

Secondary lead smelting technology

Three approaches

(i) Blast furnace } combinations of these
(ii) Reverberatory furnace }

(iii) Rotary furnace (becoming more popular)
–less labour intensive (costs and operator exposure)
–better mixing
–greater flexibility
–smaller operating units

Changes in technology

(i) Introduction of oxygen enrichment in smelting
–Energy efficiency
–Improves operating/cycle time
–Now being utilized for softening

(ii) Mechanical battery breaking
–Operator health/environmental
–High cost of labour in some regions
–Enables easier recovery of polypropylene

(iii) Increasing concern with pollution control
–Baghouses for process and hygiene air
–Water treatment for liquid effluent

construction of baghouses for air purification, and water treatment systems for liquid effluent. These plant changes can only be undertaken by the larger smelters who can amortise and recover the costs over a higher tonnage. Present trends in secondary lead smelting technology are summarized in Table 1.

Feed sources

Scrap feed for secondary plants can be classified into two types — new scrap, that is, that which arises during the manufacturing process, and old scrap, in other words, consumers' discards (Table 2). This latter is of the most concern and arises from a combination of all forms of lead-fabricated products, over a period of time. The U.S. Bureau of Mines claims that most of the lead consumed in lead/acid SLI batteries is recycled over a period of about five years after the pig lead is first consumed by the battery manufacturer. At the other end of the spectrum, sheet lead has a life cycle of up to one hundred years (Table 3). Differing life cycles apart, changes are taking place in consumption patterns. Many of the traditional uses of lead are now in net decline, like cable sheathing, for example, or are being legislated out of existence, as is the case for anti-knock compounds — this latter being a non-recyclable use!

Despite the decline of some markets, overall lead consumption continues to hold steady at around 3.9×10^6 t. The sole reason for this is the

TABLE 2

Types of lead scrap

*New scrap**		
Battery manufacturing Defective grids Offcuts from wrought grids		remelted in-house
Defective pasted grids Oxide sludge Faulty batteries		reprocessed by smelter
Sheet and pipe offcuts		remelted in-house
Cable sheathing offcuts		remelted in-house
Solder and other alloys	–Metallic offcuts	remelted in-house
	–Drosses	reprocessed by smelter
Anti-knock compounds	–Sludge	reprocessed by smelter
*Old scrap***		
Batteries — Cases removed with polypropylene recycled and leady materials smelted and refined		
Sheet and pipe — Melted and refined (sometimes recast into low grade products, *e g*, sinkers)		
Cable sheathing — Tar and organics burnt off with lead melted and refined		
Wheel weights — Melted and refined or recast		
Type metal — Melted and refined (used as a source of tin and antimony)		
Sinkers — Usually lost		

*Produced during manufacturing, uncontaminated, metallics usually remelted in-house, oxides and compounds smelted in secondary lead plant

**Consumers' discards, mixed and contaminated with a range of alloys and other materials, often require smelting and refining

continued growth in the market for lead/acid batteries. The evolution of this mono-product market over the past ten years is shown in Fig. 6.

In spite of the narrowing of the market, it is interesting to note that global growth in battery lead consumption is broadly based across regions (Fig 7). The picture is even more pronounced for countries in the Asian region, *i e*, The Republic of Korea, Taiwan, India, etc , and this trend is expected to continue. Consequently, the lead and battery industries are inextricably linked, and that linkage will become stronger

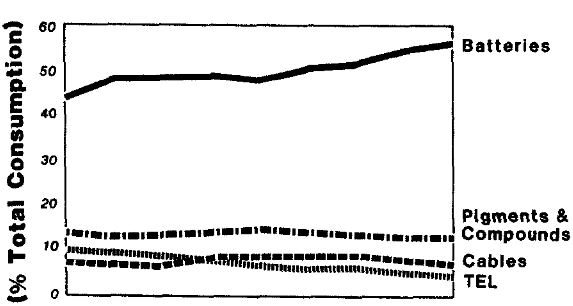

Fig 6 Trends in lead usage (source International Lead Zinc Study Group)

TABLE 3

Life cycles and recoveries for lead products (source International Lead Zinc Study Group)

Product	Life cycle (years)	Product recovery (%)	Recoverable lead (%)
Batteries			
Automobile	4 - 5	at least 90	95 - 97*
Traction	5		
Stationary	20		
Sheet	up to 100	80 - 90	98 - 100*
Pipe	50	70 - 80	
Cable sheathing	40	50	
Alloys			
Solder	varies with product in which used	20 - 30	98 - 100*
Bearings			
Type metal	indefinite–constantly recirculating	5% of annual consumption returned as skimmings and residues from melting operations	

*Depending on quality of material received

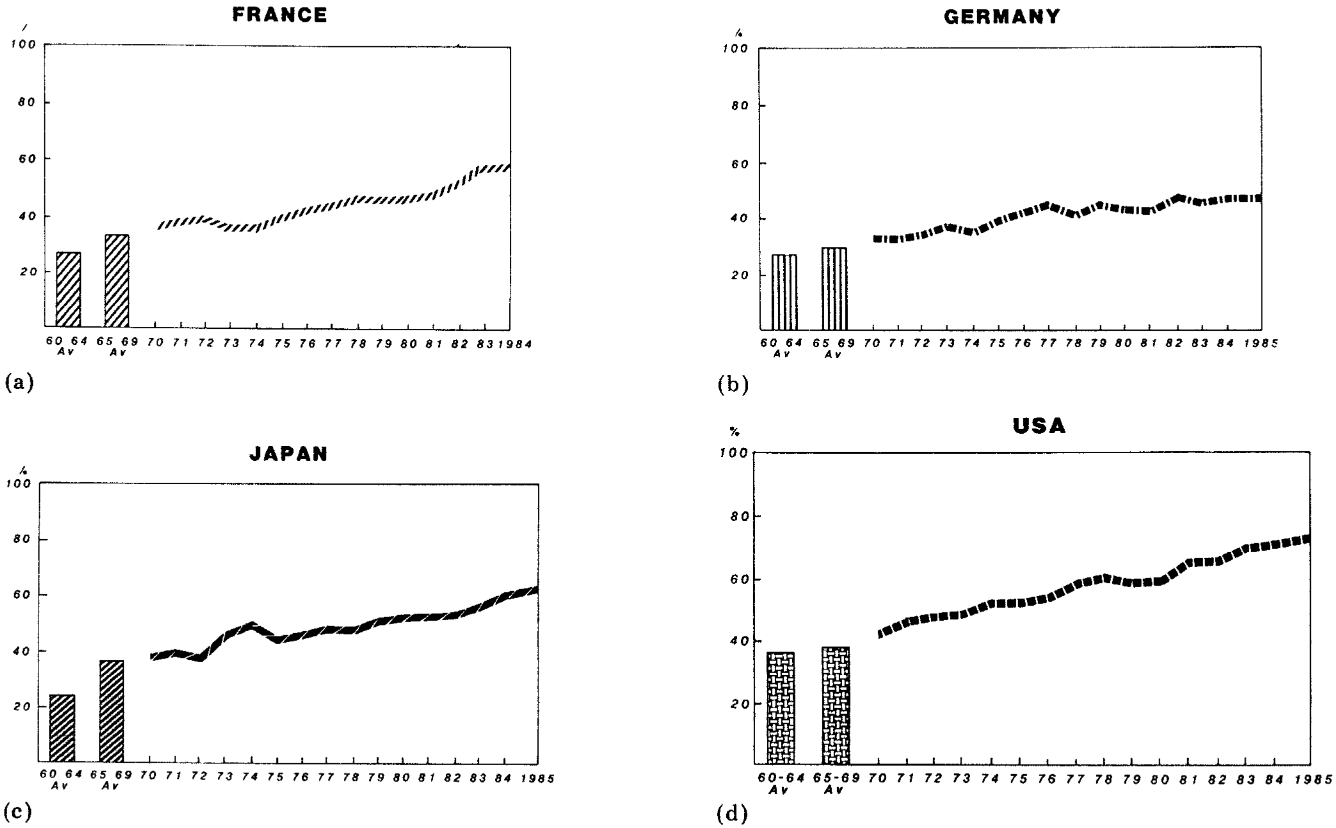

Fig 7 Consumption of lead (% total) for batteries in various countries (source International Lead Zinc Study Group)

What is the effect of new battery technology upon marketing of secondary lead? Battery technology is dynamic, and already the increasingly sophisticated range of alloys required by competing battery fabricators (such as calcium alloys) is straining the abilities of secondary refiners. With the changing pattern of battery recovery, *i e* , lower levels of antimony in returned battery scrap, and the increasingly exotic specifications demanded by battery manufacturers, the secondary lead industry faces some real challenges in the near future This, among other things, has brought the sector into direct competition with the primary industry No longer can secondary lead producers lay claim to a huge antimonial lead market. Rather, they must now concern themselves with exotic metallurgy. Their separate market domain has disappeared. In response to this market situation, some secondaries are now softening substantial portions of their output generally, because of reduced demand for conventional antimonial lead alloys. This, however, is only part of the problem. Of even greater concern is the ability of the industry to evolve methods of recycling new generations of batteries.

There is now clear evidence to suggest that, as a result of prevailing prices for refined lead, the battery scrap collection system might be breaking down. A recent NARI report cites one estimate that, since 1980, battery scrap for recycling in the U.S.A. has increased by 10.2%, while actual physical recycling of the material has declined by over 26% (Fig. 8).

This trend, if sustained, will create massive problems for the future. Not only does it run counter to environmental philosophy, which will therefore tend to bring down the wrath of legislators even further upon the industry, but it also implies the build up of excess pools of battery scrap. If not addressed in some way, the eventual result will be a massive, untapped, above-ground mine of lead metal. Concerned about the recent decline in lead battery recycling rates in the U.S.A., two Government agencies have commenced studies into the eroding scrap battery recycling system in that country. More can be expected to be heard on this issue.

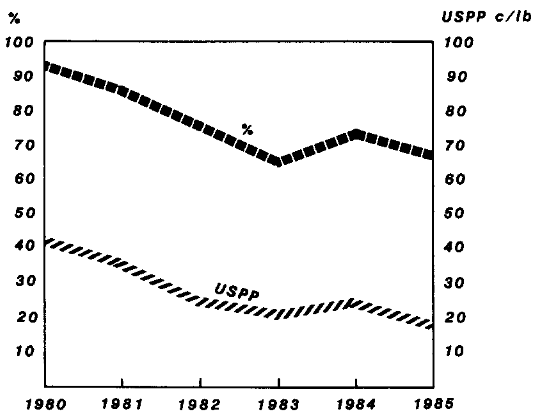

Fig. 8. Estimated collection rate of SLI battery scrap in the U S.A (source Commodities Research Unit)

The environment

The greatest single threat hanging over the secondary industry at this time is possibly the ability to meet the increasingly stringent anti-pollution requirements. In the U S A., the range of restrictions can only be described as prohibitive (*e g* , Table 4).

TABLE 4

Environmental standards in the U S A

1 Lead in air (inside plant)
2 Lead in blood (inside plant)
3 Ambient air standards (outside plant)
4 Lead in soil (outside plant)
5 Hazardous waste, *e g* , batteries
6 Slag disposal
7 Water standards — purification
8 Insurance
–$3m per occurrence of hazardous waste
$6m per smelter
–Insurance cover as yet unavailable

While the industry has learned to adapt to, and make provision for, many of these requirements, the latest attack to the jugular vein in the U.S A. has been the necessity to comply with the Resource Conservation and Recovery Act From 5 July 1986, in order to obtain a permit to process hazardous materials, battery breakers and smelters alike must be covered by the improbably named Nonsudden Liability Insurance, to the tune of $3 million per occurrence and $6 million in total The irony of this situation is that, not only would the cost of such insurance be so prohibitive as to force closure of all but the largest plants in that country, but *THE INSURANCE COVER*

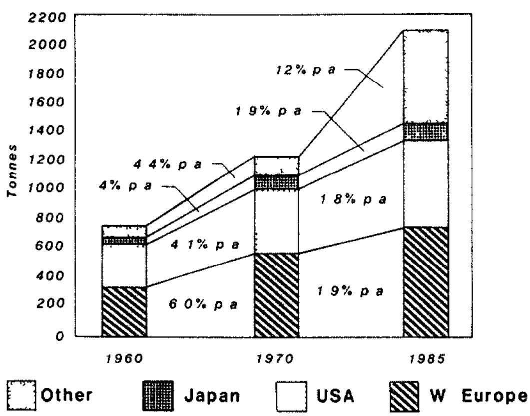

Fig 9 Secondary lead production by region (source International Lead Zinc Study Group)

ITSELF DOES NOT YET EXIST! Given the penchant in the U.S.A. in recent years for phenomenal levels of insurance payouts in all fields (*e.g.*, medical, industrial, and commercial), this legislation alone may be instrumental in forcing a massive geographical shift in secondary lead activities worldwide. This may only serve to hasten a natural tendency. As is well known, most growth in secondary smelting activity over the past decade has taken place outside major western countries (Fig. 9). For example, in Asia (excluding China) secondary smelting capacity alone now totals nearly 0.3×10^6 t per annum. The Asian region is adapting to its new role as a major supplier of finished products to western markets, and it is only natural that the raw metals for fabrication should also be produced nearby, even if this means increasing dependence on imports of scrap lead.

It is reasonable to conclude that the concentrations of secondary smelting capacity will increasingly be located in regions of natural supply, where the costs of labour and utilities are more favourable, and where strong export markets are being developed for that staple of the lead industry — the battery.