rain, dying forests, catchwords with which you too are undoubtedly familiar, are recent examples. The standards imposed on smelters still vary widely to a certain extent, depending on the location. In view of international communication today, it can be assumed that standards will be harmonized in the course of time.

The existing plants have made great efforts and major investments in order to comply with the prevailing limits. In the case of the older plants, the fall in the number of production units as a result of the increases in capacity has helped reduce the emissions. Improved hoods and enclosures cut down escape of gas and dust and thus lower the fugitive emissions. A further example is the improvement of the conversion efficiency of sulfuric acid plants by modifying the converter operation, up to the extreme of acid production with only one converter. It has become evident at this conference that in general new plants will not be built just because the pressure from this quarter is becoming so strong.

The lead smelters are an exception here. The weaknesses of conventional lead metallurgy are well known. On the other hand, the official limit values, both for the workplace and for environmental protection, are extremely low. In the United States, legislation stipulates a maximum allowable concentration at the workplace of 50 μg of lead/m^3 at NTP. The corresponding figure in Germany is 100 μg. It seems impossible that these values could ever be achieved or maintained in an updraft sintering plant for lead concentrates.

Let me give you a further example: in West Germany, the government has for the first time introduced an emission limit for lead. It has been set at 250 μg/m^3/day. As far as I know, no such regulation has yet been introduced in any other country. Therefore this figure will mean very little to you. By way of explanation: under the climatic conditions prevailing in Western Europe, the airborne lead concentration must be well below 0.5μg/m^3 (NTP), i.e., far below the current limits of 1.5 in the United States and 2.0 in the European Community. The standards for emissions have also been tightened. In the future, the lead content of the clean gas must not exceed 5 μg versus the previous limit of 20 μg. Such efficiencies can only be achieved with high-performance filters handling small gas volumes and are therefore not financially justifiable in a conventional lead smelter with huge volumes of waste air which require treatment. Only new, modern processes, the design of which lead to a dramatic reduction in waste gas rates, can make this expensive filter technology pay. In my view, we should assume that the developments in environmental protection will make new smelting technologies for primary lead production essential.

Conclusion

On the one hand, sulfide smelting has made enormous progress in recent years. On the other hand, the construction of a new plant operating on a forward-looking process requires a high capital outlay. This high outlay must be justified. Furthermore, I support the conclusions of V. P. Keran of Mt. Isa that, before a new construction decision is implemented, all the available means for improving the efficiency of the existing plants must be considered. Boosting productivity and lowering running costs by means of continuous development of the existing facilities is an even more important goal of R&D than the development of new processes.

This development potential for existing equipment can be realized in stages through the solution of many individual problems which do not require a big capital outlay and therefore constitute a justifiable economic risk. The prospects for the new processes, unless they promise dramatic cost reductions, lie with the processing of complex and highly impure raw materials on the one hand and with the solution of serious environmental problems on the other hand.

Finally, I would like to say that the papers presented at this symposium on smelter operation have clearly shown that the innovative capacity of the nonferrous industry is sufficient to enable them to adapt to the new energy and environmental protection situation.

ERRATA

The following is a list of errata sent to us by the authors after the proceedings volumes were printed.

"Distribution Behavior of Various Elements in Copper Smelting Systems"

A. Yazawa, S. Nakazawa, and **Y. Takeda** (pp. 99-118)

p. 101, par. 2, line 7:
"Thus, to establish equilibrium partial pressures of . . ." should read "Thus, to establish equilibrium, wt % Cu in the matte must be defined. Since the equilibrium partial pressures of . . ."

p. 102, par. 2, line 6:
$\gamma_{NiO_{0.67}}$ should read $\gamma_{NiS_{0.67}}$

p. 109, numerator of Eq. 12:
(γ_{XO_2}) (%X) (n_T) should read (γ_{XO_2}) (%X)/(n_T)

p. 109, 4 lines after Eq. 13:
"X" should read "[X]"

p. 109, 2 lines after Eq. 16:
$[\gamma_X]/\{\gamma_{XO_2}\}$ should read $[\gamma_X]/\{\gamma_{XS_2}\}$

p. 112, par. 3, line 4:
"in Figs. 9 and 10" should read "in Figs. 10 and 11"

"High Pressure Injection of Air into a Peirce-Smith Converter"

J. K. Brimacombe, S. E. Meredith, and **R. G. H. Lee** (pp. 329-354)

captions to Figures 1(a) and 1(b)
"Amione" should read "Aimone"

caption to Figure 9(a):
"Photograh" should read "Photograph"

Equipment section, line 2:
reference [2] should read [3]

"The Development of a Tin Sulfide Fuming Process at Capper Pass Ltd."

P. Halsall ((pp. 553-582)

Figure 5:
Curve representing 2% SO_2 should be carried from 2 hr. to 4 hr. time beyond the intersection with the vertical pointer to the 1/2% SO_2 curve.

Table V, 2nd table:
"1900-200 gph" should read "190-200 gph"

Table VI, A. Complete Combustion, Total tinny feed tonnes:
"16014" should read "26014"

Fig. 6A:
"Run D8 tinny mattee" should read "Run D8 tinny matte"