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Fact Sheet

DESALINATION AT LETHABO POWER STATION

At a thermal power station, used steam from the last stage of the turbine, is condensed back into water as part of the generating process. This is achieved by circulating cooling water through the turbine condensers. At most coal-fired power stations the cooling water, warmed by the heat of the steam, flows to cooling towers where the natural upward draught removes the heat from the water. During this process, evaporation takes place in which pure water leaves the towers - visible as a white cloud of very small water droplets at most wet cooled coal fired power stations. "Make-up" water (raw water) is added to replace evaporation losses.

Lethabo Power Station uses "make-up" water for the cooling systems from three sources:

- raw water from the Vaal River,
- treated underground water from New Vaal Colliery, mostly from the old working which have to be drained
- treated sewage water.

The mine and river water introduce approximately 15 tons of salts per day into the cooling water systems. These salts must be removed on a continuous basis to prevent salts accumulating above acceptable thresholds. If these salts are not removed, some salts will cause scaling of the condensers and other salts will cause corrosion damage leading to premature failure of the condenser and associated plant. Removal of the scale forming salts is done using lime softening. The removal of salts is called desalination. In the cooling water system desalination is carried out using a process known as reverse osmosis, this process is used to control the salts that cause corrosion.

Osmosis and Reverse Osmosis
When a semi-permeable membrane separates two solutions of different salinity (salt concentrations) water will flow through the membrane towards the more concentrated solution. This process is known as osmosis.

In reverse osmosis, a pump is used to force the liquid through membranes, thus leaving the salts behind. This process is the opposite of natural osmosis. In this process approximately 75% of the water is forced through the membranes, leaving behind approximately 25% of the water containing most of the salts.

The advantage of this process is that any volume of dirty, unusable water can be reduced by 75% leaving a residual volume, called reject, to be disposed of in an environmentally acceptable manner.

De-salination at Lethabo
Lethabo uses reverse osmosis units for desalination of the concentrated cooling water. The clean water, permeate from the reverse osmosis units, is of a better quality than the river water. Clean water is returned to the concentrated cooling water system. Another de-salination process uses an ion exchange process to produce boiler make-up water, which is extremely clean and has almost no dissolved salts in it.

Depending on the chemical condition of the water, approximately 10% of the warmed cooling water en route to the cooling towers is continually taken through the lime softening clarifiers. In the clarifiers, suspended solids and scale forming ions are reduced some of this water is fed into the reverse osmosis system. The three Lethabo reverse osmosis units are capable of purifying (desalinating) 480 cubic metres of water an hour, approximately 12 Ml/day. The amount of treated sewage sent to the treatment plant is less than 0.5 Ml/day

The reject is disposed of on the dry ash dump by mixing it with ash, by first used to cool the coarse ash from the bottom of the boiler furnace. The coarse ash which retains a lot of moisture is mixed with the fine fly ash on the conveyor belts on the way to the ash dump. The cementing properties (pozzolanic properties) of the ash are used to encapsulate the salts contained in the reject. This helps to reduce dust problems and the salts are also prevented from polluting the environment.

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