

LEAD

By Allan Cooper

World consumption of lead in 2001 was 6.4 Mt, down 1.6% from the all time high reached in 2000. Metal production was also down 1.5%, at 6.48 Mt, while mine production actually increased to 3.02 Mt, up 1.6% on the previous year. In the Western world, 61.6% of metal production came from secondary sources, up slightly from the previous year.

Net imports of lead into the Established Market Economy Countries (EMECs) were estimated at 490,000 t, 6.8% down on the 2000 figure of 526,000 t. Despite this, LME stocks fell from 130,000 t at the end of 2000 to a total of 97,000 t, having reached a low point of 87,000 t earlier in December. The lead price actually strengthened during the year, with the average LME settlement price rising to US\$476/t as compared with US\$454/t in 2000, but still lower than the US\$502 average in 1999. The price strengthened in the last quarter to finish the year at US\$504/t.

Supply and Demand

The EMEC mine production increased slightly from 2000 levels, at 2.25 Mt, up just 9,000 t. Production in the Americas fell slightly to 1.06 Mt with deliberate production cuts announced by Doe Run being offset by increases in production in Canada, Mexico and Peru. Production in Australia was again up significantly from 650,000 t to 715,000 t, with Pasminco's Century mine fully on stream. In Western Europe, production decreased 9% to 213,000 t. The decrease was largely due the closure of Boliden's Laisvall mine in Sweden in October. Boliden also announced the closure of the recently re-opened Los Frailes mine in Spain in September, and Outokumpu decided to suspend mining operations at the Tara mine in Ireland from November.

EMEC metal production decreased by 207,000 t (4.1%) to 4.88 Mt in 2001. Secondary

production decreased to 3.0 Mt (down 2.5%) representing 61.6% of total metal production. Primary production again decreased, to 1.87 Mt, (4.8%) over the 2000 level, as concentrate availability continued to tighten during the year. Scrap supplies in the US and Europe have generally been adequate.

In Western Europe, metal production fell 40,000 t to 1.57 Mt (2.5%), of which secondary production accounted for 1.02 Mt (65.3%). Output in Germany decreased from the 2000 level of 387,000 t to 375,000 t while in France production fell again by 30,000 t to 232,000 t, due in part to an extended maintenance shut down at Metaleurop's Noyelles Godault plant during the second quarter of the year. There were also production decreases in Belgium (down 24,000 t) and in Italy (down 15,000 t) but in the UK, by contrast, production increased by 43,000 t from 335,000 t to 378,000 t. The fact that secondary production in the UK was virtually unchanged at 180,000 t in 2001 suggests that primary production was up significantly, presumably due to an increase in bullion shipments from Mount Isa to Britannia Refined Metals.

In the US, metal production fell by 99,000 t to 1.37 Mt with primary production at 276,000 t, down by 65,000 t due to production cutbacks at Doe Run and the closure of the Asarco St Helena smelter. Secondary production was down 34,000 t to 1.10 Mt, representing 79.9% of the total. In Canada, production was 223,000 t, down 61,000 t on 2000. A contributing factor to this shortfall was Cominco's decision to close its Trail smelter for most of the third quarter in order to sell power from its hydro-electric plant to the US grid. The restart at the plant was in fact delayed until early November due to problems arising from thallium contamination. Production in Mexico was virtually unchanged at 240,000 t.

Lead Production and Consumption ('000 t)

	Mine Production (Metal Content)			Metal Production			Metal Consumption (Refined Metal)		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
EUROPE	361	362	336	1,855	1,879	1,850	1,990	2,056	2,039
Albania	-	-	-	-	-	-	1	1	1
Austria	-	-	-	24	24	22	55	61	58
Belgium	-	-	-	110	119	95	51	57	56
Bosnia	-	-	-	-	-	-	6	6	6
Bulgaria	14	14	16	82	84	85	7	8	8
Croatia	-	-	-	-	-	-	4	5	5
Czech Republic	-	-	-	25	28	28	52	70	78
Denmark	-	-	-	-	-	-	2	1	1
Finland	-	-	-	-	-	-	3	3	3
France	-	-	-	273	262	232	260	268	255
Germany	-	-	-	353	387	375	372	390	379
Greece	19	16	27	6	5	5	12	12	12
Hungary	-	-	-	-	-	-	10	10	11
Ireland	39	57	45	11	9	10	32	30	32
Italy	5	3	3	215	231	216	279	279	275
Macedonia	27	24	24	20	23	20	6	6	6
Netherlands	-	-	-	18	21	20	30	29	30
Norway	-	-	-	-	-	-	3	3	3
Poland	68	53	48	64	56	58	64	59	60
Portugal	-	-	-	5	4	4	23	28	27
Romania	18	19	19	18	24	29	18	20	20
Russian Federation	14	14	12	44	32	34	95	83	90
Slovak Republic	-	-	-	-	-	-	4	4	4
Slovenia	-	-	-	15	14	14	15	17	15
Spain	29	51	50	98	120	125	192	231	235
Sweden	118	107	88	79	78	75	22	11	11
Switzerland	-	-	-	10	10	8	16	11	12
Ukraine	-	-	-	10	15	14	-	-	-
UK	-	-	-	372	335	378	329	325	316
Yugoslavia	9	4	4	4	1	1	10	10	10
Other CIS	-	-	-	-	-	-	16	20	20
AFRICA	179	180	167	131	126	118	129	127	121
Algeria	1	1	1	6	6	6	21	21	20
Egypt	-	-	-	-	-	-	8	9	9
Kenya	-	-	-	1	1	1	3	3	3
Morocco	80	84	91	65	67	54	9	10	9
Namibia	12	12	14	-	-	-	-	-	-
Nigeria	-	-	-	4	4	4	5	6	6

Lead Production and Consumption ('000 t) continued

	Mine Production (Metal Content)			Metal Production			Metal Consumption (Refined Metal)		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
South Africa	80	75	52	52	46	51	67	59	56
Tunisia	7	7	8	-	-	-	6	6	5
Zambia	-	-	-	1	1	1	1	1	1
Zimbabwe	-	-	-	2	1	1	-	-	-
Other Africa	-	-	-	-	-	-	9	12	12
AMERICA	1,111	1,061	1,056	2,137	2,222	2,064	2,250	2,286	2,139
Argentina	14	14	14	26	30	34	27	34	28
Bolivia	10	10	9	-	-	-	-	-	-
Brazil	10	8	9	52	50	47	108	114	112
Canada	162	149	159	266	284	223	70	68	56
Chile	1	1	1	-	-	-	7	8	8
Colombia	-	-	-	11	10	10	12	14	14
Honduras	5	5	7	-	-	-	-	-	-
Mexico	126	138	140	199	239	240	179	185	180
Peru	271	271	275	111	116	118	16	16	15
Trinidad	-	-	-	1	1	1	-	-	-
US	513	466	443	1,447	1,471	1,372	1,793	1,805	1,686
Venezuela	-	-	-	23	21	20	29	31	30
Other America	-	-	-	-	-	-	9	11	11
ASIA	695	724	751	1,887	2,090	2,175	1,808	1,987	2,052
China	549	570	610	918	1034	1162	524	590	670
India	38	36	32	64	67	63	112	119	127
Indonesia	-	-	-	18	18	18	45	66	51
Iran	14	15	18	47	40	40	75	75	75
Israel	-	-	-	13	13	20	12	14	14
Japan	6	9	5	293	312	303	289	301	286
Kazakhstan	31	39	45	159	208	178	10	11	11
Korea DPR	26	22	20	22	19	18	17	15	14
Korea, Rep.	2	3	1	190	220	212	272	303	313
Malaysia	-	-	-	33	32	34	76	84	84
Myanmar	2	1	1	2	2	2	-	-	-
Pakistan	-	-	-	3	3	3	10	12	12
Philippines	-	-	-	24	25	26	42	38	34
Saudi Arabia	-	-	-	19	18	16	10	12	14
Singapore	-	-	-	-	-	-	14	14	14
Sri Lanka	-	-	-	1	1	1	-	-	-
Taiwan, China	-	-	-	45	42	40	150	145	146
Thailand	12	11	1	25	27	30	66	96	100

Lead Production and Consumption ('000 t) continued

	Mine Production (Metal Content)			Metal Production			Metal Consumption (Refined Metal)		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
Turkey	14	17	16	8	8	8	60	63	60
UAE	-	-	-	2	2	2	-	-	-
Uzbekistan	-	-	-	-	-	-	-	-	-
Other CIS	1	1	1	-	-	-	2	3	4
Other Asia	-	-	-	-	-	-	6	8	8
Other Asia West	-	-	-	-	-	-	16	17	16
OCEANIA	633	650	715	277	264	275	64	50	50
Australia	633	650	715	271	259	270	56	41	41
New Zealand	-	-	-	6	5	5	8	9	9
World Total	2,979	2,977	3,025	6,286	6,582	6,483	6,241	6,506	6,402
Western World	2,258	2,245	2,254	4,944	5,083	4,876	5,421	5,613	5,411

Source: International Lead and Zinc Study Group.

In Asia, production at 2.18 Mt was 85,000 t (4.1%) up from 2000 levels. However only China, up 128,000 t (12.4%), Malaysia, up 2,000 t to 34,000 t (6.3%) and Thailand, up 3,000 t (11.1%) showed any increase. Production falls were recorded in Japan (2.9%), Kazakhstan (14.4%) and the Korean Republic (3.6%) almost certainly due to the increasing difficulty in obtaining concentrates.

In Australia, metal production increased to 275,000 t (4.2%) despite financial problems at Pasminco which went into voluntary administration in September.

Lead consumption in the EMECs fell to 5.41 Mt, 3.6% below the record level set in 2000. The economic situation was already slowing in North America in the second half of 2000 and this continued into 2001 and was not helped by the terrible events of September 11. Lead consumption in the US was down by 119,000 t (6.6%) to 1.69 Mt, although this may be partly due to the move of some battery production to Mexico. By contrast in Western Europe, consumption was down only 23,000 t (1.3%) at 1.71 Mt. In Asia, China showed an impressive growth in consumption of 10.2% to

670,000 t. In most of the region demand was similar to 2000 but consumption in Japan fell back to 286,000 t, a drop of 15,000 t (5.0%) on the 2000 level.

Western European car sales rose by 0.6% to 14.8 million passenger cars in 2001 - the second best year ever. British registrations rose by 10.7% to 2.5 million cars and displaced France as Europe's second biggest car market. In Germany, the largest national market, registrations fell 1.1% to 3.3 million vehicles. In the US, vehicle production was down 11.2% over 2000 at 11,385,000 units. Strict comparison with the year 2000 for battery shipments in the US is not possible as the BCI data collected now include both Canada and Mexico as well as the US figures. In 2001, replacement battery shipments were 86.2 million and 20.4 million for original equipment. By comparison, the previous year's figures for the US alone were replacement batteries accounting for 81.1 million and original equipment batteries almost 18.5 million units.

Japanese vehicle production fell by 3.6% on the 2000 levels to 9.8 million units. Lead consumed

in battery production showed a fall of 2.3% from the levels reached in 2000, to 273,000 t.

In 2001 it is estimated that the gap between Western World production of lead metal and consumption was 535,000 t. Net imports from the former Eastern Bloc countries were estimated at 490,000 t, down 6.8% on 2000 levels of 526,000 t. US Stockpile releases were 30,000 t in 2001 as compared to 32,000 t the previous year. LME stocks decreased from the 130,000 t at the end of 2000, to 97,000 t at the end of 2001. Stocks in the Helsingborg warehouse have decreased to 12,000 t, a far cry from the 62,000 t in 1999. At the year end, the Singapore warehouse held stocks of 51,000 t.

Price Trends

The LME lead settlement price started the year at US\$471/t but reports of concentrate shortages and consequent smelter cuts drove the price to a high of US\$522.50/t on 12 March. However, softening demand for lead reversed the upward trend with the result that the price of lead reached a low of US\$430.50/t on July 3. Further concerns about falling LME stocks and potential shortages drove prices back above US\$500/t in August only to see the price drop back to US\$440/t in early October. From then on, the price climbed steadily to end the year at US\$504/t. The stock ratio (total stocks/consumption) has remained consistently around 4.4 - 4.5 weeks.

In the US, the average scrap price in 2001 was 5.6 c/lb and was at a level of 5.8 c/lb at the year-end, an increase of 9.4% compared with December 2000. In Europe, the picture was different, with UK prices declining from an average of £52/t in 2000 to average only £50/t in 2001 (3.8%), in Germany from an average of □88/t to □87/t and in France from □82/t to □80/t.

The lead-acid battery remains the key market for lead, particularly the automotive battery, and thus growth is dependent on the health of the automotive markets around the world. These have started the year 2002 generally

down in the US, Europe and Japan with the replacement battery market also weak in the US following a mild winter.

In terms of future prospects for growth of the lead market, most of the threats and opportunities continue to come from the battery market. There are increasing signs that a move to a 36-volt battery is imminent in vehicles and one such vehicle, the Toyota Crown was launched in the final quarter of 2001. The emphasis seems to have moved away from the pure electric vehicle to the hybrid and mild hybrid approach as typified by the Toyota Crown. On coming to rest, the engine stops and the electric starter/alternator starts the engine as well as generating power for the battery. These systems are capable of significant reductions in fuel consumption and harmful emissions.

The fact that the battery in such a vehicle has to accept power and also deliver power at almost any time means that the battery must be maintained in a partial state of charge during operation of the vehicle, if it is not to be over-charged or over-discharged. This can cause problems in a lead-acid battery and research is under way to solve these. The lead-acid system will have to demonstrate that it can do the job required in a reliable fashion as there is also a move to include features such as brake and steer-by-wire in this generation of vehicles. Otherwise, the much more expensive nickel/metal hydride or lithium ion systems could gain a share of this market. The position could become clearer in the next year or so as some top end European models seem destined to lead this change. It is important for lead-acid batteries to succeed in this market, not solely to avoid the risk of substitution, but for the fact that this generation of batteries will contain up to 50% more lead than in the present 12-volt units.

Toyota is also continuing to sell the Prius hybrid electric vehicle and Honda has added a hybrid version of the Civic to its range. The economic problems facing US car manufacturers seems to

have delayed the introduction of hybrid versions of their sports utility vehicles by GM and Ford. Currently the battery of choice for this type of vehicle remains the nickel/metal hydride type but this is acknowledged to be very expensive. Research continues into the improvement of the valve-regulated lead-acid battery for this application through the initiatives of the industry-supported Advanced Lead-Acid Battery Consortium. One such project, part sponsored by the DTI in the UK, is seeking to develop a novel lead acid battery and management system for HEV applications. A special dual terminal 2V cell for this battery has been developed by Hawker Batteries and is showing considerable promise in testing to an aggressive hybrid vehicle test cycle. A novel way of constructing the battery to minimise interconnect and to incorporate battery management functions has been devised and the battery should start to undergo extensive bench testing in the second half of 2002. When developed, the battery will be evaluated in a Honda Insight which has been acquired for the purpose.

2001 was a poor year for the industrial battery markets, particularly in the US. Here, ten years of almost uninterrupted growth was followed by a 15% decline. This applied in motive power largely because of the recession in the US and in the uninterruptible power supply (UPS) and the telecom sectors because of a slowdown in capital expenditure in these areas. Some further decline is anticipated in 2002 before the market starts to recover in 2003.

Predicting price trends is not easy, despite the fact that reduction in the availability of concentrates because of mine closures and cutbacks suggests an ever-tightening lead supply. The lead price seems reluctant to climb above US\$500/t and this situation is likely to persist until there is clear evidence of improvement in demand.

Health and Environmental Issues

It is widely recognised that lead is a material with potentially harmful properties. However, there is an important difference between a substance having harmful properties (ie its

hazardous characteristics), and the ability of these properties actually to cause harm to humans or the environment (ie the risk it presents). Hazard relates to the intrinsic properties of a substance, whereas risk is associated with the way in which a material is used. To ensure the safety of both human health and the environment, the use of lead is tightly regulated to reduce any risks associated with its use. However, despite the many measures already taken, which have resulted in significant reductions in the emissions of lead to air, water and soil over the past 20-30 years, the use of lead often continues to be targeted by regulators on the basis of hazard.

One of the most important issues in early 2001, both for the lead industry and for industry as a whole, has been the launch of a European Commission draft white paper on chemicals policy which sets out a new approach for the management of all chemicals in the EU. Proposals include:

- All existing chemicals to be assessed to determine their impact on both human health and the environment.
- A reversal of the burden of proof, whereby industry would become responsible for the testing and risk assessment of its chemicals.
- A stringent authorisation system for chemicals of particular concern. Specific permission would be required before a chemical could be used for a certain purpose, for which its safety had been demonstrated.
- Downstream users, as well as producers and importers, would also be required to provide health and safety data on the production, use and disposal of their products.
- The substitution principle would be applied, whereby 'dangerous' chemicals should be replaced by 'less dangerous'

substances where suitable alternatives were available.

As yet it is unclear whether lead and its compounds will be subject to the more stringent authorisation system.

Other important initiatives include a European Commission Directive on Restrictions on the Use of Hazardous Substances in Electrical and Electronic Equipment (ROHS) which looks set to ban

many uses of lead in electrical and electronic equipment from 2007. The first steps towards the implementation of the EU Water Framework Directive, which aims to integrate the protection and management of water bodies across Europe, were taken during 2001. For Priority Hazardous Substances (PHS) the directive requires a cessation of emissions by 2020. The appropriateness of including lead on the PHS list is currently under discussion.