



# THE SFP CADMIUM PRESS REVIEW

24<sup>th</sup> May 2004

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### Cadmium Metal Quotes

#### LMB Free Market 20<sup>th</sup> May 2004

\$/lb in warehouse	Low	High
Min. 99.99%	0.55	0.65
Min. 99.95%	0.45	0.55

#### Metal Pages 20<sup>th</sup> May 2004

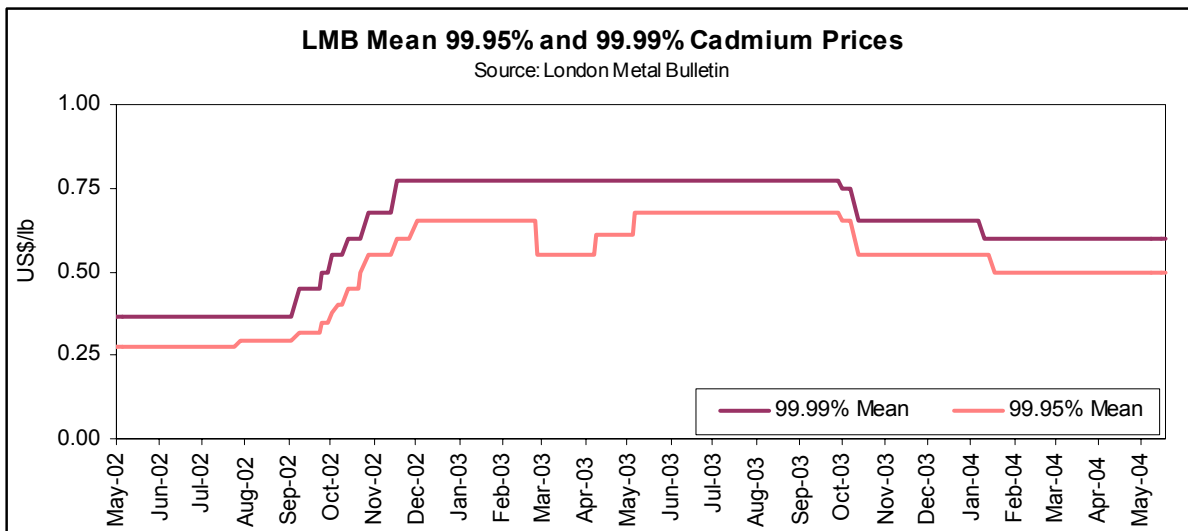
\$/lb in warehouse	Low	High
Min. 99.99%	0.48	0.53
Min. 99.95%	0.45	0.50

#### Platt's Metals Week 17<sup>th</sup> May 2004

\$/lb in warehouse	Low	High
Free Market HG	0.65	0.75
MW NY Dealer	0.45	0.50

#### Ryan's Notes 17<sup>th</sup> May 2004

\$/lb in warehouse	Low	High
Min. 99.95% (Rotterdam)	0.50	0.55



### WBMS World Refined Cadmium Production and Consumption 2000 – 2003

(all in MT) Year	2000	2001	2002	2003
Production	19,205.5	17,597.2	16,209.5	16,319.1
Consumption	20,591.6	18,062.1	19,240.4	19,811.0
MARKET BALANCE	-1,386.1	-464.9	-3,030.9	-3,491.9

### Currencies and Commodities

Financial Times Currency Market Data: 20 <sup>th</sup> May 2004	
Euro (€) per US Dollar (\$)	0.84
Pound Sterling (£) per US Dollar (\$)	0.56
Japanese Yen (¥) per US Dollar (\$)	113.22



## **Cadmium Market Executive Summary**

### **MARKET ROUND UP**

1) Cadmium has been quiet for the past four or five months. Production is going down substantially, while demand is down only slightly. "You can pick up four-nines cadmium for about 50¢/lb," said a merchant, adding: "Cadmium is not doing too well; there is little consumer buying. Demand is terrible."

[Platt's Metals Week 03/05/04. Read source article? – See page 5]

### **SUPPLY**

#### Chelyabinsk

2) Russia's leading zinc producer cut output of the metal by over a fifth in January-March, part of its previously announced plans to reduce production this year, chiefly due to high feed prices. Chelyabinsk Zinc Plant produced 34,400 tons of zinc, over three quarters of which was sold domestically, representing a 22% decline on the year ago period. The firm produced 177,336 tonnes of zinc in 2003 but intends to bring this down to 150,000 tonnes this year. Cadmium output totalled 84.6 tons.

[Metal Pages 21/04/04. Read source article? – See page 5]

#### The U.S. DLA stockpile

3) The U.S. DLA stockpile has submitted proposed revisions to its fiscal 2004 annual materials plan to Congress along with its planned fiscal 2005 sales. The only metal affected by the 2004 revisions is ferrochrome and absent from the list was cadmium, supplies of which were exhausted in April last year. The revisions to the 2004 materials plan will go into effect 45 days from the date submitted, assuming Congress makes no changes, the DNSC said.

[Metal Bulletin 30/03/04. Read source article? – See page 5]

#### Kazakhstan

4) In the first quarter of 2004 Kazakhstan produced 354 tonnes of unprocessed cadmium, including scrap and waste, and powders, up 237% from the same period in 2003. Meanwhile Kazakhstan reduced refined gold production 0.7% year-on-year to 2.51 tonnes in the first quarter of 2004 and Silver production fell 16% to 163.968 tonnes.

[Interfax.com 14/04/04. Read source article? – See page 6]



### Pasminco - Zinifex

5) Troubled lead and zinc & cadmium miner Pasminco upped its mine output in the last quarter, but this was offset by lower smelter production from its smelters. The Melbourne based firm reported mined production of contained zinc totalled 156,483mt, representing a 4.7% year on year increase. The firm, which has been operating under an administrator for nearly three years, began a new metal marketing arrangement with Trafigura at the start of this year. Pasminco is to be renamed as Zinifex.

[Metal Pages 30/04/04. Read source article? – See page 6]

6) Zinifex has completed its share offer. The \$1 billion Zinifex float faced a tough sharemarket debut after dismal support from major investors cut \$400 million from the price that backers had hoped to net from the zinc miner. The Melbourne group, formed from the failed Pasminco, was forced to accept \$1.95 a share as local fund managers shunned one of the largest floats this year. A Zinifex spokesman said "The float has been filled and it's our job to run the company the best we can."

[TheAge.com.au 05/04/04. Read source article? – See page 6]

### Penoles

7) Mexican polymetallic giant Penoles achieved a new high in terms of sales in a strong first quarter, returning to the black on the back of booming prices for its major products. The firm posted net profits of P343m (US\$30.3m) for the three months ending March 31st, compared to the P86.4m loss YoY. Output was down however. Zinc production fell 16% year on year to 52,000 mt following the closure of a zinc-lead mine in September last year.

[Metal Pages 28/04/04. Read source article? – See page 7]

### Peru

8) The Peruvian Energy & Mines Ministry has reported that copper and cadmium were among the most notable movers in terms of February output in Peru. Production of copper surged by 29% year on year to 81,671mt, however output of cadmium fell by 17% year on year to 35mt, after cuts at both Peruvian producers, TeckCominco's Cajamarquilla's refinery and Doe Run's La Oroya refinery.

[Metal Pages 22/04/04. Read source article? – See page 7]

### Teck Cominco

9) Net earnings rocketed for polymetallic miner Teck Cominco in the first quarter, with higher prices cited as a major factor. The Vancouver based firm reported net earnings of C\$96 million (US\$71 million) for the three months ending March 31st, dwarfing the restated net profit of \$5 million in the same period last year, and around 18% higher than most analysts had expected. Teck's portfolio of metals includes zinc, lead, copper, cadmium, and indium.

[Metal Pages 27/04/05. Read source article? – See page 8]



## DEMAND

### Electronics

10) The European Commission has launched a revision of the list of products that are exempted from bans on using hazardous substances in the manufacture of electrical and electronic equipment. A consultation document issued this week calls for stakeholder views on how the list should be amended. Under a 2002 directive lead, mercury, cadmium, hexavalent chromium, PBDEs and PBBs should be eliminated from production processes by July 2006. However, an annex to the law lists applications and components that are exempt from this restriction because alternatives were not yet available when the legislation was passed. An independent study has been commissioned to guide the EU debate.

[EDIE.net 07/05/04. Read source article? – See page 8]

### Recycling

11) Calls for a ban on the use of cadmium in batteries have caused friction between the European Commission (EC) and the European Parliament (EP) on the extent and nature of cadmiums future recycling potential. The EP have asked for amendments to the proposed law, but these amendments are not supported by the results of the Extended Impact Assessment (EIA), which identified the EC's proposals as the most sustainable ones from an environmental, economic and social perspective. Among the most significant amendments tabled by the Parliament is a different collection target for portable (i.e. normal household) batteries, corresponding to 50% of the annual sales as of two years ago. However, the EC's EIA showed that existing legislation, such as the End-of-Life Vehicles Directive, together with the closed-loop system proposed, can provide an equivalent level of environmental protection at lower costs compared to banning lead and cadmium in batteries. The closed-loop system would mean that all batteries be collected and recycled, and their metals re-introduced in the economic cycle. In this way, no lead or cadmium would leak into the environment. Now the EC will go through the amendments and discuss which to include in future legislation.

[Europa.eu.int 20/04/04. Read source article? – See page 9]

## In other news...

### Solar Energy & Wine

12) Red wine, what can beat it? It reduces your risk of heart disease. It's full of cancer-fighting compounds. And now, researchers at the University of Toledo have shown that it also makes better solar cells. The chemical properties of wine, when added to solar cells made out of cadmium and telluride, raises solar cell efficiency to the industry average of 12%. The key is to create a smooth surface on which to transform the solar energy into electricity. "It's interesting work," said Ken Zweibel, at the US National Renewable Energy Laboratory.

[Solaraccess.com 30/04/04. Read source article? – See page 9]



## **Source Press Articles**

### **1) Minor metals prices moving mostly sideways**

Platt's Metals Week 03/05/04

[...] Cadmium has been quiet for the past four or five months. Production is going down substantially, while demand is down only slightly. "You can pick up four-nines cadmium for about 50¢/lb," said a merchant, adding: "Cadmium is not doing too well; there is little consumer buying. Demand is terrible."

Bismuth is slightly firmer because the Chinese have been refusing to offer material at current prices. [...]

### **2) Chelyabinsk Q1 output down**

Metal Pages 21/04/04

Russia's leading zinc producer cut output of the metal by over a fifth in January-March, part of its previously announced plans to reduce production this year, chiefly due to high feed prices. Chelyabinsk Zinc Plant produced 34,400 tons of zinc, over three quarters of which was sold domestically, representing a 22% decline on the year ago period. The firm produced 177,336 tonnes of zinc in 2003 but intends to bring this down to 150,000 tonnes this year. Cadmium output totalled 84.6 tons, while that of sulphuric acid stood at 58,100 tons. The company also produces Indium but did not report figures for its Indium output.

### **3) DNSC revises fiscal '04 plan, details '05 sales**

Metal Bulletin 30/03/04

The U.S. Defense National Stockpile Center (DNSC) has submitted proposed revisions to its fiscal 2004 annual materials plan to Congress along with its planned fiscal 2005 sales. The only metal affected by the 2004 revisions is ferrochrome, with the agency seeking to reduce the quantity to be sold to 110,000 short tons annually from 150,000 tons previously. The fiscal 2005 plan by the arm of the Defense Logistics Agency calls for palladium sales to be halved to 100,000 ounces compared with 200,000 ounces previously. Platinum and iridium sales would be unchanged at 25,000 ounces and 6,000 ounces, respectively. All of the platinum group metals are offered by the DNSC via the basic ordering agreement (BOA) format. The annual volume of germanium offers would stay at 8,000 kilograms (17,636.9 pounds). The amount of germanium authorized for sale on a monthly basis was increased for fiscal 2004 to 800 kg. (1,763.7 pounds) from 500 kg. (1,102.3 pounds) due to a rise in demand for the stockpiled material. Annual ferrochrome offers under the fiscal 2005 plan would stand at 110,000 short tons, as proposed under the fiscal 2004 revision. The agency recently increased the quantity of metal offered for sale via the BOA, noting that sales under the format now will total a maximum of 3,000 tons a month for low-carbon ferrochrome (grades 0.05 and 0.10), up from 1,500 tons a month previously. High-carbon metal (0.15-grade) offered under the BOA was unchanged at a maximum of 10,000 tons a month and 70,000 tons annually. Cobalt offerings are listed as unchanged at 6 million pounds in fiscal 2005, of which 700,000 pounds can be sold monthly under the BOA, although the agency confirmed recently that rapidly rising prices had forced restrictions on sales of the metal due to a dollar cap of \$64 million for fiscal 2004 and \$67 million for fiscal 2005. Absent from the list was cadmium, supplies of which were exhausted in April last year. The revisions to the 2004 materials plan will go into effect 45 days from the date submitted, assuming Congress makes no changes, the DNSC said. The 2005 plan will begin Oct. 1, again subject to approval by Congress. [...]



#### 4) Kazakhstan reduces Q1 gold output 0.7%

[Interfax.com](http://Interfax.com) 14/04/04

Kazakhstan reduced refined gold production 0.7% year-on-year to 2.51 tonnes in the first quarter of 2004. Silver production fell 16% to 163,968 tonnes, the national statistics agency told Interfax. Production of refined copper grew, by 4% to 105,869 tonnes, production of alumina rose 3% to 359,795 tonnes and primary zinc output increased 6% to 73,672 tonnes. Production grew 15% for magnesium and its products, including scrap and waste, but fell 0.8% for titanium and its products, including scrap and waste, the statistics agency said, without saying how much of these metals were produced. And Kazakhstan produced 354 tonnes of unprocessed cadmium, including scrap and waste, and powders - 237% more than in January- March 2003.

#### 5) Production dips for Pasmaenco

[Metal Pages](http://Metal Pages) 30/04/04

Troubled lead and zinc miner Pasmaenco upped its mine output in the last quarter, but this was offset by lower smelter production from its smelters. The Melbourne based firm reported total output for the three months ending March 31st of 391,156mt, down marginally on the year ago figures. Mined production of contained zinc totalled 156,483mt, representing a 4.7% year on year increase. Contained lead output surged by 37.9% to 28,394mt. Smelter production of zinc was 150,353mt, slightly below last year's levels. Lead output was down by nearly a quarter, to 55,926mt. The loss of bullion from the now closed Cockle Creek operation, combined with a planned furnace shutdown for maintenance work at Port Pirie, were the major factors in the fall. The firm, which has been operating under an administrator for nearly three years, began a new metal marketing arrangement with Trafigura at the start of this year. "As a result sales of lead and zinc from the Australian smelters showed a one-time increase as stock previously contained in the Asian distribution channel was realised," the company said in a statement. "Improved margins negotiated under this arrangement will flow from sales now and into the future." Pasmaenco, soon to refloat under the new name Zinifex reported a widening loss of A\$272.4 million (US\$210.5 million) for the first half of this financial year, although output was on the rise. The firm also produces cadmium, copper, gold and silver.

#### 6) Zinifex endures tough passage

[TheAge.com.au](http://TheAge.com.au) 05/04/04

Chief executive Greig Gailey, with chief financial officer Tony Barnes on Friday, says Zinifex is delighted with the completion of its share offer. The \$1 billion Zinifex float faces a tough sharemarket debut today after dismal support from major investors cut \$400 million from the price that backers had hoped to net from the zinc miner. It was less than a week ago that Zinifex chief executive Greig Gailey predicted the three-day book-build for institutions would be "readily" filled within the targeted range of \$2.10 to \$2.70 a share. But on Friday the Melbourne group, formed from the failed Pasmaenco, was forced to accept \$1.95 a share as local fund managers shunned one of the largest floats this year. The price of shares offered to retail investors was subsequently set at just \$1.85 a share, after a 10¢ discount. With Pasmaenco's creditors forced to accept just under \$960 million, instead of the \$1.35 billion they had hoped for at the top of the range, Zinifex has put on a brave face ahead of what is set to be a tough listing. "We are delighted with the successful completion of the Zinifex share offer," Mr Gailey said. "It represents the culmination of 21/2 years of hard work by many people in transforming the business," he said. A Zinifex spokesman said the failure of the float lead managers UBS, Deutsche Bank, and Citigroup to sell the shares within the book-build range would not affect the way the Melbourne group did business. "The float has been filled and it's our job to run the company the best we can," he said. On Friday, Mr Gailey stuck by the pre-float line that Zinifex's "asset portfolio" and "conservative financial structure" would enable it to exploit any improvements in the zinc market. However some analysts and fund managers do not share the company's enthusiasm. Credit Suisse First Boston last week suggested the "sweet spot"





for metals and mining stock values had passed in January. Although not negative towards the zinc price, CSFB said it could see more potential in other metals. The investment bank set a 12-month price target for Zinifex of \$1.90 a share. Of particular concern to some analysts are the 74 million shares, or 15 per cent of the stock, taken up by creditors of the old Pasminco who are free to sell as soon as the bell rings. They were among the hundreds owed \$2.8 billion when Pasminco collapsed in 2001. "Leaving aside any questions you might have about the zinc price, which appears to have flattened out at the moment, it seems as if institutions were worried about the overhang," said one mining analyst who did not want to be named. The analyst also said hedge funds had bought some of Pasminco's debt before the float, giving them a chunk of shares. "This makes people nervous," he said. Some analysts said that concerns about the float would be exacerbated by the failure to secure the full \$1.35 billion. The failure to win over institutions came in the same week the company announced a solid response from so-called "mum and dad" investors, who coughed up \$315 million at the top targeted retail price of \$2.60 a share.

## 7) Penoles back in black

Metal Pages 28/04/04

Mexican polymetallic giant Penoles achieved a new high in terms of sales in a strong first quarter, returning to the black on the back of booming prices for its major products. The firm, the world's largest producer of refined silver and metallic bismuth, posted net profits of P343 million (US\$30.3 million) for the three months ending March 31st, compared to the P86.4 million loss in the same period last year. Sales surged by 26% to P4.16 billion, surpassing the record set in the previous quarter. Average realised prices for lead and zinc soared by 84% and 36% respectively as compared to the first quarter of 2003, while those for gold and silver surged 55% and 16%. Output was down however. Zinc production fell 16% year on year to 52,000 tonnes, while that of lead dropped 28% to 15,000 tonnes, following the closure of a zinc-lead mine in September last year. Gold output was down 4% to 84,000 ounces, with silver dropping 4.3% to 11.3 million ounces. Last year Penoles saw its net loss widen to P153 million despite a strong final quarter. Earlier this year the company announced plans for major investment in its Milpillas copper project. The firm also produces cadmium, iron ore, magnesium, selenium and tellurium.

## 8) Mixed output for Peru

Metal Pages 22/04/04

Copper and cadmium were among the most notable movers in terms of February output in Peru, albeit in different directions, the Energy & Mines Ministry has confirmed. Production of copper surged by 29% year on year to 81,671mt, after improved performances at all major producers, particularly BHP Billiton who moved into third place after a 246% increase following the restart of its sulfides operation. For the first two months of the year combined, output totalled 155,755mt, up 15% from the same period 2003. Zinc production was down, dropping 4.9% to 93,757mt, with cuts Antamina and Volcan offsetting growth at Los Quenuales. For January-February together output was up however, by 2.4% year on year to 207,304mt. Lead output fell by 5.7% in February to 24,733mt, with declines at Atacocha and Los Quenuales overriding a 61.9% increase at El Brocal. For the two months production was also down 5.7%, to 50,048mt. Tin production at domestic monopoly Minsur rose by 6% to 3,326mt, with January-February figures standing at 6,507mt, 3.1% above the same period last year. Output of cadmium fell by 17% year on year to 35mt, after cuts at both Peruvian producers, TeckCominco's Cajamarquilla's refinery and Doe Run's La Oroya refinery. Molybdenum production dropped 3.4% to 745mt, after both Antamina and SPCC made cuts. Tungsten production continues to be suspended in the country. Gold output surged by 28.7% to 16,282kg in February and 15% to 33,669kg for the first two months, after hikes at Newmont and Minera Ares. Silver production edged up 0.9% to 230,558kg in February. Copper was the exception to across the board base metal production rises in Peru last year.





## 9) Profit soars for Teck

Metal Pages 27/04/05

Net earnings rocketed for polymetallic miner Teck Cominco in the first quarter, with higher prices cited as a major factor. The Vancouver based firm reported net earnings of C\$96 million (US\$71 million) for the three months ending March 31st, dwarfing the restated net profit of \$5 million in the same period last year, and around 18% higher than most analysts had expected. "These substantially higher earnings were due mainly to higher copper and zinc prices," explained the company, the number one global zinc producer, in a statement. "The average LME prices for copper and zinc were US\$1.24 and US\$0.49 per pound respectively in the quarter, up 64% and 37% from a year earlier. A weaker US dollar partially offset the effect of higher metal prices." Average realised prices for lead also soared, by 90% year on year. Sales revenue surged by over a quarter from the year ago period, to \$722 million. Copper was the exception to a reduction in production and sales volume during the quarter. Output totalled 50,000 tonnes, up 8.6% year on year, with sales of 49,000 tonnes over a quarter higher than the year ago period. Refined zinc production stood at 98,000 tonnes, down 4.9%, with sales dipping 2% to 99,000 tonnes. Mined zinc output of 146,000 tonnes was 9.4% below first quarter 2003, with sales falling 21.4% to 144,000 tonnes. Refined lead output dropped 30.5% to 16,000 tonnes, while sales were down 18.2% to 18,000 tonnes. Mined lead production fell by 6.9% to 27,000 tonnes, and sales were halved, to 3,000 tonnes. Teck also produces gold, bismuth, cadmium, indium, germanium and silver. Earnings soared for the company last year after strong prices offset production declines.

## 10) EU consults on electronics substance ban

EDIE.net 07/05/04

The European Commission has launched a revision of the list of products that are exempted from bans on using hazardous substances in the manufacture of electrical and electronic equipment. A consultation document issued this week calls for stakeholder views on how the list should be amended. Under a 2002 directive lead, mercury, cadmium, hexavalent chromium, PBDEs and PBBs should be eliminated from production processes by July 2006. But an annex to the law lists applications and components which are exempt from this restriction because alternatives were not yet available when the legislation was passed. The law calls on the Commission to revise the list regularly, and in the case of four controversial applications, to decide "as soon as possible" whether they should be added or removed. Two of these - the use of mercury in straight fluorescent lamps and lead in solder for a wide array of computer and network infrastructure equipment - enjoy exemptions, and the review will decide whether these should end. The other two - the use of flame retardant deca-BDE in plastics and lead in light bulb glass - were not exempt from the general ban and the revision will determine whether this should change. The fate of deca will be decided following the completion of a separate risk assessment that has been underway for several years and is now drawing to a close. For the other three, an independent study has been commissioned to guide the EU debate. A committee of member states' experts will have the final decision on amendments to the list. Beyond the four priority applications, the Commission has been requested by various industry groups to consider other applications for exemption. Among them are the lead used in high-temperature solders and lead-bronze bearing-shells, lead and cadmium in optical and filter glass, and all of the substances in safety equipment used by fire and rescue services. For each application the Commission's consultation paper asks whether "feasible substitutes currently exist in an industrial or commercial scale", whether substitutes are subject to any restrictions themselves, and what the costs and benefits of substitutes are.



## 11) Batteries: Commission stands firm on new Directive

[Europa.eu.int](http://Europa.eu.int) 20/04/04

The European Commission welcomed the swift European Parliament vote today on a new Directive on batteries and accumulators. In particular the priority given to making producers contribute to the collection of all battery types. But the European Commission disagrees with some of the 87 amendments put forward by the EP. Notably, the Commission stands firm on amendments calling for a different collection target for portable batteries and a ban on lead and cadmium. These amendments are not supported by the results of the Extended Impact Assessment, which identified the Commission's proposals as the most sustainable ones from an environmental, economic and social perspective. The Directive, as proposed by the Commission, seeks to prevent spent batteries from ending up in landfills and incinerators, and to recover the various metals used in them. It would create an EU-wide framework for national battery collection and recycling schemes and enhance the proper functioning of the internal market. Environment Commissioner Margot Wallström commented: "I welcome this fast reaction from the European Parliament. It reaffirms the high priority that the EU gives to making sure that batteries and accumulators no longer pollute the environment when they become waste. However, I maintain that our original proposal can achieve the environmental objectives we share with Parliament. At the same time it is the most cost-effective proposal, in line with the results of the Extended Impact Assessment that we conducted. I therefore stand by our proposal to introduce a closed loop system for lead and nickel-cadmium batteries, and the collection targets we set out for the different kinds of batteries." The Parliament's vote in first reading comes less than six months after the Commission proposed the new Directive in November 2003. Among the most significant amendments tabled by the Parliament is a different collection target for portable (i.e. normal household) batteries, corresponding to 50% of the annual sales as of two years ago. The Commission's proposal envisaged a general collection target of 160 grams per inhabitant and year (corresponding to four to five batteries). In addition, the Commission proposed an additional target of 80% of the nickel-cadmium batteries disposed annually in each Member State. The Commission's proposed collected target was identified as the most cost-efficient target. Moreover, these proposals take account of the unpredictable life span of batteries and the fact that consumers often hoard them before bringing them to a collection point, which makes it difficult to link battery collection to annual sales, as well as of the special environmental concerns that nickel-cadmium batteries raise. The Commission will therefore reject the respective amendments. The Parliament has further tabled an amendment extending an already existing ban on mercury in batteries to lead and cadmium. However, the Commission's Extended Impact Assessment showed that existing legislation, such as the End-of-Life Vehicles Directive, together with the closed-loop system proposed, can provide an equivalent level of environmental protection at lower costs compared to banning lead and cadmium in batteries. The closed-loop system would mean that all batteries be collected and recycled, and their metals re-introduced in the economic cycle. In this way, no lead or cadmium would leak into the environment. Next steps: After today's vote in the European Parliament, the Commission will introduce a modified proposal, accepting some of the amendments and rejecting others. The Council will then formulate its opinion on the proposed Directive in a common position. The co-decision procedure will end when the European Parliament and the Council reach agreement and formally adopt the Directive. After publication in the Official Journal and its entry into force, Member States will have 18 months to transpose the obligations of this Directive into national legislation.

## 12) Red wine leads UT scientists to juice up potency of solar cells

[Solaraccess.com](http://Solaraccess.com) 30/04/04

Red wine, what can beat it? It reduces your risk of heart disease. It's full of cancer-fighting compounds. And now, researchers at the University of Toledo reveal yet another use for the juice of the grape. It makes better solar cells. UT researcher Yann Roussillon didn't expect wine to boost the efficiency of solar cells. Still, the doctoral candidate was game when UT physics professor Victor Karpov proposed the idea of wine-soaked solar cells in a brainstorming session. No, they weren't drinking at the time. Dr. Karpov had a hunch that the chemical properties of wine could help solve a major problem in solar cells made out of cadmium and telluride. Unfortunately for Ohio's wine crop, this isn't really a practical way to make solar cells. So Mr. Roussillon found a substance



that shared wine's properties. A paper in the current issue of Applied Physics Letters shows that the research team settled on a chemical called aniline. While a glass of aniline with dinner would have distressing effects, it works on solar cells because it too contains charged particles. In fact, aniline performed slightly better than wine, raising solar cell efficiency to the industry average of 12 percent. While cadmium-telluride solar cells will convert sunlight into electrical energy, they do so stingily. Only 1 to 3 percent of the light that strikes the cell turns into electricity. Despite efforts to goose the efficiency rate to an average of 10 to 12 percent, methods generally are expensive and often inefficient. Cadmium cells start with a layer of glass, then a slather of a transparent oxide, followed by a sheet of cadmium sulfide, then cadmium telluride, and finally a metal sheet that acts as the electrical contact. While the solar cell looks ice-rink smooth, it's really a rough landscape. Electrons traveling across the surface lose their way in its many valleys. Red wine contains microscopic spheres called colloidal particles. Each sphere carries an electrical charge. When wine spills across the cadmium-telluride layer, these particles fill in the valleys, smoothing the electrons' path. The result? Solar cells that can convert some 9 percent of the light that strikes them into energy - nearly as good as all-but the most experimental and expensive processes. The university has applied for a patent on the aniline process. "It's interesting work," said Ken Zweibel, at the National Renewable Energy Laboratory. NREL is a part of the U.S. Department of Energy. However, the market value of the invention must be proven. "It's really too early to tell," said Chip Hambro, general manager of First Solar, which makes cadmium-telluride solar cells.

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