RECLAIM AND WASTE TREATMENT OF LEAD FROM LEAD/ACID BATTERY PLANTS

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Introduction

Why save water? Why treat water? Why re-use water? Why invest in equipment to reclaim lead? For industrialists, the reasons may not be the same. But the bottom line is: to save money!

Fresh, incoming water can be expensive and not always readily available. Treatment of waste-water is very expensive: equipment must be purchased and there is a continuous cost for treatment chemicals, sewer taxes, and liability for what leaves the plant. If not handled in the correct way, the reclaiming of the lead may become difficult and too expensive to be profitable.

The best waste system is *no* system, or the smallest system designed to meet the customer's requirements. At an output of 500 - 2000 batteries per day, a plant will use between 15 000 and 20 000 gallons of water each day. This amount can be reduced, however. To do this, it is necessary to establish where and why the amount of water is being used. Once these areas have been defined, an evaluation can be made as to whether they can be closed-looped to re-use the water. The author's company has taken plants that were using 18 000 gallons per day and has successfully reduced their usage to less than 600 gallons per day of fresh, incoming water.

Figure 1 shows the four main areas that can contribute water to the waste stream. These are as follows.

(i) Cooling water. This has the highest volume of water, but the least concentration of lead. Between 60% and 80% of the plant water is used here. Even though there is no lead in this water, by combining it with the rest of the waste stream, it becomes contaminated and has to be treated.

(ii) Pasting wash-down. This has the lowest volume of water but the highest concentration of lead. The latter is in the oxide or suspended form. This is where the largest quantity of lead resides.

(iii) Dry charge. The bulk of the problem here is that the lead is in a very complex, dissolved form, and it is difficult to make the lead hydroxide suspended solid. Water usage is not high and can be easily handled.

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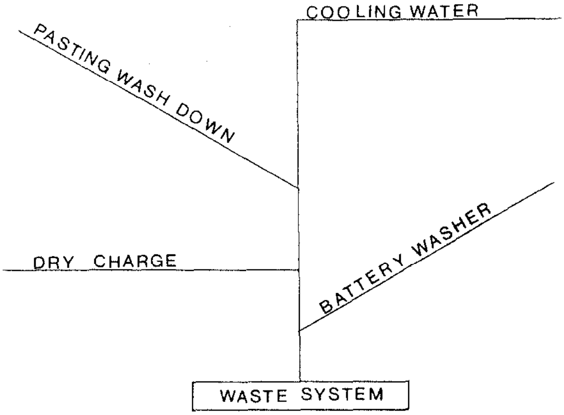

Fig. 1. Contributors to waste-water stream in a lead/acid battery plant.

(iv) Battery washer. Again, low volume of water, but high in oils/greases, lead suspended solids, and soaps. This, too, can be handled without much difficulty.

Cooling water

Now, how can the cooling system be closed-looped when using either a cooling tower or a refrigeration unit? The amount of water, the temperature to be maintained, and the outside temperature will determine the optimum solution. It is best to contact the manufacturer of the equipment that requires the cooling system: usually, the manufacturer also makes the cooling equipment.

Pasting wash-down water

Figure 2(a) shows a typical floor layout of most plants that handle this operation; *i.e.*, wash down into a collection pit and allow the lead oxide to settle out to the bottom; the semi-clear water then goes to the sewer, and every so often the highly concentrated lead oxide is bucketed out and sent to the smelter. It should be remembered that the "semi-clear" water has to go to the waste system.

To upgrade this procedure, first change the name of the pit from 'collection pit' to 'staging pit'. It is now no longer necessary to collect heavy amounts of the lead oxide and remove them at a later date. Rather, the lead oxide should be removed from the pit at the same rate that it is being generated in the wash-down operation. This operation will not involve heavy collected sludges, but diluted sludge or 'dirty water'. This alone brings down the cost of any equipment that has to be purchased.

Further, if a gear-driven mixer is added, then the lead will be kept in suspension at all times (Fig. 2(b)). It should be remembered that the lead should not be allowed to settle out at the bottom of the pit. By adding a pump that will handle this diluted sludge or dirty water (Fig. 2(b)), complete

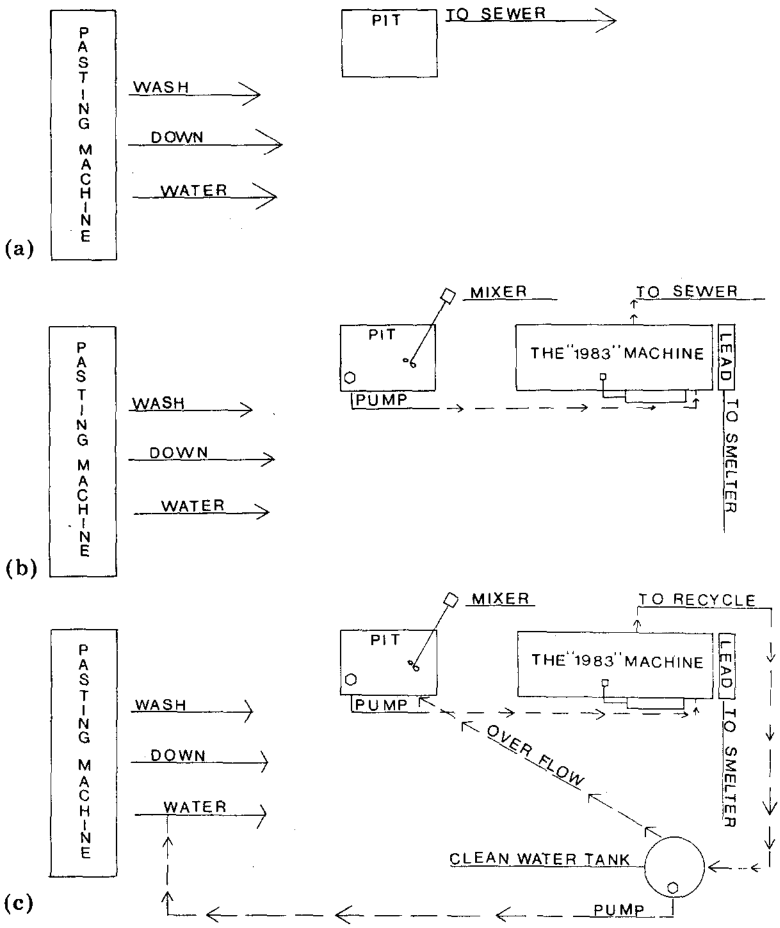

Fig. 2. Paste wash-down process: (a) typical operation; (b), (c), stages of improvement in the operation.

control over the effluent will be achieved. Keeping the mixer going all the time will allow the pump to pick up the suspended lead oxide and transfer it to the next operation.

At this point, the diluted sludge contains too much water for it to be handled economically for any further operations. A dewatering unit has to be added. This unit is designed to remove 50 - 70% of the water from the lead oxide paste mixture that remains in the dewatering media. The water from the dewatering unit is clear of all suspended solids. The dewatering media and reclaimed paste can then be shipped over to the smelter. There is now the choice of either directing the clear water to the sewer or recycling it.

By recycling, or closed-looping, the processed water (Fig. 2(c)), it is not necessary for it to go to the sewer. By adding a clean water tank, wash down can be effected at any desired time. If washing down is not in progress, then the lead oxide can still be processed by adding an overflow which is directed back to the pit. Since this operation has now been closed-looped, any amount of water can be used to keep the area clean. In doing so, the airborne lead is just about alienated. Lead oxide does not dry out when wet.

Dry-charge water

The next stage to tackle is the dry-charge water. Although some plants still carry out this operation, the practice is on the decline. If this water must be considered as part of the waste system, then the equipment is simply sized to handle it.

Battery-washer water

The water from the battery washer should be the last to be considered for the waste system. There may be some water from the showers/other floor areas and laundry that is present in smaller amounts, but this can be handled without difficulty.

Conclusions

What type of waste system is best? If a closed-looped system is not chosen, and a factory still uses large quantities of water, a continuous-flow waste-system is in order. As seen in Fig. 3, there are five main parts to this system. This arrangement has the following disadvantages: (i) high water volume; (ii) high chemicals' cost, (iii) high equipment cost; (iv) high maintenance cost; (v) large floor space; (vi) high labor costs.

On the other hand, if a decision is made to implement the closed-loop idea (Fig. 4), a batch waste-water system would be the best approach to handling the small amount of water that remains. This would involve the purchase of only a batch tank and a dewatering unit. A batch-treatment

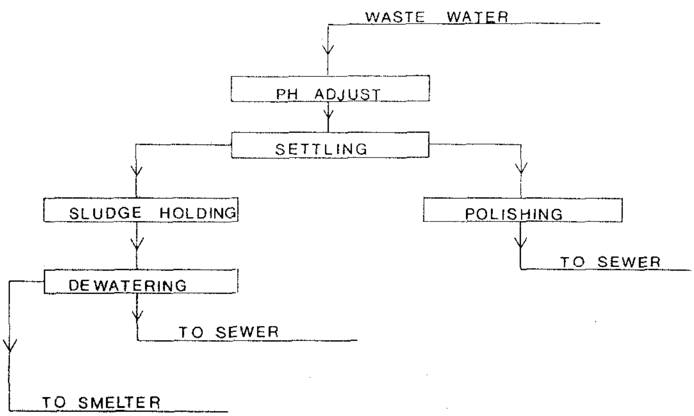

Fig. 3. Continuous-flow waste-water system.

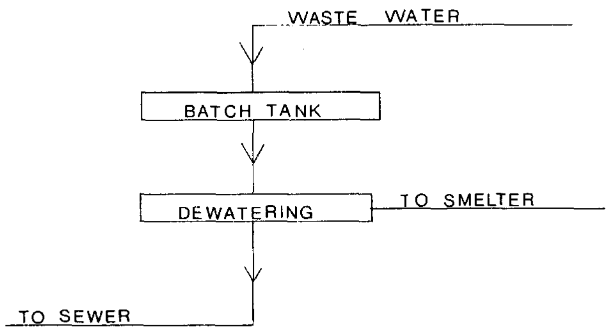

Fig. 4. Batch waste-water system.

system can be sized as high as 5000 gallons per day. By adding a second tank, one can be filled while the other is being processed.

There are two reasons for adjusting waste water chemically: (i) pH adjustment to neutral; (ii) lead removal (precipitation). If the pasting operation is closed-looped, then the bulk of the lead is in solution (dissolved lead). On pH adjustment with the correct chemical, the lead-suspended solids are formed as a precipitate. (Note, ammonia should not be used at this point: it will adjust the pH, but a precipitate will not be formed.)
formed.)

The following is a list of chemicals used in sludge generation (in order of increasing efficiency): calcium hydroxide, sodium hydroxide, magnesium hydroxide, organic additives. The last two are the most appropriate for a batch-treatment system. They can also be used together to promote even better results.