ENVIRONMENTAL TECHNOLOGY

How to save

19 Billion Liters / 5 Billion Gal (US)

of water per year ...

... the easy way

- AESSEAL PLC WATER POLICY STATEMENT
- INTRODUCTION TO MECHANICAL SEALS AND SEALING SYSTEMS
- TARGET INDUSTRIES
- RETURN ON INVESTMENT CALCULATION
- CASE HISTORIES
- AESSEAL® SAVE $10 MILLION IN WATER PER YEAR

Acknowledgements

AESSEAL plc believe that although the development of water saving technology is important, it is fair to say that unless this technology is taken up and implemented by like minded companies, there will be no environmental gain. Accordingly, AESSEAL plc would like to acknowledge the huge water saving contributions that have been brought about by the following companies:

Aughinish Alumina

mondi

BASF
The Chemical Company

Kimberly-Clark

AKER KVÆRNER

Specialty MINERALS

AESSEAL® Support Systems - How to Save 5 Billion Gallons of Water Per Year ... the Easy Way.

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Abstract

"Almost three billion people will face severe shortages of fresh water by 2025 if the world keeps consuming water at current rates …" **The United Nations**

"Even where supplies are sufficient or plentiful, they are increasingly at risk from pollution and rising demand. Fierce national competition over water resources has prompted fears that water issues contain the seeds of violent conflict …" **Kofi Annan, UN Secretary-General**

"The simple fact is that there is a limited amount of water on the planet, and we cannot afford to be negligent in its use. We cannot keep treating it as if it will never run out …" **Mohamed ElBaradei, IAEA (International Atomic Energy Agency)**

"This crisis is one of governance, essentially caused by the way we mismanage water …" **World Water Development Report (UN)**

"It has been estimated that the annual water volume used by industry will rise from 752 km^3/year in 1995 to 1,170 km^3/year in 2025. It is therefore paramount that new technologies and practices are employed to encourage cleaner production …" **United Nations Association - UK**

"The wastage created by industry is also a fundamental problem. Industry should accept the responsibility of managing waste created by the manufacturing and production process …" **United Nations Association - UK**

America's Water Supply: Status and Prospects for the Future by Kenneth D. Frederick:

The United States is relatively well endowed with water. Annual precipitation averages nearly 30 inches or 4,200 billion gallons per day (bgd) throughout the conterminous forty-eight states. Two-thirds of the precipitation is quickly evaporated and transpired back to the atmosphere; the remaining one-third flows into the nation's lakes, rivers, groundwater reservoirs, and eventually to the ocean (Figure 1). These flows provide a potential renewable supply of 1,400 bgd, which is nearly fifteen times current daily consumptive use - the quantity of water withdrawn from but not returned to a usable water source. Moreover, much larger quantities of freshwater are stored in the nation's surface and groundwater reservoirs. Reservoirs behind dams can store about 280,000 billion gallons (about 860 million acre-feet), even larger quantities are stored in lakes, and water stored in aquifers (subterranean bodies of unconsolidated materials such as sand, gravel, and soil that are saturated with water and sufficiently permeable to produce water in useful quantities) within 2,500 feet of the earth's surface is at least 100 times the reservoir capacity. **These stocks are equivalent to more than fifty years renewable supply. Despite the apparent global and national abundance and the renewability of the resource, water adequacy has emerged as one of the nation's primary resource issues.**

For many of the developing countries of the world the problem is a critical one. In this country concerns about the availability of freshwater to meet the demands of a growing and increasingly affluent population while sustaining a healthy natural environment are based on several factors:

(1) uncertainties as to the availability of supplies stemming from the vicissitudes of the hydrologic cycle and the threat that a greenhouse warming might alter the cycle;

(2) the high costs of developing additional surface-water supplies;

(3) the vulnerability of the resource and the problems of restoring and protecting valued surface and groundwater resources;

(4) the importance of reliable supplies of high-quality water for human and environmental health and economic development; and

(5) the shortcomings of our institutions for allocating scarce supplies in response to changing supply and demand conditions.

(**Dr. Kenneth D. Frederick** is an economist and senior fellow at Resources for the Future in Washington, D.C., an independent organisation that conducts research on the development, conservation and use of natural resources and the quality of the environment.)

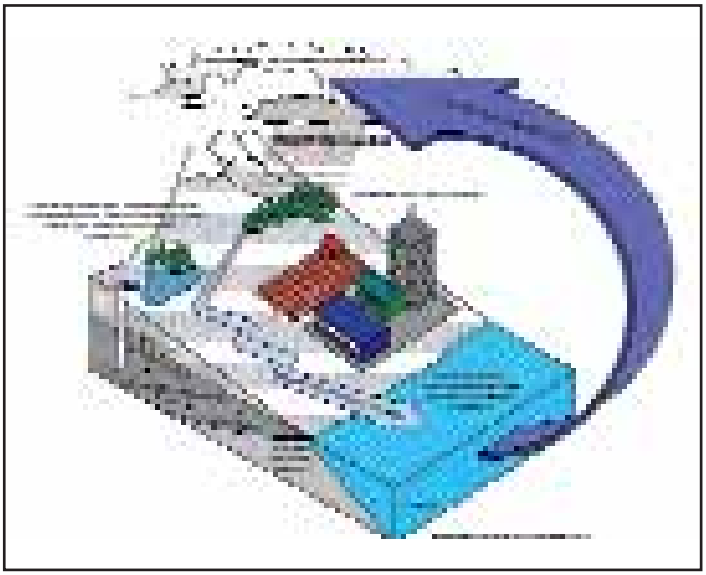
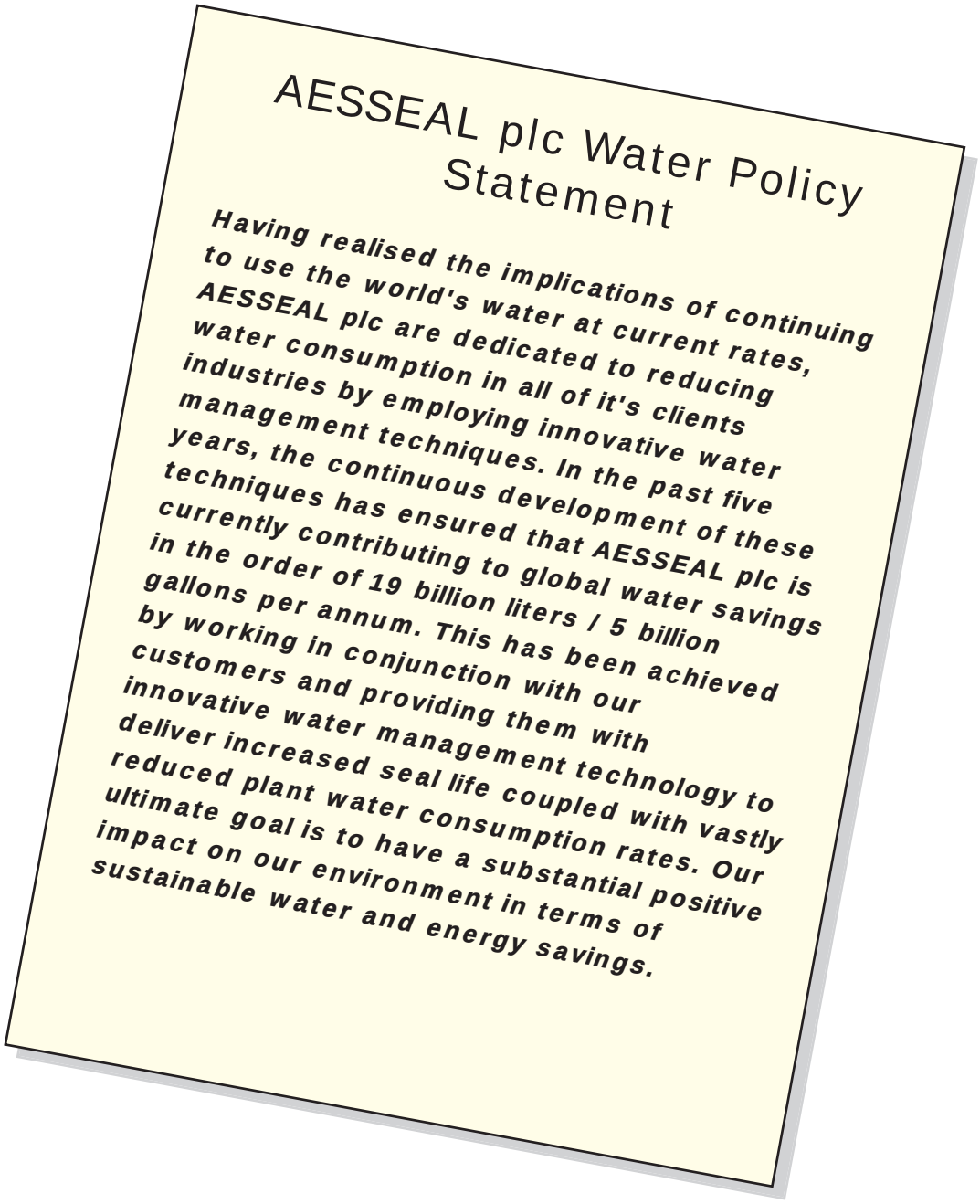


Figure 1

“There is a common assumption that the world’s water supply is huge and infinite. This assumption is false. At some time in the near future, water bankruptcy will result.” **Maude Barlow, Council of Canadians**

“The development of industrial water withdrawal is one the main causes of water pollution in the world. This is explained by the rapid industrial growth in different countries and exacerbated by the fact that much of the intake is discharged as waste water to natural water courses, for the most part untreated or only partially purified. To struggle with such pollution problems, many countries have undertaken energetic measures to decrease industrial water withdrawals and discharges.” **UNESCO (United Nations Educational, Scientific and Cultural Organisation)**



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Introduction to Mechanical Seals and Water Management Systems

Over the past several years there has been significant growth in the use of mechanical seals in the processing industries. Seals manufactured by AESSEAL® have been used successfully in a variety of applications. The growth in mechanical seal use can be attributed to the following factors:

a. Traditionally, many sites used mechanical packing in their pumps. The introduction of smaller pumps operating at higher speeds made mechanical packing a less desirable sealing alternative.

b. More stringent Health and Safety regulatory controls have made product leakage unacceptable. Fluid leakage poses a health and safety threat as well as being a housekeeping nuisance.

c. As the cost of raw materials has increased, the need for reliable fluid sealing has increased. Yield loss of expensive process fluids can be reduced by positively sealing the process equipment.

d. Mechanical packing damages the rotating equipment. Shaft sleeve wear and bearing failure caused by excessive leakage are common complaints. Additionally, chemical attack of the concrete base and ductile iron pump components occurs when corrosive chemicals are allowed to leak from packed glands.

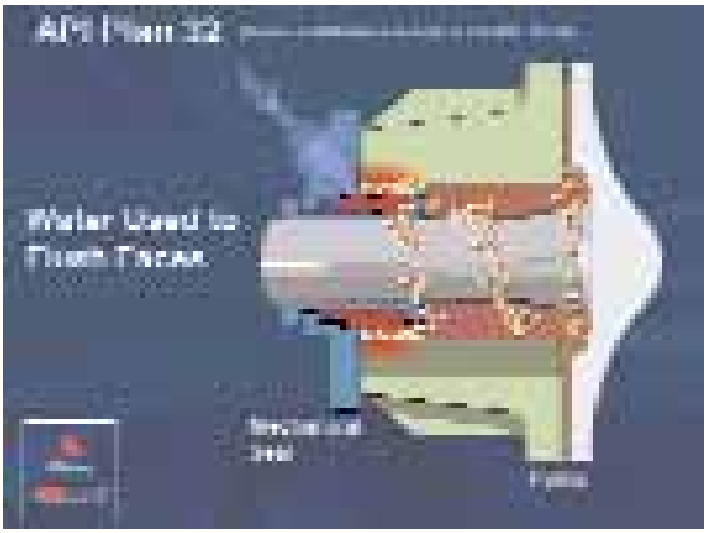
e. Periodic maintenance attention is required to constantly monitor and adjust packed glands.

f. Reduction in costly flush water can occur when using properly designed and specified mechanical seals. The cost of clean water, process evaporation and waste water treatment makes the conversion to mechanical seals beneficial and cost effective.

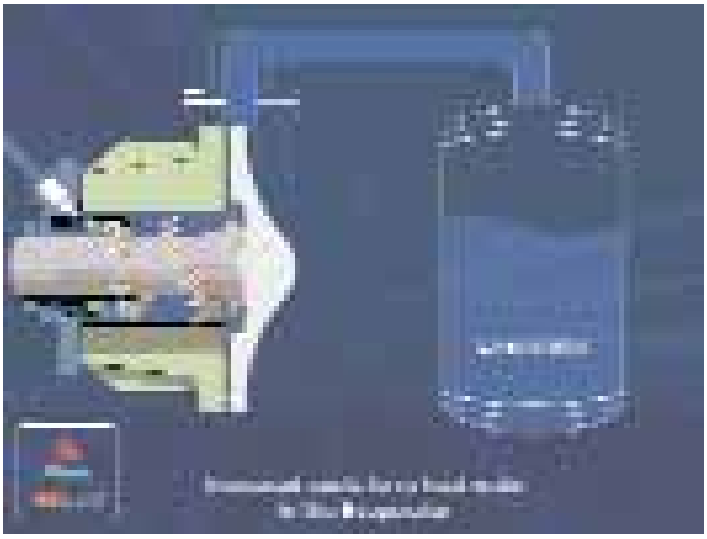
g. Many seal chambers operate under vacuum conditions. Positive sealing from properly designed mechanical seals eliminates air ingress through the seal housing.

This section explains how mechanical seals and water management systems designed and manufactured by AESSEAL plc have been used successfully in industry. The information outlines the previous wasteful practices and the benefits of the newly adopted water management systems.

The most common methods of supporting mechanical seals with water are outlined below. These methods typically waste huge amounts of water, and in some cases produce vast amounts of water effluent which subsequently needs to be treated, adding even more cost and consuming even more environmental resources.



In this case pressurized plant water is taken and injected into the ‘flush’ port of the seal in an effort to keep contamination away from the seal faces. The two key impacting negatives here are the high water consumption and the high cost of removing the injected water by evaporation further along in the manufacturing process, shown directly below.



Typical water consumption of a single mechanical seal in this arrangement is in the region of 12 liters per minute (3.17 gallons per minute), which gives a total consumption for one pump of 6.3 million liters per year (1.7 million gallons per year). We should also bear in mind that there is an initial cost attached to this water which multiplies upwards when we consider the cost of steam generation required to drive this flush water out of the process via the evaporator. This figure further escalates when we consider the number of pumps associated in any given production line.

Another method of supporting a mechanical seal is by using a ‘quench to drain’ arrangement.

In this case, a double mechanical seal is supported by supplying water to the ‘quench’ port. This water then cools and lubricates the seal faces, and exits via the ‘drain’ port.

Quench to drain wastes millions of liters per year and the resultant water that passes through the mechanical seal must be treated as effluent. This effluent treatment adds considerable cost to the process.

The API Plan 54 method involves feeding a number of mechanical seals from a common water header. This water passes through the mechanical seals and discharges to a common drain. This contaminated water is then treated and in some cases re-circulated back to the common water header tank. Not only does this process incur costs associated with water treatment, but occasionally the whole water header can become contaminated due to process upsets. The costs associated with decontamination can be extremely high.

Water Savings Conclusion

Due to the shortcomings of the described mechanical seal support methods, AESSEAL plc began developing a range of modular systems which would bring about a revolution in mechanical seal support methodology. One of the first systems to use this revolutionary concept was the SW2™ water management system.

AESSEAL plc have sold thousands of water management systems, usually in combination with the CDSA™ double seal. The systems are maintenance friendly, requiring no external compressed air or gas pressurisation. They are also largely self-regulating and self-operating and do not require any manual intervention for refilling.

The total annual operating cost of a CDSA™ seal and SW2™ water management system would give a typical return on investment of around 200 days.

In considering all of the above seal support arrangements, we can clearly see that in each case, water consumption at the rate of between 6-18 liters per minute (1.59 - 4.76 gallons per minute) per seal was the previously accepted norm. This allows for a conservative estimate of an average of 12 liters per minute (3.17 gallons per minute) water consumption to be applied to all pumps run in this manner. Therefore in continuous 24 hour running one pump uses 6,307,200 liters per year (1.7 million gallons per year). By retrofitting a water management system (which uses only 32 liters / 8.45 gallons per year) to each of these applications we are saving 6,307,168 liters / 1,666,178 gallons per year for every water management system that we manufacture. For the past three years we have on average produced and supplied 3,000 of these units each year.

Therefore we feel it is fair to claim water savings of approximately **19 Billion Liters / 5 Billion Gallons per year!**

SW2™ Standard Water Management System

The Cost of Water

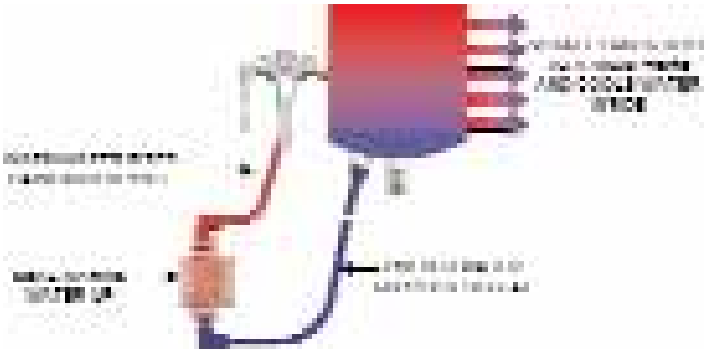
The following figures are costs of fresh water, and do not include the cost for preparation of the water, nor do they include the cost of water treatment, after it has been used.

Country	Water Cost Per Gallon		
	£	$	€
Germany	0.00482	0.00723	0.00603
Denmark	0.00414	0.00621	0.00518
Belgium	0.00389	0.00583	0.00486
Netherlands	0.00315	0.00473	0.00394
France	0.00310	0.00466	0.00388
UK	0.00298	0.00447	0.00373
Italy	0.00192	0.00288	0.00240
Finland	0.00174	0.00261	0.00218
Ireland	0.00159	0.00238	0.00198
Sweden	0.00146	0.00220	0.00183
Spain	0.00144	0.00216	0.00180
USA	0.00129	0.00193	0.00161
Australia	0.00126	0.00189	0.00158
South Africa	0.00119	0.00178	0.00148
Canada	0.00101	0.00151	0.00126
China	0.00020	0.00030	0.00025
Average cost	0.002199	0.003298	0.002748

5 Billion Gallons @ Worst Case Cost of 16 Countries Listed	£24,100,000	$36,150,000	€30,150,000
5 Billion Gallons @ Best Case Cost of 16 Countries Listed	£1,000,000	$1,500,000	€1,250,000
5 Billion Gallons @ Average Cost of 16 Countries Listed	£10,995,000	$16,490,000	€13,740,000

Water Management Methodology

Rather than running water straight through the seal to drain, the SW2™ standard water management system removes heat and lubricates the mechanical seal faces by use of the 'thermosyphon effect'.



Colder water is supplied to the mechanical seal, which is in turn heated up by the seal faces. This 'warmer' water then rises back into the vessel, raising the bulk temperature of the vessel. The vessel then loses heat to the atmosphere which results in an 'equilibrium temperature' being reached.

Should the vessel be required to lose more heat to the atmosphere, the increased surface area of the SW2-25™ system (opposite, top) ensures that this can occur.

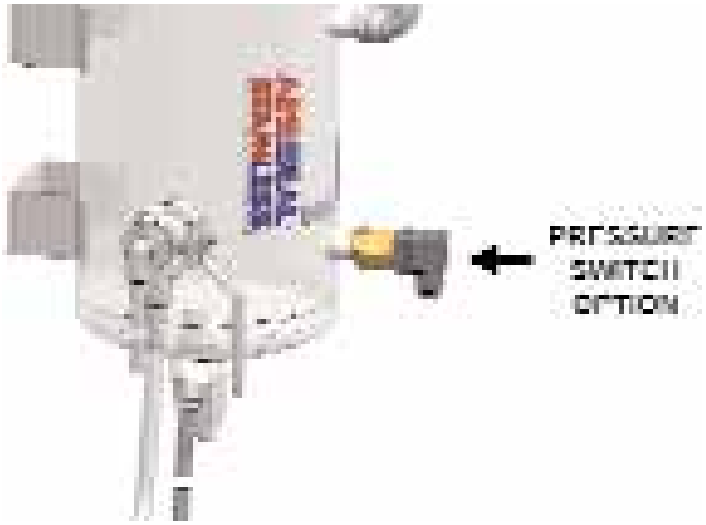
There is also the option of losing even more heat to the atmosphere by employing finned tube. There one metre lengths of tube boast a massive 0.5 metres squared of surface area each. Adding two lengths of finned tubing to a SSE10 vessel triples the effective cooling surface area.

In order to prevent contamination of the system, a positive pressure is applied to the clean water in the system. This is achieved by connecting the system to the plant mains water supply and adjusting the integral water pressure regulator to the required pressure. This also ensures that if a small trace of water is lost into the process across the seal faces, this will be immediately replaced by water from the mains supply.

The AESSEAL plc SW2™ water management system also alerts the user to seal failure by way of a water flow indicator. This clever device contains an integral ball which appears only if there is a seal failure, which is incredibly important in larger plants which make use of hundreds of mechanical seals.

An integral non-return valve ensures that in the unlikely event of the vessel becoming contaminated, no liquid can enter the mains water supply from the system.

The modular concept of the AESSEAL plc SW2™ water management system ensures that additional instrumentation can be added to the system to give immediate seal failure indication. This can be in the form of a pressure switch (below) or even a flow switch.

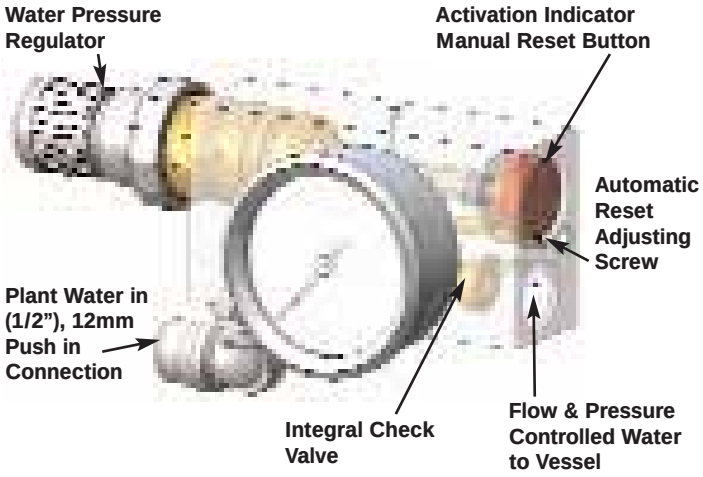


In the drive to achieve further water savings, AESSEAL plc launched the intelligent Flow Fuse™ System in 2003.

SWFF-TF System with Flow Fuse device

This intelligent system monitors (mechanically) the flow of water from the mains and should a process upset or seal failure occur, the mains water supply is automatically shut off.

The Flow Fuse™ device achieves this, yet also maintains all of the essential components featured in the SW2™ water management system.



Should a process upset occur, the intelligent Flow Fuse™ can automatically reset itself should the operating conditions in the process return to normal.

AESSEAL plc recognises that it is not always feasible to replace traditional sealing methods with double mechanical seals. Therefore, it acknowledges that some processes have to consume water. However, AESSEAL plc has developed a stepped approach in which the consumption of this water can be dramatically reduced. One such method is the introduction of the AESSEAL FLOWETRUE flow meter device, which has the ability to reduce water consumption by a factor of 2/3. The FLOWTRUE can be used on compression packing, single mechanical seals or double mechanical seals and adjusted so that the flow and pressure of water can be accurately controled. This vastly reduces the amount of water consumed when double mechanical seal technology in conjunction with water management systems cannot be employed.

FLOWTRUE for Double Mechanical Seals

FLOWTRUE for Single Mechanical Seals and Packing

Aluminium Processing

Background:

Aluminium is the most plentiful metallic element in the Earth's crust. Aluminium was first isolated in 1829 from Aluminium chloride, but it was not commercially produced until 1886.

Aluminium is a silvery-white, tough, but lightweight metal (specific gravity 2.7). It is a good conductor of electricity and is very resistant to atmospheric corrosion. Aluminium alloys combine lightness with strength and as a result are used in a great variety of industries.

Occurrence

The main minerals in Bauxite are Gibbsite (Al203.3H20), Boehmite (Al203.H20), and diaspore, which has the same composition as Boehmite but is denser and harder. The pure anhydrous oxide of Aluminium, Alumina (Al203), contains 52.9% Aluminium and 47.1% Oxygen. Bauxite may be as hard as rock or as soft as mud and its colours may be pink, yellow, red, or white, or any combination of these.

Bauxite ore refers to Bauxite that contains sufficiently high levels of Al203 and suitably low levels of Fe203 and Silica to be economically mineable.

Named after the French district of Les Baux, where it was first discovered in 1821, Bauxite is produced by tropical or semitropical weathering of Alumina-bearing rocks. Because of the way it forms, Bauxite deposits are generally very extensive. Bauxite is found on just about all the continents of the world. The largest known economic resources of Bauxite occur in Australia and Guinea. In terms of ranking, these countries are followed by Brazil, Jamaica, and India. Although the USA, Japan, and the Federal Republic of Germany are the world's largest consumers of Aluminium they possess little or no Bauxite deposits of their own.

Mining

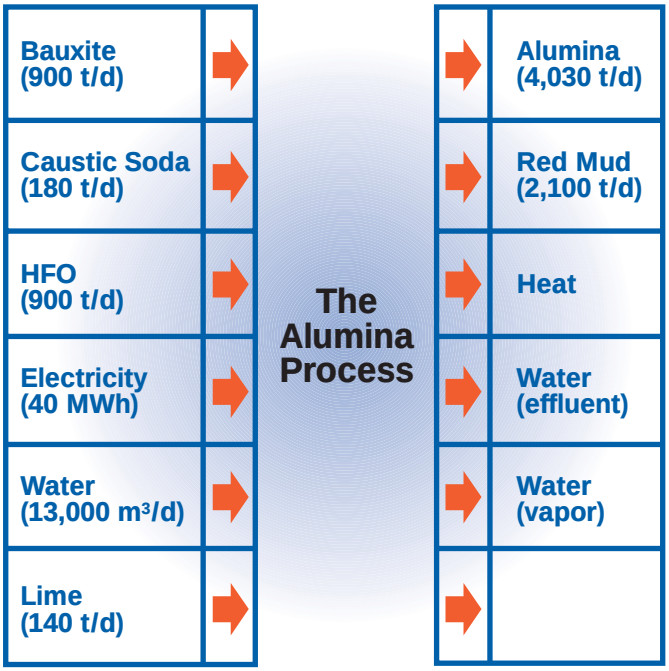
Extraction of Aluminium metal takes place in three main stages - mining of Bauxite ore, refining the ore to recover Alumina, and smelting Alumina to produce Aluminium.

Bauxite is mined by surface methods in which the topsoil and overburden are removed by bulldozers and scrapers and then used for revegetating the area and returning it to sometimes better than original condition or converting it to agricultural land. The underlying Bauxite is mined by front-endloaders, power shovels, or hydraulic excavators. Sometimes the Bauxite is crushed and washed to remove some of the clay and sand waste and then dried in rotary kilns. Other Bauxites may just be crushed or dried.

Extraction

In nearly all commercial operations, Alumina is extracted from the Bauxite by the Bayer Process.

The Alumina Refinery - Inputs & Outputs



One tonne of Alumina is refined from approximately two tonnes of Bauxite. The plant keeps more than 250,000 m^3 (56 million gallons) of process solution circulating through tanks, pressure vessels and pipes. The process is continuous 365 days a year.

Having discussed the Aluminium process, a Case History is shown overleaf which outlines how one company in this industry adopted the water management methodology which AESSEAL plc has developed over the years in order to save a massive amount of water.

Aughinish Alumina Ltd.

The Challenge - Gland Water Reduction on Rotating Equipment (by Kevin Cahalane)

Aughinish Alumina Ltd uses centrifugal pumps as the main process pump on site. The vast majority of these pumps use the principle of the packed gland to seal the pump shaft. This system has worked well over the years but increases in production have resulted in more pumps being installed and upgrading of some of the original pumps. As a result gland water used to seal the glands had increased to approximately 110m³/h. Gland water contributes directly to dilution in the plant.

Evaporation limits forced the plant to look at water reduction and a team was formed to try and improve gland water control. If gland water usage could not be better controlled or reduced then an evaporator of the order of 100 m³/hr would have to be installed for any future plant expansion. This has substantial capital costs of around €13M.

A program was developed and implemented to reduce/control gland water usage. Cross-functional teams involving process and mechanical personnel were formed in each area of the plant. The gland water flow and pressure requirements for each pump on site were re-evaluated. Drawings and piping & instrumentation diagrams were updated and the information was then converted into process book displays. Thus real time information on gland water flows is always available plant wide on approximately 200 plus PCs. Training was provided to fitters and process operators on how to use the process book displays and identify potential problems. In addition, to raise the awareness of controlling gland water, weekly reports are issued in the plant information notes, monthly review meetings are held and regular audits are carried out in each area. In conjunction with the purchasing department various manufacturers and suppliers of mechanical seals carried out evaluation programs to identify pumps suitable for mechanical seals.

AESSEAL plc then took up the challenge to work with Aughinish Alumina to reduce water consumption by employing mechanical seals and innovative water management systems.

Considerable improvements have been achieved since the reduction program was implemented.

Over the last twelve months gland water usage has been reduced by **40 m³/h (10,566.88 gallons per hour)** and is currently at 70 m³/h (18,492.04 gallons per hour).

Every **1 m³/h (264.17 gallons per hour)** of gland water used in the plant costs €23.5k ($28.2k US) per year in direct costs to the company.

Approximately €1m ($1.2m US) per year will be saved by maintaining current flows.

Less pump failures have also occurred together with reduce downtime. An evaporator is not now required.

To achieve the results obtained, required team work across the different disciplines and at all levels and is the key to the success of the program.

A further reduction in gland water usage of 25-30 m³/h (6,604-7,925 gallons per hour) is expected/achievable.

In this single application

WATER SAVINGS

350,400,000 liters per year

92,565,869 galls (US) per year

WATER COST SAVINGS

£666,000 per year

€1,000,000 per year

$1,200,000 per year

As a result of the savings achieved, Aughinish Alumina Ltd received the MEETA Award for Best Large Foreign Company.
From left: Ray O'Neill, General Manager, ESS Ltd.; Damien Clancy, MD Aughinish Alumina Ltd.; Minister Michael Ahern TD, Minister of State for Enterprise,Trade and Employment; Kevin Cahalane, Team Leader and Larry Tobin, MD, PMI Software (sponsors).

In another application, a double suction pump originally sealed using pump packing was upgraded using two AESSEAL plc double mechanical seals in conjunction with two SW2™ water management systems. The original pump packing was supported using the flush method, which had a total flow rate of 1.5 m^3 per hour (1,500 liters per hour / 396.3 gallons per hour) for both sides of the pump.

Hence, the daily water consumption of this pump was 36 m^3 (36,000 liters / 9,504 gallons), and the annual consumption was 13,140 m^3 (13,140,000 liters / 3,468,960 gallons).

On an annual basis, 1 m^3 (1,000 liters / 264 gallons) per hour of gland water costs Aughinish Alumina £15,667 / $28,200 / €23,500 in direct costs.

Therefore, this single application was costing in the region of £23,500 / $42,300 / €35,250 per year.

Since the upgrade in February 2002, the AESSEAL plc water management systems have only consumed a combined total of 64 liters (16.9 gallons) per year. The other side of the success is the fact that the AESSEAL plc double mechanical seals are still running, whereas the old sealing method needed replacing every 3 months.

Aughinish Alumina are now in the process of converting further pumps on their site.

In this single application

WATER SAVINGS

13,140,000 liters per year
3,468,960 galls (US) per year

WATER COST SAVINGS

£23,500 per year
€35,250 per year
$42,300 per year

Chemical

Over the past fifteen years AESSEAL plc have focused on, and developed specialised knowledge on the sealing requirements of the chemical industry. Due to the high risk and high value associated with the chemicals being handled, double mechanical are specified in the majority of applications.

With the inception of the AESSEAL® "Seal Management Program" we were able to gain a more detailed understanding of seal life and performance across a diverse range of chemical applications. As this was a world-wide program, we soon saw the emergence of common trends in similar plants and processes on a global scale. The most impacting of these became evident in the early 90's when we were auditing the seal failure modes on a Neoprene plant. After the first year's data were analysed we found that of all the double seals that where replaced, the original cause of failure was not the seal components themselves but the barrier fluid system that was there to support them. That is to say that 64% of failures were induced by incorrectly applied or mis-managed barrier fluid systems. On wider investigation we have now seen figures of between 50% and 68% become a world wide average for barrier fluid system induced failures. This is not only true of the chemical industry but of all process industries where double seals are used. We are now of the opinion that in understanding and addressing the barrier fluid issues you will in fact address the largest volume of seal failures on any given plant.

It would be only fair to note that in the chemical industry a majority of these systems use oil based barrier fluids due to the need for compatibility with the process that is being sealed. This still leaves a significant number of water compatible chemicals needing double seals and barrier support systems.

Three of the many chemicals which have been successfully sealed around the world using water based barrier fluid systems are Acrylonitrile, Caustic and Ketone. Due to the high commercial value of these chemicals, introducing excessive water into the final product by way of mechanical seal failure or support system failure cannot be tolerated. At the early stage of production a small amount of water may be permitted but a large amount of ingress can dramatically increase the cost of production due to increased energy consumption, as this water needs to be removed at the latter stages of the production by additional evaporation. At the final stage of production of a high cost product no ingress can be tolerated as this would lead to contamination of the total production batch. Not only do you lose the value of the product but you will have additional disposal costs. So for this reason a "total shut off" water management system is required.

BASF Seal Sands

BASF Seal Sands is a major producer of Acrylonitrile (AN). AN is used principally as a precursor in the manufacture of synthetic polymers, especially acrylic fibres and nylon. The chemical is made up from the elements Carbon, Hydrogen and Nitrogen, and is a colourless liquid which is both flammable and toxic.

AN is produced using Propylene (a gas derived from oil), Ammonia (a substance found in some household cleaners) and Oxygen (from the air). These gases react to form AN using particles of catalyst (fine sand grains with a special coating) at a temperature over 400°C.

World-wide, 5 million tonnes of AN are produced each year. Over half of this is used to make acrylic fibres, which are used to make clothing and carpets etc. A further third is used to make durable plastics such as Acrylonitrile Butadiene Styrene (ABS) or Styrene Acrylonitrile (SAN). These can be used in pipes and fittings, cars, telephone and computer casings and packaging.

Of the AN which BASF Seal Sands manufacture, a large proportion is used to make Adiponitrile (ADN) and Hexamethylenediamine (HMD) (which are intermediates for nylon), while the balance is shipped to other chemical plants to make plastics or fibres.

The Challenge – Saving Water in Quench to Drain & Flush Applications

In the past, BASF Seal Sands mainly used mechanical seals supported with the quench to drain method (API Plan 62) or the flush method (API Plan 32). As discussed previously, these methods can waste vast quantities of water, which incurs costs in terms of purchasing the water and then treating it to bring it to the minimum required site standard. All of the water used via API Plan 62, plus water ingested into the process via API Plan 32 (which potentially may need removing by way of evaporation), is treated in an effluent plant before disposal. To compound the costs, BASF predominantly use treated water (de-mineralised water), which is more expensive than standard potable water, and therefore the cost of using the quench to drain and flush methods were even greater.

AKER KVÆRNER

BASF employ AKER KVAERNER as a Pump Management Team.

The Pump Management Team identified that the water usage and poor support of the existing mechanical seal unit were leading to unsatisfactory reliability and low MTBF. AESSEAL plc were tasked to propose a solution.

AESSEAL plc proposed solutions to replace a number of original sealing arrangements seals with double mechanical cartridge seals in conjunction with water management systems. The closed loop thermosyphon system provided the water and effluent savings, whilst the controlled constant positive barrier fluid pressure provided a clean, lubricating, fluid film to the mechanical seal faces. The water saving, effluent saving, increased MTBF and zero product emission tasks were achieved.

In just 16 pumping applications, by July 2004, AESSEAL plc had helped to save 60,217,600 liters (15,907,810 gallons) of water. An example of how one application helped to save this huge amount of water is shown:

ORIGINAL SEALING ARRANGEMENTS

Seal Type :	Competitor component seal back to back with Plan 62 to drain
MTBF Rate :	On average 12 months

AESSEAL® SEALING ARRANGEMENTS

Equipment Manufacturer	KSB
Location	BASF Seal Sands
Pumped Liquid	Acrylonitrile Slop Water
Pumping Temperature	50ºC
R.P.M.	2,900
Suction Pressure	Flooded
Discharge Pressure	9.3 barg (135 psig)
AESSEAL® Type	CDSA™ 1.625" C/SIC/SIC/C/K/EPR
INSTALLATION DATE	Installed Feb 1997
APPLICATION DETAILS Retention System SW2™	Double seal with water

	Previous Cost of Sealing		AESSEAL® Option	
MTBF	Average 12 months		No failures to date	
Spares / Year	1 x seal changes per year		0 x seal changes per year	
Cost of Spares	£640 x 1:	£640.00	None Used:	£0.00
Administration	1 Hour per seal change @£25 per hour x 1 x 1 per year:	£25.00	1 Hour per seal change @£25 per hour x 1 x 0 per year:	£0.00
Man Hours Charged	8 Hours per seal change @£25 per hour x 8 x 1 per year:	£200.00	8 Hours per seal change @£25 per hour x 8 x 0 per year:	£0.00
Total Cost of Repair/ Replacement :		£865.00		£0.00

In this single application

WATER SAVINGS

2,102,000 liters per year
555,289 galls (US) per year

MAINTENANCE SAVINGS

£865.00 per year
€1,297.50 per year
$1,557.00 per year

TOTAL COST SAVINGS

£1,285 per year
€1,928 per year
$2,313 per year

Fertiliser (Crop Nutrition)

The annual world trade in fertilisers in the mid-1990s amounted to approximately 120 million tonnes, which represented around 8% of all sea-borne bulk trade. The international fertiliser trade is a huge industry, which ranks fourth after coal, iron, and grain in terms of value.

The various steps involved in the manufacture of finished fertiliser products, from raw materials through intermediate products, are shown below.

AESSEAL plc have formed an alliance with a number of fertilizer manufactures with the common goal of reducing seal failures and increasing up time. Traditionally two main seal support methods are used in this industry when sealing slurries and or the chemicals associated with fertilizer manufacture, which within themselves have been identified as large volume water consumers whilst not providing the anticipated seal life. These two methods are indeed again the quench to drain method (API Plan 62), and the flush method (API Plan 32).

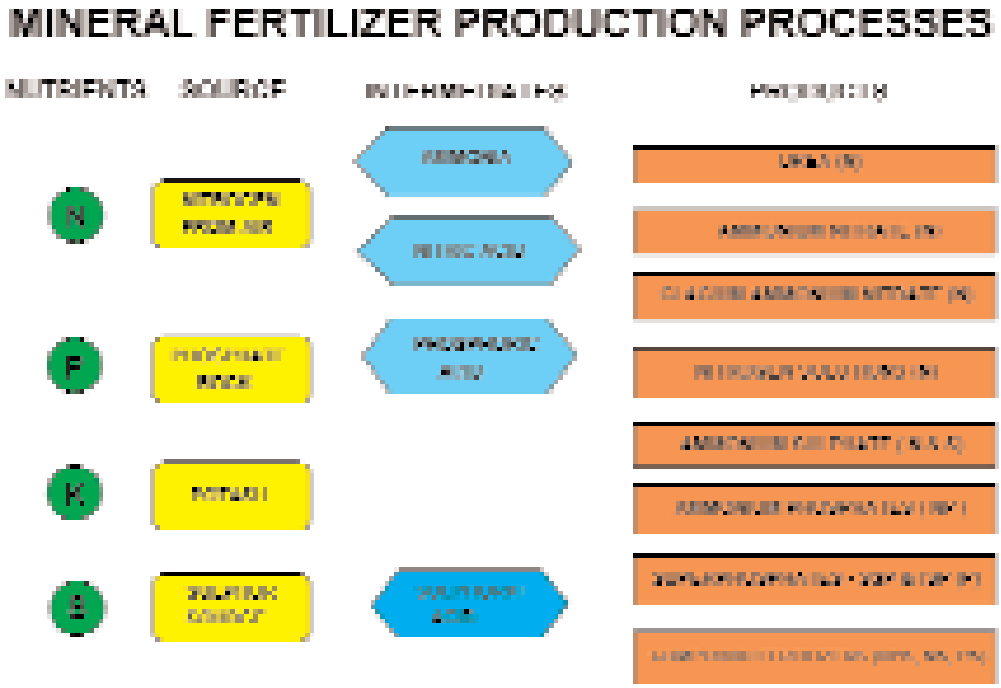
As previously discussed, these seal support methods have major limitations in normal process industries, however, using seals when pumping fertiliser constituents brings additional sealing challenges.

For example, Phosphoric Acid and pond water are less than desirable liquids to seal as compared to cold drinking water. Mechanical seal faces do not like heat nor do they like dirt and solids. When phosphoric acid is being sealed at normal process temperatures it does provide minimum lubricating qualities for the faces. The problem is that as the process changes so does the acid providing the film on which the mechanical seal faces run. If the acid gets too hot it will vaporise and when the temperature is too low the solids in the acid can come out of suspension. Both of these conditions will create adverse face conditions and greatly reduce the reliability needed to seal Phosphoric Acid.

Pond water is more difficult to seal than is Phosphoric Acid. Hot pond water is aggressive in nature, and due to its chemical make up it grows crystals that are very abrasive. Pond water does not provide the seal faces with any lubricating qualities, short or long term. Film stability is compromised here as well.

In the past, packing and single seals with high-pressure flushes have given the ability to run mechanical seals with a limited degree of success. The price paid for this success is shortened seal life, dilution of the acid strength, higher energy costs to drive off the water in the evaporation process and the continuous flow of water being added to the pond water system. All of these issues give way to higher plant operating costs.

The costs associated with water being added to the process are very high. The evaporation costs can be around £0.15 / $0.27 / €0.22 per liter per hour (£0.55 / $1.00 / €0.83 per gallon per hour). Water to ground costs are very high as well. If the plant is in the liming process, the costs are considerably higher. Liming costs are somewhere around £1,611.11 / $2,900.00 / €2,416.66 per year per liter per minute (per year per gallon per minute). There are two cost concerns here, one being the neutralisation of the pond water itself and the other being the loss of the Phosphoric Acid contained in the pond water. Plant costs and savings are easily seen here.



Crop Nutrition Case History

The company illustrated is one of the world's major producers of phosphate and nitrogen fertilizers. As a company, they mine millions of tons of phosphate rock every year, producing a considerable percentage of the total U.S. phosphate fertilizer supply and large amount of the world's phosphate fertilizer supply. Their phosphate operations are located in the South East of the USA, home of one of the largest deposits of phosphate rock.

The company is committed to helping to provide safe and affordable food for the world. With predictions that the world's population will climb to a staggering 9 billion people by 2040, estimates show that food production will need to increase more than two percent annually just to maintain current diets.

The Challenge –Water Reduction and Savings Plan

A water survey was carried out at one of the company's fertilizer production facilities. The purpose of the plant survey was to measure and evaluate all pumps and rotating equipment to facilitate reduced plant water intrusion, increased equipment reliability and increased plant production. The following data was collected or verified to initiate this process.

1) ***Pump size, motor and drive details and base plate and sub-base conditions were noted if necessary.***
2) ***A random water survey was done on non-operating equipment in all areas of the plant.***
3) ***The areas of the plant excluded from this survey were the Green Super Acid, Black Super Acid and Liquid Fertilizer. Thirty-one ANSI Process pumps were excluded in these areas. These areas were deemed non-critical for this survey.***

Results (Figures based upon 345 days operation per year)

Current Rates:

Process intrusion rate: 559.37 liters per minute (147.77 gallons per minute)

The conservative estimate of 660.97 liters per minute (174.61 gallons per minute) of fresh water is going into the process stream by way of single mechanical seals, mechanical packing or going to the ground through double seals using forced circulation. All add costs to the operational budget of the plant. Costs are different depending on where the water ends up.

559.37 liters per minute (147.77 gallons per minute) is the amount of fresh water going into the product through mechanical seals and packing. This water has to be evaporated out of the acid to make 50% Phosphoric Acid. The rate at which the water now enters the plant process stream is 277,895,200 liters per year (73,412,136 gallons per year). The water has to be evaporated out or driven off in the dry products process.

35,844,120 liters per year (9,469,008 gallons per year) are going into the evaporator seals alone. The cost of evaporation is £0.15 / $0.27 / €0.22 per liter per hour (£0.55 / $1.00 / €0.83 per gallon per hour). The evaporation costs on the eleven seals alone are £87,676.00 / $157,816.80 / €131,514.00

The rate of flow into the evaporators is 72.15 liters per minute (19.06 gallons per minute). This leaves 242,051,100 liters per year (63,943,128 gallons per year) going into the process stream somewhere else, or the acid, or the pond water systems.

Water to Ground Rate:

Fresh water going onto the ground either from seals through forced circulation or packing is at the rate of 101.71 liters per minute (26.84 gallons per minute). This is a total of 50,529,528 liters per year (13,334,112 gallons per year). This water goes directly into the pond water system and has to go through the liming process. The cost of the liming process is £1,611 / $2,900 / €2,416 per liter per minute per year (£6,111 / $11,000 / €9,166 per gallon per minute per year). At this rate the cost of the liming process for fresh water to the ground is £163,837 /$294,907 / €245,756 per year.

All water that enters the process stream has to be removed and ends up in the pond water system. The rate at which fresh water is added to the pond water system through mechanical seals and packing is 660.97 liters per minute (174.61 gallons per minute).

Cost of Evaporation per Year:
£87,676 / $ 157,817 / €131,514

Cost of Water to the Ponds per Year
£1,067,061 / $ 1,920,710 / €1,600,591

Total Estimated Plant Water Costs per Year
£1,154,737 / $ 2,078,527 / € 1,732,105

Total Cost to Upgrade
£162,388 / $ 292,330 / €243,583

SAVINGS FIRST YEAR AFTER ALL INSTALLATIONS -
£1,154,737 / $2,078,527 / €1,732,105

THE PAY BACK PERIOD ON THIS PROJECT WAS IMMEDIATE. THE SAVINGS IN THE AREA OF EVAPORATION ALONE PAID FOR HALF OF THE SEALS AND SYSTEMS UPGRADE.

Evaporator Pump – Survey, Process Intrusion

Equipment Location #	Description	Location	Model	LPM	GPM
B-E4P101	Pump, Cent, 20 Inch	#4 Evaporator Recirculating Pump	RDS	5.67	1.5
B-E3P101	Pump, Cent, 20 Inch	#3 Evaporator Recirculating Pump	RDS	8.33	2.2
B-E2P101	Pump, Cent, 20	#2 Evaporator Recirculating Pump	RDS	6.06	1.6
B-E1P101	Pump, Centrifugal, Elbow, Morris 20x20-20	#1 Evaporator Recirculating Pump	RDS	7.57	2
B-EEP101	Pump, Cent, 700 MM	E Evaporator Recirculating Pump	442	7.57	2
B-EDP101	Pump, Cent, 700 MM	Evaporator D Recirculating Pump	442	6.06	1.6
B-ECP101	Pump, Cent, 700 MM	Evaporator C Recirculating Pump	442	6.06	1.6
B-EBP101	Pump, Cent, 700 MM	Evaporator B Recirculating Pump	442	6.43	1.7
B-EAP101	Pump, Cent, 700 MM	Evaporator A Recirculating Pump	442	6.43	1.7
B-E6P101	Pump, Cent, 700 MM	#6 Evaporator Recirculating Pump	442	5.91	1.56
B-E7P101	Pump, Cent, 700 MM	#7 Evaporator Recirculating Pump	CURC	6.06	1.6
Total Per Minute				72.15	19.06
Total Per Year (345 Days)				35,844,120	9,469,008

In this single application

WATER SAVINGS

328,369,896 liters per year
86,746,150 galls (US) per year

WATER COST SAVINGS

£1,154,737.20 per year
€1,732,105.00 per year
$2,078,527.00 per year

(These numbers are slanted to the conservative side for this document. History and practices tell us that there is actually more water than this going into the product and onto the ground.)

Double seals with tank systems to support the seals eliminate most of the water measured in this survey and bring down plant costs associated with water intrusion and water to ground. At the same time these systems will provide a favourable film for mechanical seals thus giving way to longer seal life and greatly improved reliability.

Mining

The mining industry has proven over the years to be one of the most arduous and most expensive industries to maintain when one considers the maintenance of rotating equipment found in this sector. Not only does one have to deal with the most abrasive as well as corrosive applications found in any industry, one also has to accommodate traditionally bad maintenance practices. The mining industry has been lead to believe that the only way to maintain process, tailings, slurry and other typical applications, is through the use of gland packing. Gland packing inherently goes hand in hand with high maintenance cost, poor plant availability, and huge production losses.

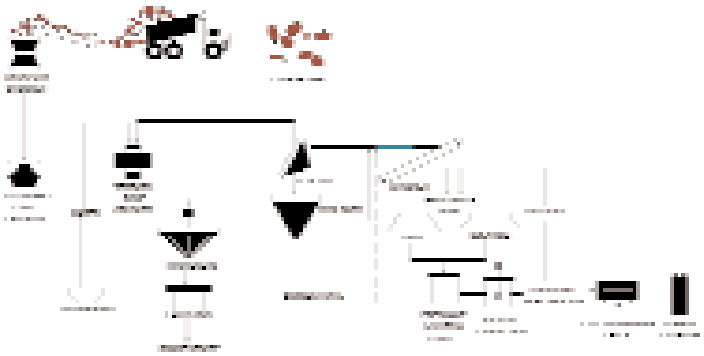
Unfortunately, with the introduction of mechanical seals a few decades ago, seal suppliers have neglected to educate end users in this market, and for years have been supplying wrong seals, wrong materials, and wrong (or no) seal support systems to the end user. This has lead to the general misconception that mechanical seals do not work in the mining industry.

Wrong!

Over the last 10-15 years AESSEAL plc has done extensive research and development in this area. By simply following the basic fundamental rules of mechanical seal performance, AESSEAL plc can now, without reservation state that they can SUCCESSFULLY seal slurry pumps, using standard products!

No specially designed seals, or pump specific seal is required. By simply adhering to the golden rule: 'Create a stable fluid film' AESSEAL® now has numerous (100s) of slurry pumps running across the globe in various mining sectors such as platinum, gold, diamond and other mineral mining plants.

The diagram above right shows a basic copper mine process, from the mine to metal. There are two different types of copper ore, the sulfide ore and the oxide ore. The sulfide ores are beneficiated in flotation cells, while the oxide ores are usually leached. First the copper ore from an open pit mine is blasted, loaded and transported to the primary crushers. The ore is then crushed and screened, with the fine sulfide ore (~-0.5mm) going to froth flotation cells for the recovery of copper. The coarser ore goes to the heap leach, where the copper is subjected to a dilute sulfuric acid solution to dissolve the copper. The leach solution containing the dissolved copper is subsequently subjected to a process called solvent extraction (SX). The SX process concentrates and purifies the copper leach solution so the copper can be recovered at a high electrical current efficiency by the 'electrowinning' cells. This is achieved by adding a chemical reagent to the SX tanks which selectively binds with and extracts the copper, and is easily separated from the copper (stripped), recovering as much of the reagent as possible for recycling. The concentrated copper solution is then dissolved in sulfuric acid and sent to the electrolytic cells for recovery as copper plates (cathodes). These plates can then be used to manufacture wire in appliances, etc. that are used in everyday life.



A common phenomenon within the mining industry is the need for a 'tailings dam'. Tailings are the residue of the milling process that is used to extract metals of interest from mined ores.

During this process ores are first milled, finely ground, and then treated in a hydro-metallurgical plant. As the extracted metal represents only a small proportion of the whole ore mass, the vast majority of the material which is mined ends up as a fine slurry.

The tailings contain all other constituents of the ore except the extracted metal, among them heavy metals and other toxic substances. The tailings also contain the chemicals added during the milling process.

In addition, as a result of the milling process, all of these contaminants are now much better available for dispersion into the environment than in the original ore. The mechanical stability of the tailings mass is very poor due to its small grain size and the high water content.

The majority of the mill tailings mass produced worldwide is dumped in large surface impoundments (tailings dams). The embankments forming these impoundments are earthfill dams. Although water-retention type dams would be very suitable for tailings dams, they are not used due to their high cost.

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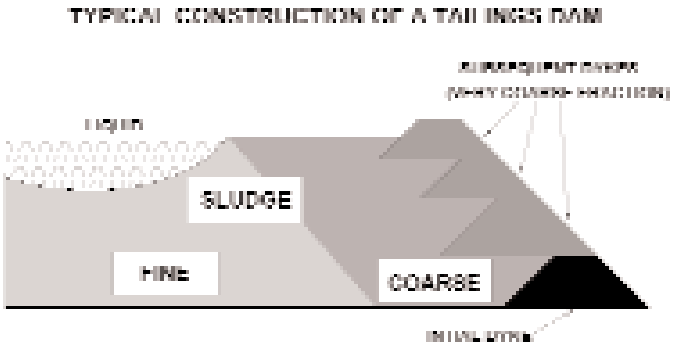
Typically tailings are pumped, or flow by gravity, to an engineered impoundment area where the solid fraction is allowed to settle out and the water is recycled to the mill for reuse in the grinding and flotation processes used to recover the desired minerals.

The sealing of tailings is made more of a challenge due to the erosive and abrasive nature of the tailings.



Mining Case History

This is a Case history from a mining facility in Zambia. The company's main business is copper mining, but it also has a pyrite mine and contract manages a smelting and refinery operation. Across its four locations the company has roughly 10,000 employees and 2,600 contract employees .

A number of pumps exist in the tailings dam in order to transport material to and from the dam. As already discussed, sealing pumps which transport tailings is difficult due to the erosive and abrasive nature of the tailings.

Historically, the company have used pump packing in conjunction with the 'flush' method in order to support the packing. Not only does this method waste huge quantities of water, but the packing constantly needs replacing and can cause major damage to the pump shaft. The packing also causes extra resistance, which needs to be overcome using extra electrical power.

AESSEAL plc now supply mechanical seals and support systems for the tailings dam. The water savings incurred by this switch are also complimented by the reduced pump energy consumption, as well as the reduced number of hours spent on replacing the seals for the pump equipment. The figures for just one application are shown below:

Items of cost:	Qty per yr:	Value (£/$/€)	Expense per annum
Packing Material	52	£96.67 / $174.00 / €145.00	£5,026.84 / $9,048.32 / €7,540.00
Labour for Packing	104	£17.33 / $31.19 / €26.00	£1,802.32 / $3,244.18 / €2,704.00
Gland Adjustments (15 mins/Adjustment)	91	£17.33 / $31.19 / €26.00	£1,577.03 / $2,838.65 / €2,366.00
Flush Water	1	£5,520.96 / $9,937.73.44 / €8,281.44	£5,520.96 / $9,937.73 / €8,281.44
Extra Power for Gland Packing and Lip Seals	1	£575.10 / $1,035.18 / €862.65	£575.10 / $1,035.18 / €862.65
Machine Repairs:			
Shaft Sleeves	24	£230.00 / $414.00 / €345.00	£5,520.00 / $9,936.00 / €8,280.00
Recon & Overhaul Bearing Barrel	12	£4,000.00 / $7,200.00 / €6,000.00	£48,000 / $86,400 / €72,000
Labour Hours (Install Pump and Align etc.)	160	£20.00 / $36.00 / €30.00	£3,200.00 / $5,760.00 / €4,800.00
Total Cost per Unit per Year			£71,222.25 / $128,200.05 / €106,834.09
The Total Cost of the AESSEAL plc Upgrade for this Application was:			£26,666.67 / $48,000.00 / €40,000.00
Actual Return on Investment per Year (for this Application)			£44,555.58 / $80,200.04 / €66,834.09
The AESSEAL plc upgrade broke even within 136.66 days			

In this single application

WATER SAVINGS	WATER COST SAVINGS	TOTAL COST SAVINGS
17,809,548 Liters per year	**£5,520.96 per year**	**£44,555.58 in the first year**
4,704,785 galls (US) per year	**€8,281.44 per year**	**€66,834.09 in the first year**
	$9,937.73 per year	**$80,200.04 in the first year**

In subsequent years the annual saving will increase, as the upgrade has already been carried out.

Pulp & Paper

The importance of paper in day to day living would be difficult to exaggerate. Most things are either designed on it, made of it, wrapped in it, sold by it or written on it. It was the Chinese who were the first to make paper as we know it, nearly two thousand years ago. They made it by soaking and pounding rags and plant fibres into a watery pulp which they poured onto a woven bamboo screen. It was lifted off carefully and, as it dried, it matted into a sheet of paper.

Paper continued to be made in this way for hundreds of years until a Frenchman, René de Reamur, having watched American wasps making nests from chewed up wood fibre, commented in 1719 that this would be an ideal way to make paper. It was not until 1844 though, that wood began to be commonly used for pulp.

The first automated paper machine was invented in 1799 by Louis Robert and was improved by the Fourdrinier Brothers in the mid nineteenth century, but even today, the age old principles of pulping, dewatering and drying still apply.

The first step in making paper is to turn the wood into pulp and the breaking down of the wood into fibres is called the Pulping Process. Wood is made up of cellulose fibres held together by a resinous substance called lignin. It is from these fibres that paper is made.

The next stage in the process is the blending of the different types of pulp, further refining if required, and the addition of various non fibrous additives. Different types of pulp are used in various combinations to produce the many different kinds of paper used by printers. The different pulps are mixed with additives such as caustic soda to adjust the pH level, alum to disperse pitch and calcium carbonate (for Fine Paper) or clay (for Gravure Paper) in a vessel called a Blending Chest. The combination of stock and additives which go to make up a particular type of paper is called the Furnish. The stock is then diluted to about 99% water and less than 1% wood fibres and is now ready to be made into paper.

The stock is pumped to the paper machine where the watery mixture is turned into paper.

Sheet formation commences with the stock being pumped to the Paper Machine Headbox which sprays the mixture onto a fast moving endless belt called the Wire.

The speed of movement of the Wire causes a low pressure effect, which sucks some of the water through and begins the de-watering process. More water is removed by suction boxes underneath the Wire and a suction roll at the end.

By now the stock has become a weak, wet sheet which transfers onto a moving felt at the start of the Press section.

In the Press section of the machine, the wet sheet lying on a moving felt passes through pairs of heavy rollers. Here the sheet is pressed, squeezing out more of the water through the felt. After pressing, so much of the water has been removed it is no longer possible to remove the remaining water by pressure alone. Now strong enough to sustain its own weight, the fast moving sheet enters the Drying section of the paper machine.

Here the paper travels through a long series of rotating, steam heated rollers, where nearly all of the remaining water is removed through evaporation. The paper is now ready for smoothing.

This is done by passing the paper between heavy, polished steel rollers called Calender Rolls. The pressure on the paper compresses it, giving it a flat smooth surface. This process or ironing of the paper is called Calendering. Certain types of paper are also Supercalendered to give a glossy finish such as that required for magazine grade paper; this Gravure Paper has clay added to the Furnish which, when Supercalendered, produces a gloss.

From the Machine Calender the paper is wound onto a rubber covered spool. A full spool of paper is called a Jumbo Reel and weighs 15 - 20 tons depending on the diameter and type of paper. When a Jumbo Reel has reached the required diameter a new spool is lowered onto the running sheet of paper. The sheet is torn across its width and transferred onto the new spool. This is done without stopping or slowing down the machine.

The Jumbo Reel is then moved to the Rewinder where it is cut into narrower width rolls by circular slitter knives, again depending on customer requirements, and wound onto smaller cardboard cores prior to wrapping.

Various grades and types of paper and board may receive a surface coat in order to either improve the characteristics of the paper or to give it special properties, such as a barrier to water or grease. These coats may be applied during the papermaking process itself (on line) or after the sheet has been cut down to specific sized reels (off line) and could include waxes, lacquers, resins and adhesives, but is most often clay.

From this description, it is clear that pumps are used on most processes within this industry.

Mondi Ltd.

Mondi Ltd, an Anglo American group company, is a large South African producer of pulp, paper, packaging board, sawn-timber and related products. It owns or leases 526,000 hectares of forest land and has an annual turnover of approximately US$2 billion.

Since the first reel of newsprint rolled out of the Merebank mill in 1971, Mondi has grown into a major supplier of paper products to South Africa and the world.

Many of the pumps used by Mondi are sealed using pump packing in conjunction with the 'flush' method in order to support the packing. As discussed, not only does this method waste huge quantities of water, but the packing constantly needs replacing and can cause major damage to the pump shaft. The packing also causes extra resistance, which needs to be overcome using extra electrical power.

Having seen the methods employed in this industry throughout the years, AESSEAL plc has engineered and developed a complete sealing solution for this industry, which replaces the pump packing with a much more energy efficient double mechanical seal in conjunction with a water management system to support the mechanical seal. This technique was gratefully embraced by Mondi when it was presented to them. The savings in terms of water, energy and labour were immediate. One particular application in which pump packing was replaced with the AESSEAL plc complete sealing solution is shown overleaf.

AESSEAL® Team Pictured left to right:
Luke Longmore - Technical Representative
Ryan Smith - Technical Representative
Rob Waites - MD
Rob Adam - Divisional Director
Don van Rooyen- Technical Representative

Due to the successes experienced within Mondi, AESSEAL plc was awarded with a most prestigious award by Mondi themselves.

At a spectacular banquet held at the premier venue of the Sandton Sun Hotel in Johannesburg, AESSEAL® were presented with the Mondi Supplier of the Year Award in the Intermediate Category.

A total of three awards were made amongst thirteen finalists, namely in the development, medium and large company categories. The ceremony was well attended by members from the Mondi Group and their supplier base.

Rob Adam from AESSEAL® accepted the award from Mr Thompson the Chairman and CEO of Mondi South Africa. In his acceptance speech Mr Adam placed a strong emphasis on the fact that teamwork went a long way to securing this accolade.

Some of the deciding factors in the evaluation of the finalist was the exceptional service carried out at the Piet Retief Mill by Mr Ryan Smith of AESSEAL® and the unprecedented cost savings generated at the Merebank Mill through the hard work of Mr Don van Rooyen and his team, also of AESSEAL®.

Environmental performance, particularly with regard to the saving and correct utilization of our water resources has been a strong driving force behind the success of AESSEAL® in South Africa. The need to carefully and aggressively manage this resource has been identified by the Mondi group and constitutes a component of their environmental policy.

AESSEAL® has successfully dovetailed into Mondi's water saving initiative by installing equipment that eliminates water consumption into stuffing box glands, saving billions of liters of water over the past six years.

AESSEAL® Cost / Water Savings

Items of Cost:	Qty per Yr:	Value (£/$/€)	Expense per Annum
Packing Material	9	£54.77 / $98.59 / €82.16	£492.93 / $887.27 / €739.44
Labour for Packing	9	£14.23 / $25.61 / €21.35	£128.07 / $230.53 / €192.15
Product Loss/Downtime/Lost Production	1	£8,846.15 / $15,923.07 / €13,269.23	£8,846.15 / $15,923.07 / €13,269.23
Flush Water	1	£833.65 / $1,500.57 / €1,250.48	£833.65 / $1,500.57 / €1,250.48
Extra Power for Gland Packing and Lip Seals	1	£147.76 / $265.97 / €221.64	£147.76 / $265.97 / €221.64
Machine Repairs:			
Shaft Sleeves	2	£61.54 / $110.77 / €92.31	£123.08 / $221.54 / €184.62
Bearings	4	£76.92 / $138.46 / €115.38	£307.68 / $553.82 / €461.52
Lip Seals	2	£1.54 / $2.77 / €2.31	£3.08 / $5.54 / €4.62
Other (Main Shaft) and Spiraltrac	1	£1,115.38 / $2,007.68 / €1,673.07	£1,115.38 / $2,007.68 / €1,673.07
Labour Hours to Repair pump	20	£23.08 / $41.54 / €34.62	£23.08 / $41.54 / €34.62
Heating Costs	1	£1,365.86 / $2,458.55 / €2,048.79	£1,365.86 / $2,458.55 / €2,048.79
Water Treatment	1	£51.32 / $92.38 / €76.98	£51.32 / $92.38 / €76.98
Total Cost per Unit per Year			£13,438.04 / $24,188.47 / €20,157.16
The Total Cost of the AESSEAL plc Upgrade for this Application was:			£2,192.31 / $3,946.16 / €3,288.47
Actual Return on Investment per Year (for this Application)			£11,245.73 / $20,242.31 / €16,868.69
The AESSEAL plc upgrade broke even within 59.55 days			

In this single application

WATER SAVINGS

2,689,194 liters per year
710,410 galls (US) per year

WATER COST SAVINGS

£833.65 per year
€1,250.48 per year
$1,500.57 per year

TOTAL COST SAVINGS

£11,245.73 in the first year
€16,868.69 in the first year
$20,242.31 in the first year

In subsequent years the annual saving will increase, as the upgrade has already been carried out.

Kimberley-Clark

Kimberly-Clark is a leading global health and hygiene company with operations in 38 countries and product sales in more than 150. Employing more than 60,000 people worldwide, Kimberly-Clark posted sales of $14.3 billion in 2003.

K-C is home to some of the world's most trusted and recognized brands - including Kleenex, Scott, Huggies, Pull-Ups, Kotex and Depend. As a company they hold the No. 1 or No. 2 position globally in most of the major consumer products categories in which they compete. Every day, 1.3 billion people - nearly a quarter of the world's population - trust their brands to enhance their health, hygiene and well-being.

AESSEAL plc reviewed an application at the Whiting Mill in the United States of America, in which pump packing was employed to seal a pump. It was discovered that thousands of dollars per year were being spent on introducing water through the pump, and subsequently evaporating the water towards the end of the process. For this reason AESSEAL plc installed a CDSA™ double mechanical seal with a supporting SW2™ water management system.

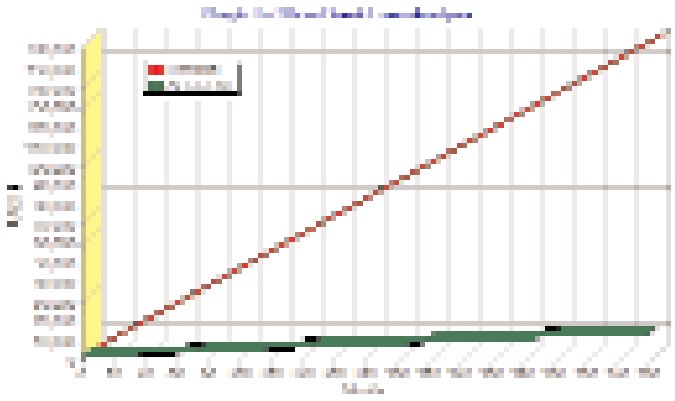
This new arrangement saves an immense amount of water and energy, and has also increased the Mean Time Between Failure (MTBF) for the whole arrangement. The break even point for this complete solution was 177 days.

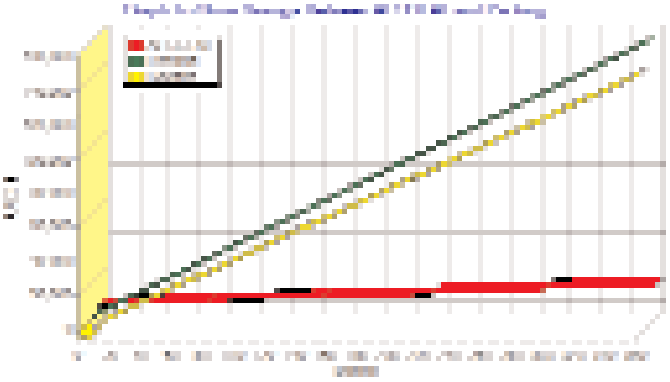
Input	Value	Input	Value
AESSEAL® Cost	£777.78 / $1,400.00 / €1,166.67	Flush Water Temperature	21.1°C / 70.0°F
Additional System Cost	£666.67 / $1,200.00 / €1,000.00	Process Fluid Temperature	48.9°C / 120.0°F
Packing Cost (per lb)	£42.37 / $76.26 / €63.55	Flush Water Cost per 1,000 Gal (3,785 liters)	£0.25 / $0.45 / €0.38
Density of Packing	0.38 lb/ft	Cost of Steam per 1,000 lb	£1.64 / $2.95 / €2.46
Packing Rings per Shaft	5.00	Efficiency: Fluid Heat by Steam	85.00%
Pump Shaft Size	2.12”	Water:Steam Ratio for Evaporation	4.95
Time Taken to Pack Pump	2.00 Hours	Steam Recovery after Evaporation	0.00%
Time Between Packing Adjustments	1.00 Months	Annual Operating Hours	8,400.00 Hours
Time Taken to Adjust Packing	0.25 Hours	Labour Rate per hour	£33.33 / $50.00 / €50.00

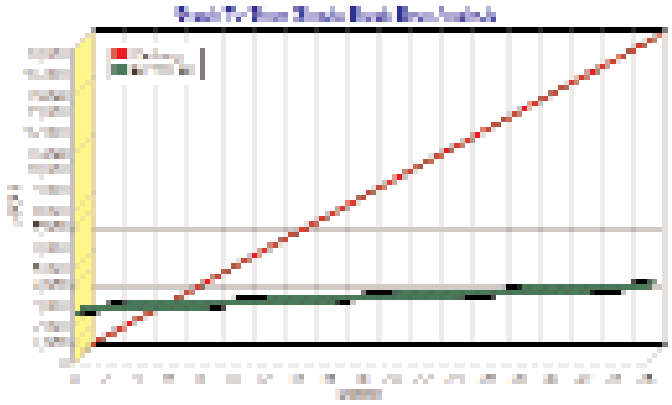
Input	Previous Pump Packing	AESSEAL® Total Sealing Solution
Expected Life of Sealing Solution	6.00 Months	72.00 Months
Time Between Pump Repairs	12.00 Months	72.00 Months
Time Between Pump Sleeve Replacements	12.00 Months	72.00 Months
Pump Sleeve Cost	£166.67 / $300.00 / €250.00	£166.67 / $300.00 / €250.00
Pump Bearing Cost	£138.89 / $250.00 / €208.33	£138.89 / $250.00 / €208.33
Other Replaced Parts Cost	£222.22 / $400.00 / €333.33	£222.22 / $400.00 / €333.33
Pump Repair Time	12.00	12.00
Flush Water Flow Rate	2.50 GPM (11.36 LPM)	0.00
Flush Water Lost Into Pumping Chamber	25.00%	0.00%

Annual cost breakdown

Description	Previous Pump Packing	AESSEAL® Total Sealing Solution
Sealing Cost	£201.39 / $362.50 / €302.08	£77.78 / $140.00/ €116.67
Pump Repair Cost	£944.44 / $1700.00 / €1416.67	£143.52 / $258.33 / €215.28
Flush Water Cost	£314.97 / $566.94 / €472.45	£0.13 / $0.23 / €0.19
Reheating Cost	£275.77 / $469.38 / €413.65	£0.00 / $ 0.00 / €0.00
Evaporation Cost	£1,350.09 / $ 2,430.17 / €2,025.14	£0.00 / $ 0.00 / €0.00
Type in One Off Costs Below:		
Product Loss Cost	£0.00 / $ 0.00 / €0.00	£0.00 / $ 0.00 / €0.00
Production Downtime Cost	£0.00 / $ 0.00 / €0.00	£0.00 / $ 0.00 / €0.00
Total Annual Cost	£1,151.03 / $2,071.85 / €1,726.54	£221.42 / $398.56 / €332.13







In this single application

WATER SAVINGS

5,725,440 liters per year
1,512,501 galls (US) per year

WATER COST SAVINGS

£378.17 per year
€567.25 per year
$680.70 per year

TOTAL COST SAVINGS

£2,850.24 per year
€4,275.37 per year
$5,130.44 per year

Speciality Minerals

Specialty Minerals Inc. (SMI) is one of the world's foremost manufacturers of performance-enhancing industrial minerals and chemicals for the paper, polymer, building products and allied industries.

An integrated company employing innovative mineral processing techniques, they are the world's largest supplier of PCC (precipitated calcium carbonate) to the paper industry. The precipitated calcium carbonate products are used in a wide range of unique paper applications from filling and coating to extending expensive wood fibre and replacing opacifying pigments. They are also used in the manufacture of PVC plastics and in consumer products such as antacid tablets and calcium supplements.

In April 2004, AESSEAL plc upgraded 17 pumps at the Brookhaven (Mississippi) plant by installing SW2™ water management systems. The previous arrangement used 3 gallons per minute (11.36 liters per minute) per application, compared to virtually zero water consumption using the SW2™ Systems.

The previous annual water consumption was 26,805,600 gallons (101,470,200 liters). The cost per thousand gallons (3,785 liters) of water is £2.50 / $4.50 / €3.75, and hence the total water cost saving per year is a staggering £67,014.00 / $120,625.20 / €100,521.00.

In this single project

WATER SAVINGS

101,470,200 liters per year
26,805,600 (US) per year

WATER COST SAVINGS

£80,416.80 per year
€100,521.00 per year
$120,625.20 per year

Sugar

Sugar is produced in over 120 countries and global production now exceeds 130 million tons a year. Approximately 70% is produced from sugar cane, largely grown in tropical countries. The remaining 30% is produced from sugar beet, which is a root crop resembling a large parsnip grown mostly in the temperate zones of the north.

PLANTING

Sugar cane cuttings are planted in fields by either workers or mechanical planters. In order for the cane to grow, the seeds need to be planted in soil which is well drained. Typical cane soil is made up of a mixture of silt, sand, clay particles and organic matter. Canes are usually spaced at least 4-feet apart and lined in rows and covered with soil. Fertilisers are applied to the soil from the time of planting up until the beginning of the ripening period. Cane fields are regularly weeded to provide for optimum growth of the cane. Depending on the region where the crop is planted, cane seasons can last between 8 and 22 months.

HARVEST COLLECTION

The mature canes are collected by a combination of manual and mechanical methods. Canes are cut at ground level, the leaves are then removed and the top is trimmed off by cutting off the last mature joint. The canes are subsequently placed into large piles and picked up, tied, and transported to a sugar factory.

CLEANSING AND GRINDING

The stalks are thoroughly washed and cut when they reach the sugar mill. After the cleaning process, a machine which contains a series of rotating knives shreds the cane into pieces. This is known as the “grinding” process. During grinding, hot water is sprayed on to the sugarcane to dissolve any of the remaining hard sugar. The smaller pieces of cane are then spread out whilst on a conveyer belt.

JUICING

The shredded pieces of sugar cane travel on the conveyer belt through a number of heavy-duty rollers, which extract juice from the pulp. The pulp that remains or “bagasse” is dried and may be used as fuel. The raw juice then moves on through the mill to be clarified.

CLARIFYING

Carbon dioxide and the milk of lime are added to the liquid sugar mixture and it is heated to its boiling point in the early stages of the clarifying process. As the carbon dioxide travels through the liquid it forms calcium carbonate, which attracts the non-sugar debris (fats, gums and wax) from the juice and pulls them away from the sugar juice. The juice is then pushed through a number of filters to remove any remaining impurities.

EVAPORATION

The clear juice, which results from the clarifying process, is placed under vacuum conditions where the juice boils at a low temperature and begins to evaporate. It is heated until it forms into thick, brown syrup.

CRYSTALLIZATION

By evaporating the small amount of water left in the sugar syrup, crystallisation begins to take place. Inside a sterilised vacuum pan, pulverised sugar is fed into the pan as the liquid evaporates which encourages the formation of crystals. The remaining mixture is a thick mass of crystals which is sent to a centrifuge to spin and dry the crystals. The dried product is then raw sugar which is still inedible.

REFINERY

Raw sugar is transported to a Sugar Refinery for the removal of molasses, minerals and other non-sugars, which still contaminate the sugar. The raw sugar is mixed with a solution of sugar and water to loosen the molasses from the outside of the raw sugar crystals, producing a thick matter, which is typically called “magma”. Large machines then spin the magma, which separates the molasses from the crystals. The crystals are promptly washed, dissolved and filtered to remove any further impurities. The golden syrup which is produced is then sent through yet more filters to remove the colour and water. The remainder is concentrated, clear syrup, which is again fed into a vacuum pan.

SEPARATION AND PACKAGING

Once the final evaporation and drying process is performed, screens separate the different sized sugar crystals. Large and small crystals are packaged and shipped, and are labelled as white, refined, sugar.

Sugar Production Case History 1

A sugar plant in Germany had 16 pumps using single mechanical seals which were supported by using the quench to drain method. These pumps were pumping liquid sugar and had a 19mm shaft size. The seals needed replacing regularly due to the nature of the liquid sugar and the support method meant that the water consumption was around 3.6 liters per minute (0.79 gallons per minute) per pump.

Hence, the consumption for 16 pumps was 57.6 liters per minute (12.67 gallons per minute).

This equates to a massive 30,274,560 liters (6,659,469 gallons) of water consumption per year.

1,000 liters (219.97 gallons) of water costs the company £1.87 / $3.37 / €2.81, which includes the treatment of the effluent.

This results in an annual water cost of £56,714.00 / $102,085.20 / €85,071.00.

The sugar plant invested in 16 water management systems in order to combat this huge water consumption and since the installation, massive water savings have been experienced as well as extended seal life.

In this single application

WATER SAVINGS

5,256,000 liters per year
1,388,488 galls (US) per year

WATER COST SAVINGS

£772.98 per year
€1,159.47 per year
$1,391.36 per year

TOTAL COST SAVINGS

£725.20 per year
€1,087.80 per year
$1,305.36 per year

An additional break even analysis with details of annual water & cost savings for another Sugar Production Case History is shown overleaf.

Sugar Production Case History 2

In early 2002, AESSEAL® discovered that a sugar plant in South Africa was passing water through seal glands at a rate of around 15 liters per minute (3.3 gallons per minute). At least 85% of this water was being introduced straight into the product, which was sugar syrup. The irony here was that a lot of money is spent removing water from the product in this process, and then massive quantities of water are re-introduced into the process through the pump and seal. This water then needs to be evaporated again, at even more expense.

AESSEAL plc upgraded a single pump at the plant, so that a double mechanical seal was used in conjunction with a water management system, at it's own expense. It was discovered that the power consumption of the motor was reduced by 4.5% and water consumption was reduced to virtually zero.

Before the upgrade, the pump was costing an extra £19.60 / $35.28 / €29.40 to run per day which equated to £5,486.79 / $9,874.80 / €8,230.19 per season. This simple installation showed the path for improving water and energy savings for many other similar pumps around the plant.

Items of cost:	Qty per yr:	Value (£/$/€)	Expense per annum
Packing Material	6	£50.00 / $90.00 / €75.00	£300.00 / $450.00 / €450.00
Labour for Packing	12	£15.39 / $27.70 / €23.09	£184.68 / $332.42 / €277.02
Product Loss	0	£0.00 / $0.00 / €0.00	£0.00 / $0.00 / €0.00
Flush Water	1	£521.06 / $937.91 / €781.59	£521.06 / $937.91 / €781.59
Extra Power for Gland Packing and Lip Seals	1	£326.59 / $587.86 / €389.89	£326.59 / $587.86 / €389.89
Machine Repairs:			
- Shaft Sleeves	1	£192.31 / $346.16 / €288.47	£192.31 / $346.16 / €288.47
- Bearings	1	£192.31 / $346.16 / €288.47	£192.31 / $346.16 / €288.47
- Lip Seals	2	£7.69 / $13.84 / €11.54	£15.38 / $27.68 / €23.08
- Labour Hours	10	£15.39 / $27.70 / €23.09	£153.90 / $277.02 / €230.90
Heating Costs	1	£646.38 / $1,163.48 / €969.57	£646.38 / $1,163.48 / €969.57
Water Treatment	1	£111.62 / $200.92 / €167.43	£111.62 / $200.92 / €167.43
Water Extraction by Evaporation	1	£2,842.68 / $5,116.82 / €4,264.02	£2,842.68 / $5,116.82 / €4,264.02
Total Cost per Unit per Season (280 days per year)			£5,486.91 / $9,876.44 / €8,230.37
The Total Cost of the AESSEAL plc Upgrade for this Application was:			£2,461.54 / $4,430.77 / €3,692.31
Actual Return on Investment per Year (for this application)			£3,025.37 / $5,445.67 / €4,538.06
The AESSEAL plc upgrade broke even within 163.75 days			

In this single application

WATER SAVINGS

1,680,839 liters per year
444,031 galls (US) per year

WATER COST SAVINGS

£632.68 per year
€949.02 per year
$1,138.32 per year

TOTAL COST SAVINGS

£3,025.37 per year
€4,538.06 per year
$5,445.67 per year

Waste Water

Domestic

Waste water treatment is a generally unseen but expensive process, which often gets taken for granted by most people. As long as water goes down the drain without a problem, the average person doesn't worry too much about what happens to the water and its contents after it disappears from view.

That's as it should be, because this would indicate there are no major problems with most sanitary sewer systems. Behind the scenes however there is a complex process manned by thousands of employees that are working for waste water treatment plants around the world. They are constantly testing, maintaining and improving waste water treatment facilities, to ensure that what is returned to the environment complies with strict local and global standards.

Industrial

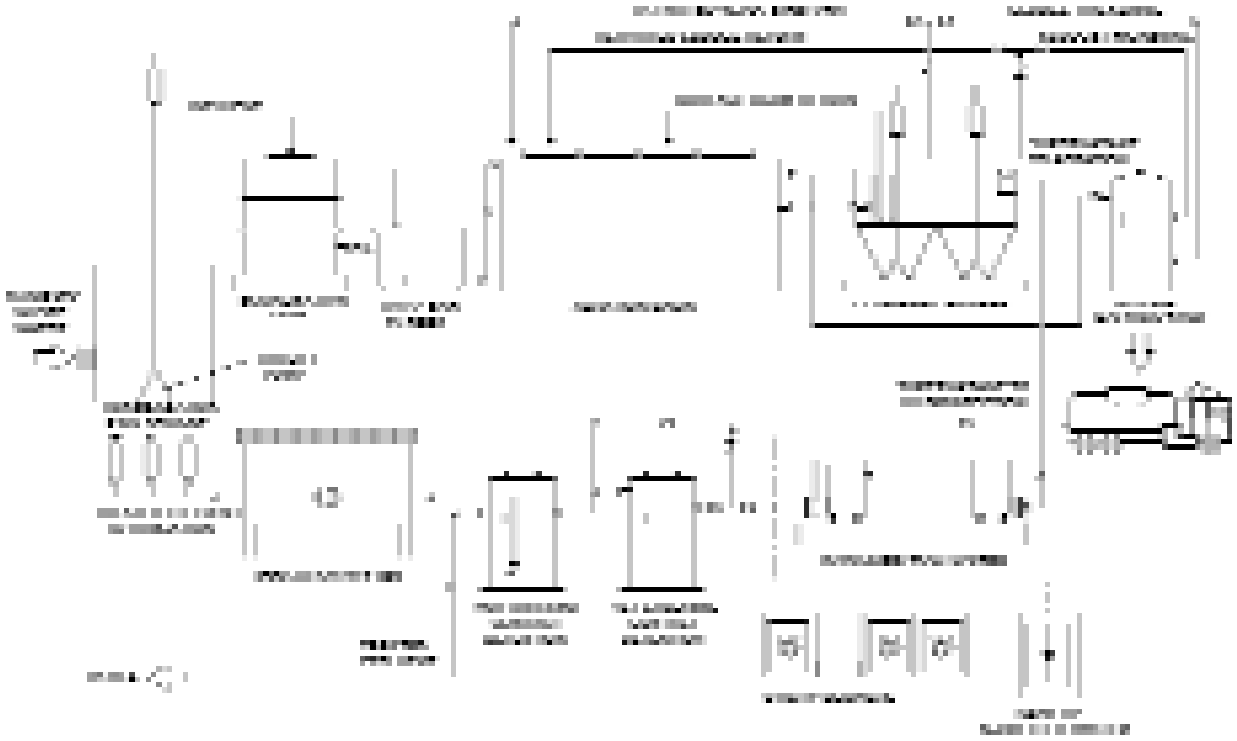
In industry there is a tendency to adopt a similar "out of sight, out of mind" approach. In some instances not truly considering the additional cost to production that comes along with building and running an efficient industrial effluent plant.

In the absence of an on site plant, effluent is often added to the city sewer system and a tax or levy is paid by the company to the water authority to deal with the diluted waste on their behalf. In the past, these costs also had a habit of get overlooked in the "cost of production" calculations.

More enlightened producers not only factor-in the cost of acquiring and cleaning their water at each stage but take the view that, just with any cost, if it is carefully managed it can be considerably reduced. It is a little realised fact but Industrial effluent clean up costs can be up to ten times the cost of the original clean water.

The same producers now realise that the AESSEAL® SW2™ water management system allows them to greatly reduce their water consumption and with the introduction of the SW2™ Flow Fuse™ System they can simultaneously reduce their waste water and waste product knowing that all three factors will massively impact upon their bottom line.

Waste water is cleaned using physical and biological processes similar to those that occur in nature, but which have been accelerated to produce clean water in just a few hours. (See the diagram below of the treatment process.) By the end of the treatment process, the water meets ocean swimming standards. After treatment and disinfection, the water enters an outfall pipeline and is usually discharged through a pipeline to a large body of water, such as an ocean. The last section of the outfall can contain many portals through which the water exits. The portals create an area of rapid mixing that allows non-saline water to be quickly assimilated with the saline ocean water.



Waste Water Treatment plant Case History 1

As can be seen from the illustrated process, pumps are utilised in numerous locations around a waste water treatment plant. AESSEAL plc have discovered that the common practice employed when sealing these pumps is to use pump packing, or the quench to drain method when a mechanical seal is used. Both these methods have been proven time and time again to be unreliable and wasteful. AESSEAL plc presented the complete sealing solution to a waste water treatment plant in the Eastern States of the USA, who decided to trial the technology on their site. One particular application on which the pump packing method was replaced with a double mechanical seal and an SW2™ water management system is shown below:

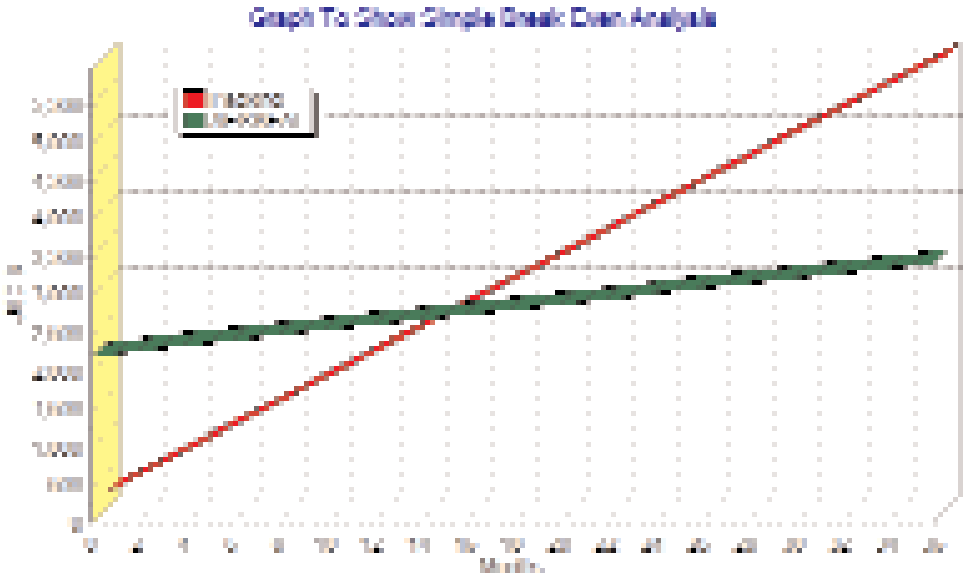
Input Values for ROI Calculation

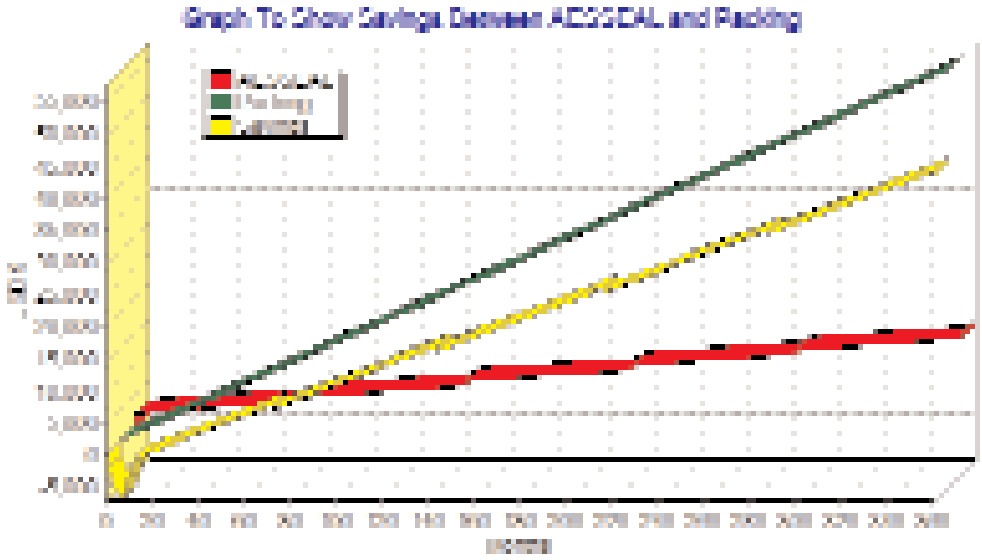
Input	Value	Input	Value
AESSEAL® Cost	£666.67 / $1,200.00 / €1,000.00	Flush Water Temperature	21.5°C / 70.7°F
Additional System Cost	£555.56 / $1,000.00 / €833.33	Process Fluid Temperature	26.67°C / 80.0°F
Packing Cost (per lb)	£42.37 / $76.26 / €63.55	Flush Water Cost per 1,000 Gal (3,785 Ltrs)	£0.28 / $0.50 / €0.42
Density of Packing	0.38 lb/ft	Cost of Steam	£0.00 / $0.00 / €0.00
Packing Rings per Shaft	5.00	Efficiency: Fluid Heat by Steam	0.00 %
Pump Shaft Size	3.00”	Water: Steam Ratio for Evaporation	0.00
Time Taken to Pack Pump	2.00 Hours	Steam Recovery after Evaporation	0.00 %
Time Between Packing Adjustments	1.00 Months	Annual Operating Hours	8,400.00 Hours
Time Taken to Adjust Packing	0.25 Hours	Labour Rate (per hour)	£27.78 / $50.00 / €41.67

Input	Previous Pump Packing	AESSEAL® Total Sealing Solution
Expected Life of Sealing Solution	6.00 Months	72.00 Months
Time Between Pump Repairs	24.00 Months	72.00 Months
Time Between Pump Sleeve Replacements	24.00 Months	72.00 Months
Pump Sleeve Cost	£194.44 / $350.00 / €291.67	£194.44 / $350.00 / €291.67
Pump Bearing Cost	£180.56 / $325.00 / €270.83	£180.56 / $325.00 / €270.83
Other Replaced Parts Cost	£250.00 / $450.00 / €375.00	£300.00 / $450.00 / €375.00
Pump Repair Time	12.00 Hours	12.00 Hours
Flush Water Flow Rate	9.46 LPM (2.50 GPM)	0.00 LPM (0.00 GPM)
Flush Water Lost into Pumping Chamber	25.00%	0%

Annual cost breakdown

Description	Previous Pump Packing	AESSEAL® Total Sealing Solution
Sealing Cost	£238.57 / $429.42 / €357.85	£66.67 / $120.00/ €100.00
Pump Repair Cost	£562.50 / $1,012.50 / €843.75	£159.72 / $287.50 / €239.58
Flush Water Cost	£349.97 / $629.94 / €824.95	£0.14 / $0.25 / €0.21
Re-heating Cost	£0.00 / $0.00 / €0.00	£0.00 / $0.00 / €0.00
Evaporation Cost	£0.00 / $0.00 / €0.00	£0.00 / $0.00 / €0.00
Type in One-Off Costs below:		
Product Loss Cost	£0.00 / $0.00 / €0.00	£0.00 / $0.00 / €0.00
Product Downtime Cost	£0.00 / $0.00 / €0.00	£0.00 / $0.00 / €0.00
Total Annual Cost	£1,151.03 / $2,071.85 / €1,726.54	£226.53 / $407.75 / €339.80





In this single application

WATER SAVINGS

4,767,140 liters per year
1,259,530 galls (US) per year

WATER COST SAVINGS

£349.83 per year
€524.74 per year
$629.69 per year

TOTAL COST SAVINGS

£924.50 per year
€1,386.75 per year
$1,664.10 per year

Waste Water Treatment Plant Case History 2

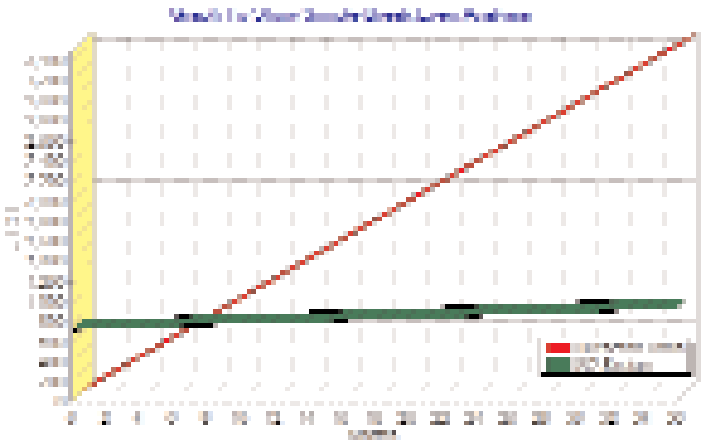
AESSEAL plc offered the complete sealing solution to a waste water treatment plant in the Mid-Western States of the USA, who have also embraced the technology, and have enjoyed excellent water savings as a result. One particular application in which the quench to drain method was replaced with an AESSEAL plc SW2™ water management system is shown below.

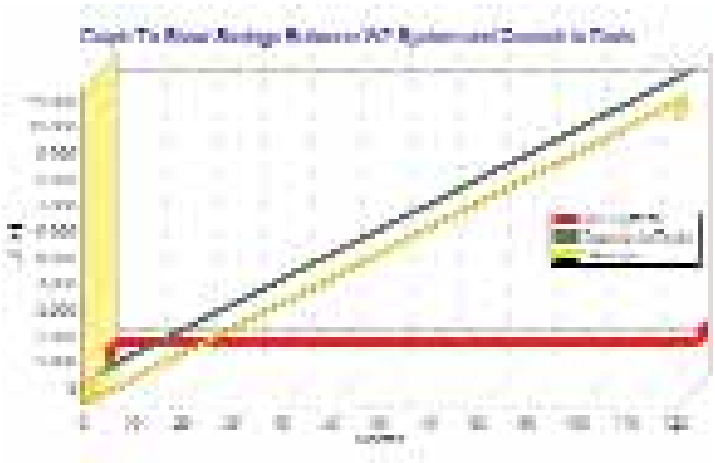
Input Values for ROI Calculation

Input	Value	Input	Value
SW2™ Cost	£398.18 / $716.72 / €597.27	Water used by SW2™ System	40.0 Liters / 10.57 Galls
SW2™ Expected Lifetime	10 Years	Running Hours per Day	24
Water Cost (m^3)	£0.12 / $0.22 / €0.18	Running days per Year	365
Quench to Drain Flowrate	10 Liters / min / 2.64 Galls/min	Number of Systems Installed	1

Annual cost breakdown

Description	Previous Quench to Drain Method	AESSEAL® Total Sealing Solution
Investment Cost	£0.00 / $0.00 / €0.00	£39.82 / $71.67/ €59.73
Water Cost	£644.16 / $1,159.48 / €966.23	£0.006 / $0.01 / €0.01
Total Annual Cost	£644.16 / $1,159.48 / €966.23	£39.83 / $71.68 / €59.74





In this single application

WATER SAVINGS

5,256,000 liters per year
1,388,488 galls (US) per year

WATER COST SAVINGS

£644.15 per year
€966.23 per year
$1,159.47 per year

TOTAL COST SAVINGS

£604.33 per year
€906.50 per year
$1,087.80 per year

Wet Corn Milling

Over the past 10 years there has been significant growth in the use of mechanical seals and support systems in the Wet Corn Milling Industry. Seals and support systems manufactured by AESSEAL® have been used successfully in a variety of applications. This growth can be attributed to the following factors:

a. The recognition of the financial benefits that occur when using properly designed and specified mechanical seals and support systems. These cost saving are derived from the reduced consumption of costly clean water, the reduction in process evaporation and the reduction of waste water treatment which make the conversion to mechanical seals beneficial and cost effective.

b. More stringent health and safety regulatory controls have made product leakage unacceptable. Fluid leakage poses a health and safety threat as well as being a housekeeping nuisance.

c. As the cost of raw materials has increased, the need for reliable fluid sealing has increased. Yield loss of expensive process fluids can be reduced by positively sealing the process equipment.

d. Traditionally, many sites used mechanical packing in their pumps. The introduction of smaller pumps operating at higher speeds made mechanical packing a less desirable sealing alternative.

e. Mechanical packing damages the rotating equipment. Shaft sleeve wear and bearing failure caused by excessive leakage are common complaints. Additionally, chemical attack of the concrete base and ductile iron pump components occurs when corrosive chemicals are allowed to leak from packed glands.

f. Frequent maintenance attention is required to constantly monitor and adjust packed glands.

g. Many seal chambers operate under vacuum conditions. Positive sealing from properly designed mechanical seals eliminates air ingress through the seal housing.

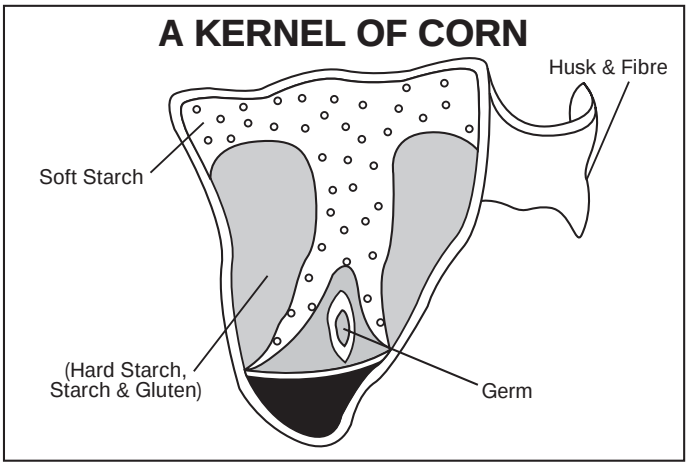
The following information outlines the various stages of corn processing by using generic flow charts accompanied by a brief explanation of the process steps.

CORN WET MILLING

The basic component used in the production of starch is corn. European manufacturers refer to corn wet milling as maize processing. Other raw products such as wheat, rice, barley, sago and potatoes can be used in the milling process.

Corn refiners use shelled corn that has been stripped from the cob during harvesting. Refiners then separate the corn into its components starch, oil, protein and fibre and convert them into higher value products.

The illustration below details the various components of a corn kernel. The corn kernel varies in quality, typically a standard analysis would yield the following:



Starch:	67.6%
Protein/Gluten:	4.6%
Oil:	2.7%
Fibre:	22.8%
Shrinkage:	2.3%
TOTAL:	**100.0%**

CORN PRODUCTS

For more than 150 years, corn refiners have been perfecting the process of separating corn into its component parts to create a myriad of value added products. The corn wet milling process separates corn into its four basic components: starch, germ, fibre and gluten.

Starch: Starch is used in its natural state or it is modified for specialty starches and converted into syrup.

Germ: Germ is converted into corn oil. Fibre removed through pressing is used as cattle feed.

Gluten: Gluten consists of a mixture of proteins used primarily for poultry feed enrichments.

Fibre/Steep: The fibre and steep mixture is used for livestock feed.

Corn sweeteners are by far the most important refined corn product as they supply around 55% of the U.S. nutrient sweetener market.

The second major refined corn product is ethanol, which is gaining increasing acceptance as a burning option for motor fuels.

The third major corn product is starch which most of the American population rely on for their starch needs.

Other important products such as corn oil and animal feed are produced.

CORN WET MILLING – THE PRODUCTION PROCESS

There are several basic steps to accomplish this process. First the incoming corn is inspected and cleaned. Then it is steeped for 30 to 40 hours to begin breaking the starch and protein bonds. The next step in the process involves a coarse grind to separate the germ from the rest of the kernel. The remaining slurry consisting of fibre, starch and protein is finely ground and screened to separate the fibre from the starch and protein. The starch is separated from the remaining slurry in hydrocyclones. The starch can then be converted to syrup or it can be made into several other products through a fermentation process. All these processes are shown in the following sections.

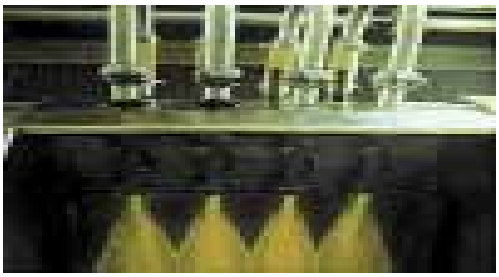
1. Inspection and Cleaning

After delivery by truck, rail, or river barge, corn is held in large silos awaiting the start of the production process. Unwanted debris is removed as the product enters the next stages of production.

2. Steeping

The purpose of steeping is to soften and condition the corn kernel for subsequent milling and to prevent germination and fermentation. Corn is soaked in water at a controlled temperature, normally 118°F (47.8°C), for approximately 30-50 hours. Sulphur Dioxide (SO_2) is added to prevent bacterial growth and to reduce the bond between gluten and starch. This batch steeping process occurs in large tanks fitted with side-entry agitator units.

3. First Grind Mill



The Grind Mill, which consists of studded drums rotating in opposite directions, is designed to crack the corn kernel separating the starch without damaging the corn germ. Kernels not fully opened are reground in a second mill as required.

4. Germ Separation

The oil-bearing germ is lighter than other particles and is segregated in a series of cyclone separators. A combination of mechanical and solvent processes extracts oil from the germ. The oil is then refined and filtered into finished corn oil. The remaining mixture of corn, starch and husks is filtered, to remove husks, and processed into cattle feed.

5. Germ Washing

The starch slurry is removed through a germ washing stage. Further purification occurs as the germ pours through multiple cyclone separator units.

6. Primary Separator

The starch and gluten are segregated in the primary separator. Typical equipment consists of a Centrifuge and Ventbox. The product passes through a gluten filter which uses a filter cloth in a rotary drum to reduce the water content of the gluten slurry.

7. Dorroclone Starch Washing

The remaining starch is washed in the Dorroclone Starch Washer. Slurry concentrations are increased resulting in a high percentage of solids (i.e. typically more than 40%).

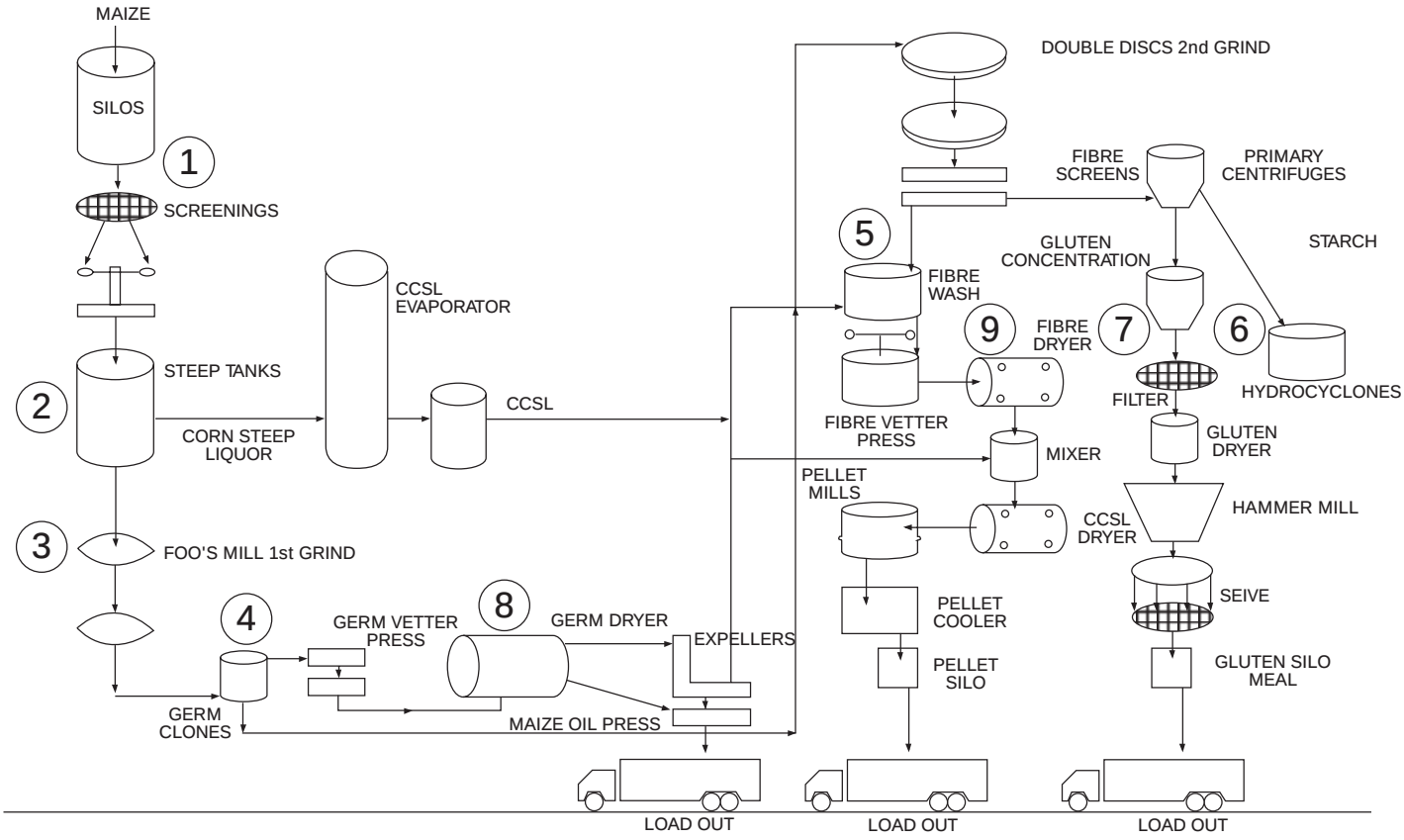
8. Germ Dryers

The germ is dried and transferred to oil presses. The clean oil expelled from the cake is stored or loaded on tankers. The cake is recycled or transferred to the fibre dryer.

9. Concentrated Corn Steep Liquor Dryer and Fibre Dryer

Fibre is pressed, dried and thickened through the addition of cake mixtures. The Veta Press, Fibre Dryer and Paddle Mixers comprise the typical pieces of equipment used in this production stage. Concentrated Corn Steep Liquor (CCSL) and residual waste products go to the CCSL dryer. The dried product is extruded through a rotary pellet mill and stored in silos for distribution as cattle cake.

Wet Corn Milling Process Diagram



As can be gathered from the complex processes shown, rotating equipment is highly used throughout the wet corn processing industry.

Wet Corn Milling Case History

The company shown has grown to become one of the largest, privately-owned businesses providing food, agricultural and risk management products and services around the globe.

They have operations in the United States of America as well as other parts of the world, and have become one of the largest companies within the wet corn milling industry.

AESSEAL plc have had the pleasure of working in partnership with the company for a number of years with the common goal of helping to save the world's water.

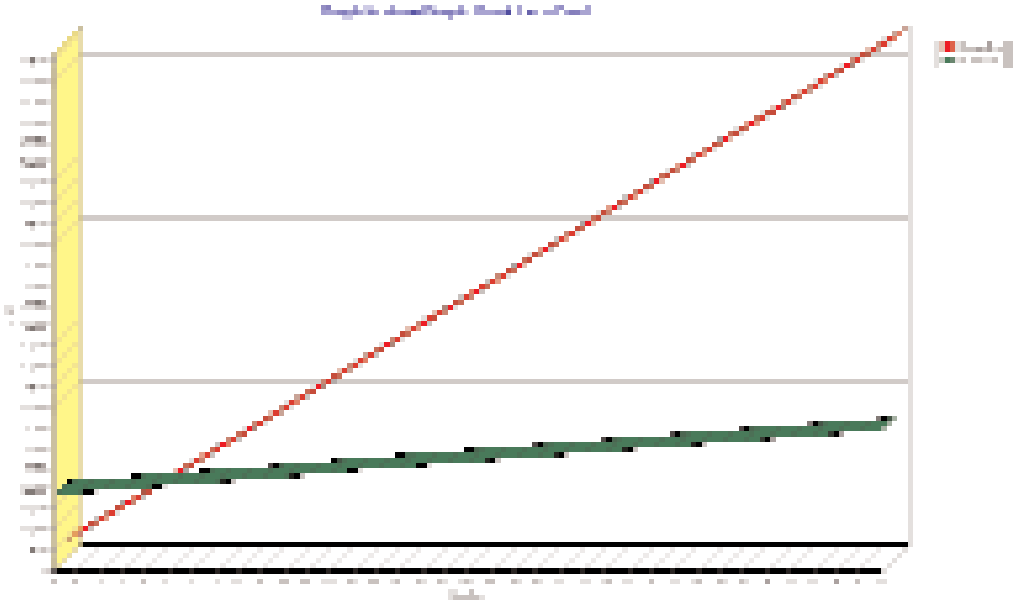
An example of a TriSyl Slurry Pump in which a single mechanical seal supported using the flush method was replaced with an AESSEAL® double mechanical seal in conjunction with an SW2™ water management system is shown below:

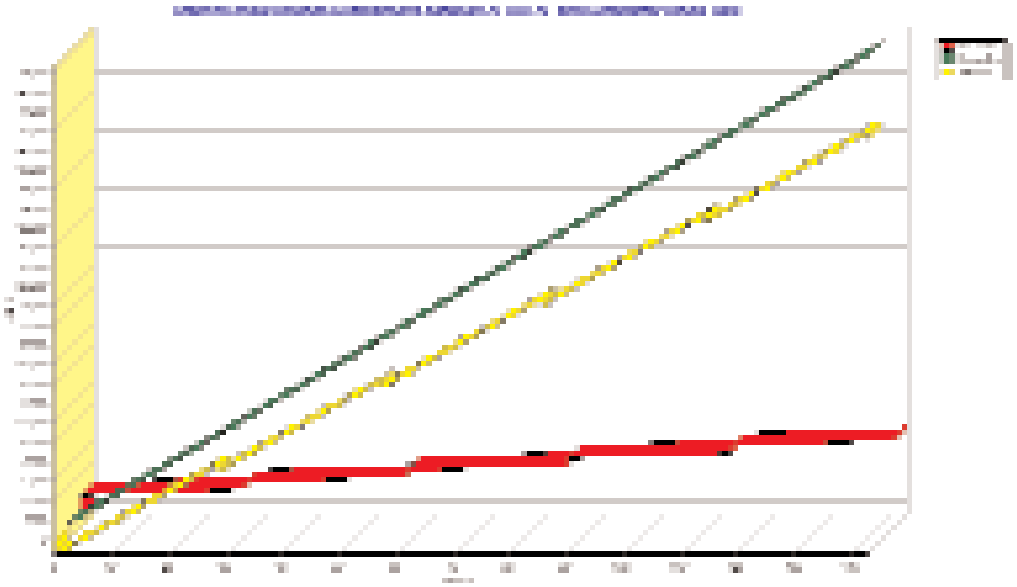
Input Values for ROI Calculation

Input	Value	Input	Value
AESSEAL® Cost	£598.33 / $1,077.00 / €897.50	Cost of Steam	£0.00 / $0.00 / €0.00
Additional System Cost	£442.78 / $797.00 / €664.17	Efficiency: Fluid Heat by Steam	85 %
Competitor Single Seal Cost	£211.32 / $380.38 / €316.98	Water:Steam Ratio for Evaporation	0.00
Flush Water Temperature	21.1°C / 70.0°F	Steam Recovery after Evaporation	0.00 %
Process Fluid Temperature	54.4°C / 130.0°F	Annual Operating Hours	8,400.00 Hours
Flush Water Cost (per Gallon 3.79 Liters)	£0.18 / $0.324 / €0.27	Labour Rate	£25.00 / $45.00 / €37.50

Annual cost breakdown

Description	Previous Pump Packing	AESSEAL® Total Sealing Solution
Sealing Cost	£845.29 / $1,521.53 / €1,267.94	£150.47 / $270.85 / €225.71
Pump Repair Cost	£1,347.93 / $2,426.27 / €2,021.89	£141.24 / $254.24/ €211.87
Flush Water Cost	£90.71 / $163.27 / €136.06	£0.00 / $0.00 / €0.00
Re-heating Cost	£0.00 / $0.00 / €0.00	£0.00 / $0.00 / €0.00
Evaporation Cost	£0.00 / $0.00 / €0.00	£0.00 / $0.00 / €0.00
Type in One Off Costs Below:		
Product Loss Cost	£0.00 / $0.00 / €0.00	£0.00 / $0.00 / €0.00
Production Downtime Cost	£0.00 / $0.00 / €0.00	£0.00 / $0.00 / €0.00
Total Annual Cost	£2,283.92 / $4,111.06 / €3,425.88	£291.72 / $525.09 / €437.58





In this single application

WATER SAVINGS
1,910 liters per year
504 galls (US) per year

WATER COST SAVINGS
£90.71 per year
€136.06 per year
$163.27 per year

TOTAL COST SAVINGS
£1,992.21 per year
€2,988.30 per year
$3,585.97 per year

Word on the street?
or...
Decant-erbury Tales

From: Sky Hoffman
Sent: 02 July 2004 01:00
To: Jim McKeever
Subject: Re: Sky Water savings

Jim, your timing is perfect. I just delivered 5 SW2™ Sealant Reservoir systems to a customer this week. I was walking through the plant with the Chief Engineer one day, when we happened upon 5 booster pumps that were fitted with CDSA™ seals. I pointed out to him that they were running "city water" into and out of these seals, to drain, at a fairly high rate. He spotted a "graduated" vessel sitting nearby and measured the water coming from one CDSA™ for 30 seconds. After some advanced calculus, we determined that each pump was using 1.5 gpm of water (24 hours a day, seven days a week). That's almost 4 million gallon of water per year! Around here water costs about $0.0019 per gallon. That's almost $7,500.00 per year for just those 5 pumps. The 5 SSE/SW2™ cost less than $5,000.00. The math is pretty easy. This customer uses a lot of SW2™ reservoirs, but they still have areas where they're sending water to drain. This was a good exercise for them (one which I've been trying for years to get them to fully realize). I should also mention that these folks were running water through these seals "water in/water out". They were not "throttling" the outboard side, in order to raise the barrier fluid pressure above the pump product pressure in the box (another thing I've been beating them up on, forever). The SW2™ systems will not only save them $7,500.00 per year in water, but the seals will perform as they are intended to, with higher barrier fluid pressure than stuffing box pressure. Their seals will also last much longer! The key was having the engineer "see for himself" the waste. You can talk until you're blue in the face but the reality of "seeing" is worth a 1,000 words.

Regards,

Sky

From: Charles Lynch
Sent: 12 August 2004 12:29
To: Jim McKeever
Subject: Systems

Jim,

I am sorry that this information is so late, however, I hope you can still use it. My computer crashed in July, we were unable to save any information, so I am rebuilding. Anyway, below are three system installations at a company in Covington, VA.

Installation #1:
#1 Evaportator 4th Effect Discharge pump
Pump Manufacturer / Model:
Labour Model 45 Q
Seal:
1.625" CDSA™, TC/TC/TC/CB/A/316, ADTTTC13A01
System:
SSE10/SW3™
Product Pumped:
Black Liquor
Problem:
Excessive water usage, API Plan 54, no flow meter, no restriction on the discharge piping, hence no seal back-pressure, approx. 5.5 gpm to drain
System Install Date:
02/06/03
Current MTBF:
553 days
Current Water Savings:
4,379,760 gallons of water

Installation #2:
1103 Unloading pump
Pump Manufacturer / Model:
Durco MKII / GRPII
Seal:
1.875" CDSA™, TC/TC/TC/CB/A/316, ADTTTC15A01
System:
SSE10/SW2™
Product Pumped:
Clay Coating
Problem:
The mill personnel were so afraid to get water into this product and dilute it, that they were not putting enough seal water pressure on the seal, the product would overcome the inboard seal contaminating the seal, clay coating would come out of the discharge line and everyone would think that the seal was no good.
System Install Date:
02/26/03
Current MTBF:
533 days
Current Savings:
This pump does not run all the time, just when the mill is unloading tank cars or trucks. However, prior to the system, the mill would get one unloading run out of a seal. Since the system install, the mill has gotten a dozen unloading runs out of the seal (conservatively).

Installation #3:
1-1 Coating Loop pump
Pump Manufacturer / Model:
Viking
Seal:
2.437" CDSA™, TC/TC/TC/CB/A/316, 1VADTTTC20A01-01
System:
SSE10/SW2™ with Flow Fuse
Product Pumped:
Coating
Problem:
The mill personnel were so afraid to get water into this product and dilute it that they were no putting enough seal water pressure on the seal, the product would overcome the inboard seal contaminating the seal, clay coating would come out of the discharge line and everyone would think that the seal was no good.
System Install Date:
07/01/04
Current MTBF:
43 days
Current Savings:
Prior to the system with flow fuse, the mill would get approximately 3 to 4 weeks service out of this pump. This system with flow fuse has not run all that long yet, however, it has almost doubled the previous seal life history.

Again, sorry this is late, hope you can still use this info.
Regards,

Charlie Lynch
Sales Engineer
AESSEAL, Inc
4917 Apple Tree Drive
Roanoke, VA 24012
Office Phone / Fax: (540) 977-6560
Cellphone: (540) 797-1614
E-mail: clynch@aesseal.com

From: ADFLTC@aol.com
Sent: 06 July 2004 17:01
To: jmck@aesseal.co.uk
Subject: Re: (no subject)

Good morning Jim, there is a SW2™ system that has been running at the Pine Bluff mill for the last seven years. This has been confirmed by tracking the seal serial # and the date of installation which was documented. The application is a liquor heater pump south indirect, this is a Worthington CNG with a 2.125" shaft at 1,750rpm. This CDSA™ was installed on 5/13/96 which makes the MTBF 2,976 days and running. The seal serial # 67553 and is located at service location 522-07-17. It is TC/TC/TC/CR AFLAS®.

Cheers,

Mike Belanger
AFT

From: DanHartInc@aol.com
Sent: 16 July 2004 20:39
To: jmck@aesseal.co.uk
Subject: RE: INPUT FOR "HOW TO SAVE 1 BILLION GALLONS OF WATER THE EASY WAY

Dear Jim,

We would like to submit to you the following information for your "accepted challenge".

March 2002
1) A company in Brookhaven, MS. - plant purchased 17 ea. SW2™ systems in order to reduce water usage. See the following data requested:

Number of applications: 17 ea.
Previous flow rate: 3 GPM
Cost per gallon: $4.50 per thousand gallons
Seal life since: 2 failures

April 2004
2) A company in Pensacola, FL - has initiated procurement and installation of 40 ea. Total SW2™ systems. No data available to date. *will provide in the future.

Please notify us with any additional assistance needed.
Sincerely,

Brad Hartley

From: Dan Disher <ddd@brabazon.com>
To: kieran.scully@aesseal.co.uk
Sent: Wed Jun 30 17:21:30 2004
Subject: Systems

Kieran,
I don't have Jim's email and he requesting some examples of water savings. I have a few off the top of my head. I hope that these help!

Basically, I have two on Hydral and two on a PCC at the Paper Mill and two at a Lime Slurry plant for the Paper Mill. The other two are at a waste water plant, and have been running continuously, for around two years.

Water saving to date = 21,024,000 Gallons

Thanks,

Dan Disher

BPC-Wausau

From: Jeff Weber
Sent: Tuesday, October 02, 2001 11:23 AM
To: 'Charles S. Patterson'
Subject: Water costs

Charlie,

You may already know this stuff but I couldn't resist doing these calculations for myself. I made some phone calls and discovered:

One Water Company: $1.50 per 1,000 gallons first 6,000 gallons
$1.65 per 1,000 gallons next 6,000 gallons
$1.88 per 1,000 gallons next 6,,000 gallons and above.

MSD $1.92 per 1,000 gallons for industrial customers. Billing is based on 85% of water usage.

By my calculations, eight (8) pumps with a 3/16" water stream being used and going to drain would cost $50.98 per month per pump for water and sewer. Multiply this by eight (8) pumps for $407.84 per month for eight pumps, water and sewer usage.

In just over fifteen (15.65) months, eight AES SSE SW2™ Water Retention Systems like the one we have installed, would pay for themselves. After that, the savings on those eight (8) pumps would be $4894.08 per year, every year.

Best Regards,

Jeff Weber
AES Seal

From: Dieter Wede
Date: 20.07.2004
To: AESSEAL Peter Wicklmayr
Subject: Water Saving

Dear Peter,

With respect to the subject "WATER SAVINGS", we would like to add 30 million liters (confirmed from customer) to your total project savings.

Plant for liquid sugar
Temperature ca. +60°C to +80°C

16 Pumps Hilge Type Hygia with shaft 19 mm
Operation quench to drain

Usage drinking water 3.6 liter / min / Pump

= 57.6 liter / min for 16 pumps
= 3,456 liter / hour. for 16 pumps
= 82,944 liter / day for 16 pumps
= 30,274,560 liter / year for 16 pumps

= 30,274 m^3 / Year

Water cost fresh water 1.28 EURO/m^3 + sewage 1.53 EURO/m^3

= 2.81 EURO / m^3 Water cost

= 85,071.00 EURO Total Water cost / year

Investment for 16 SSE10 vessels approx. 9,000.00 EURO

= ROI after 1.2 Months

Further advantages of the SW2™ System:
Operated at a higher pressure and as a closed system with a pressure gauge,

Immediate detection of leakage of a seal if the pressure changes on the system.

When the systems were installed, 3 leaking seals were detected, and due to the previous quench to drain method, the product loss was in an unknown high range.

With best regards

Dieter Wede

Case Histories

Agrochemical

One application from Case No. 1985K

In an Agrochemical Plant in Argentina, a water management technique was employed in conjunction with DMSF™ seals fitted to reactor circulation pumps. The pump pressure is subject to reactor/process pressure (0 to 8,7 kg). The batches of product are produced in around 50 minutes and the pump is stopped between batches for between 5 and 8 minutes. A large pressure vessel known as the AS28™ was employed in this application, and the circulation of barrier fluid through the seal was maintained using a pumping scroll. Due to the high temperature of this application, an AESSEAL® heat exchanger was also used to help reduce the overall temperature of the barrier fluid. Major water savings were experienced by using this method, and seal life was also extended.

(Please contact Pablo Nogues for further information.)

Industry	AGROCHEMICAL	Elastomers	EPR (FDA)
Area Of Plant	BFT	ATEX Compliance	NO
Product	Glyophosphate	Temperature	105°C
Machine Type	CENTRIFUGAL PUMP	Concentration	100%
Manufacturer	GOULDS	Shaft RPM	1000 RPM
Z/Standard	-	System Type	AS28™ (Plan 53)
Dry Running	NO	Barrier Fluid Type	DEMIN WATER
Seal Type & Size	DMSF™ 3.750”	Bulk Temperature of System	107°C
Wetted Parts	316L	Abrasive	SALT CRYSTALS
Faces	SIC/SIC//SIC/CAR	Seal Chamber Pressure	0 TO 8,7 KG

Brewing & Beverage

Case No. 1634K

In a Brewing and Beverage Plant in Southern Ireland, KSB centrifugal pumps were historically fitted with single cartridge seals. The seals used to be flushed with a steam quench to drain, however, the steam leaked from the seal almost immediately. The steam was supplied under zero pressure and was used to soften the product when it congealed and stuck the seal faces together. Hence, the seals only lasted approximately 2 months. The product being sealed was BEER WORT at 80 °C at a product pressure of 4 bar. AESSEAL® fitted a CDSA™ and water flow control device, in which pressure was able to be introduced. The barrier fluid was changed from steam to waste hot water, and the pressure and flow were adjusted to the optimum, so that a minimum amount of waste water was consumed. The seals are fitted and have been running trouble free for over 1 year since May 2003.

(Please contact Kieran Scully (AESSEAL MCK Cork) for further information.)

Industry	BREWING AND BEVERAGE	Elastomers	EPR
Area Of Plant	BREW HOUSE	ATEX Compliance	NO
Product	BEER WORT	Temperature	80°C
Machine Type	CENTRIFUGAL PUMP	Concentration	100%
Manufacturer	KSB	Shaft RPM	1500 RPM
Z/Standard	STD	System Type	“THE FLOW”
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA 45mm	Bulk Temperature of System	-
Wetted Parts	316	Abrasive	YES
Faces	TC/TC//CHROX/CAR	Seal Chamber Pressure	2 BAR

Brewing & Beverage

Case No. 1636K

A Hydrostal pump in North America was installed in an application to transfer beer trub. The seal began to leak, and needed replacing every fortnight. A Discflo pump was then chosen to replace the Hydrostal pump, in conjunction with an AESSEAL® CDSA™ and a SW2™ water management system. The pump and seal were fitted in July 1999 and this application ran leak free for two years. Eventually, the seal failed due to starvation of water to the water management system. The spare seal was fitted in 2001 has been running successfully to date (end of May 2003).

(Please contact Rich Greatti (AESSEAL Kingsport) for further information.)

Industry	BREWING AND BEVERAGE	Elastomers	EPR
Area Of Plant	BREW HOUSE	ATEX Compliance	NO
Product	BEER TRUB	Temperature	70°C
Machine Type	DISCFLO PUMP	Concentration	100%
Manufacturer	DISCFLO	Shaft RPM	3,000 RPM
Z/Standard	-	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 1.750”	Bulk Temperature of System	-
Wetted Parts	316L S/S	Abrasive	YES
Faces	TC/TC//CHROX/CAR	Seal Chamber Pressure	1.5 BARG

Cement

Case No. 1632K

In a cement production application in the South of England, five pumps were originally fitted with packed glands which continuously leaked cement slurry after 2 weeks of running. This resulted in pumps continuously being overhauled in the workshop, with new bearings and shaft sleeves being fitted. AESSEAL® fitted double cartridge seals with SW2™ water management systems to these pumps. The average life of this application is now 3 years. The use of the water management systems has ensured that the amount of water consumed diminished to nearly zero.

(Please contact Tom Ward, (AESSEAL SE) for further details.)

Industry	CEMENT	Elastomers	VITON®
Area Of Plant	SLURRY PUMP HOUSE	ATEX Compliance	NO
Product	CEMENT SLURRY	Temperature	AMBIENT
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	SVEDALA ORION	Shaft RPM	990 RPM
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CDM™ 125mm	Bulk Temperature of System	-
Wetted Parts	316	Abrasive	YES
Faces	TC/SIC//SIC/CAR	Seal Chamber Pressure	-

Cement

Case No. 1638K

In a cement pilot plant, in the South of England, two Durco MK3-1K 15kW tanker unloading pumps had been fitted with single cartridge seals. The product is very abrasive, which caused the single seals to fail every three months. These single seals were replaced with CDSA™ ANSI+ double mechanical seals, which were supported with SW2™ water management systems. The water consumption has been dramatically reduced to around 32 liters per year, and the mechanical seals in the new arrangement are now lasting in excess of 12 months.

(Please contact Tom Ward, (AESSEAL SE) for further details.)

Industry	CEMENT	Elastomers	KALREZ®/VITON®
Area Of Plant	TANKER UNLOADING AND KILNS	ATEX Compliance	NO
Product	CEMENT SLURRY	Temperature	-
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	DURCO	Shaft RPM	-
Z/Standard	STD	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 1.375”	Bulk Temperature of System	-
Wetted Parts	-	Abrasive	YES
Faces	SIC/SIC//SIC/CAR	Seal Chamber Pressure	-

Cement

Case No. 1639K

In a cement pilot plant, in the South of England, two MK3-2K, 55kW kiln pumps had been fitted with single cartridge seals. The product is very abrasive which meant that the seals would fail every three months. The single seals were replaced with CDSA™ ANSI+ double mechanical seals and SW2™ water management systems. The double mechanical seal arrangement saves massive amounts of water, and has increased seal life to over 12 months.

(Please contact Tom Ward, (AESSEAL SE) for further details.)

Industry	CEMENT	Elastomers	KALREZ®/VITON®
Area Of Plant	TANKER UNLOADING AND KILNS	ATEX Compliance	NO
Product	CEMENT SLURRY	Temperature	-
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	DURCO	Shaft RPM	-
Z/Standard	STD	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 1.875”	Bulk Temperature of System	-
Wetted Parts	316L S/S	Abrasive	YES
Faces	SIC/SIC//SIC/CAR	Seal Chamber Pressure	-

Cement

Case No. 1721K

Originally, pump packing was used without success on the DiscFlo pumps at a plant manufacturing concrete blocks in London. AESSEAL® then fitted 65mm CURE™ seals with a quench to drain arrangement at the request of the pump supplier. This worked for a small period of time, but did not keep the product away from the mechanical seal faces. As a result of this AESSEAL® then upgraded the seals to 65mm CDSA™ double mechanical seals with SW2™ water management systems. These have been proven to last for a minimum of 6 months, with which the customer was delighted. Huge water savings were made due to the replacement of the quench to drain method with the SW2™ water management systems.

(Please contact Mike Brown, AESSEAL® Sales Engineer (UK), for further information.)

Industry	CEMENT	Elastomers	VITON®
Area Of Plant	-	ATEX Compliance	NO
Product	CEMENT SLURRY	Temperature	-
Machine Type	DISCFLO PUMP	Concentration	-
Manufacturer	DISCFLO	Shaft RPM	-
Z/Standard	STD	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 65mm	Bulk Temperature of System	-
Wetted Parts	316	Abrasive	YES
Faces	SIC/SIC//SIC/CAR	Seal Chamber Pressure	-

Chemical

Case No. 1337K

In a major chemical plant on the North East coast of the United Kingdom, a 2.500” DMSF™ was installed on a Ingersoll Rand pump 6x19AL in conjunction with an SW2™ water management system. Considerable water savings were experienced, and seal life was vastly increased.

(Please contact Richard AL Smith (AESSEAL NE) for further information.)

Industry	CHEMICAL	Elastomers	AFLAS®
Area Of Plant	AN6 PLANT	ATEX Compliance	NO
Product	87% AMMONIA SULPHATE	Temperature	87°C
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	INGERSOLL RAND	Shaft RPM	1,500 RPM
Z/Standard	-	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	-
Seal Type & Size	DMSF™ 2.500”	Bulk Temperature of System	-
Wetted Parts	ALLOY 276	Abrasive	-
Faces	SIC/SIC//SIC/C	Seal Chamber Pressure	1 BAR

Chemical

Case No. 1772K

At a chemical plant in the North East of England, a 4.000” DMSF™ seal was installed in May 2002 for use with Aqueous Electrolyte on a David Brown pump. Seal is running leak free to date and the barrier fluid consumption has been considerably reduced.

(Please contact Richard AL Smith (AESSEAL NE) for further information.)

Industry	CHEMICAL	Elastomers	EPR
Area Of Plant	-	ATEX Compliance	NO
Product	AQUEOUS ELECTROLYTE	Temperature	60°C
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	DAVID BROWN	Shaft RPM	989 RPM
Z/Standard	STD	System Type	SW2™
Dry Running	-	Barrier Fluid Type	-
Seal Type & Size	DMSF™ 4.00”	Bulk Temperature of System	-
Wetted Parts	ALLOY 276	Abrasive	-
Faces	SIC/TC//TC/C	Seal Chamber Pressure	-

Chemical

Case No. 1913K

At a chemical plant in the UK, an AESSEAL® 1.250” DMSF™ was installed on a KSB CPK SM50 160 drain surge tank pump. The pumped liquid was Electrolyte, at a temperature of 70°C. The shaft speed was 3,000 rpm and the discharge pressure was 2.67 bar. The barrier fluid consumption was greatly reduced and the seal life was greatly extended.

(Please contact Steve Barratt (AESSEAL UK systems support) for further details.)

Industry	CHEMICAL	Elastomers	K6375 / EPR
Area Of Plant	-	ATEX Compliance	NO
Product	-	Temperature	70°C
Machine Type	DRAIN SURGE TANK PUMP	Concentration	-
Manufacturer	KSB	Shaft RPM	3,000 RPM
Z/Standard	STD	System Type	SW2™
Dry Running	-	Barrier Fluid Type	-
Seal Type & Size	DMSF™ 1.250”	Bulk Temperature of System	-
Wetted Parts	-	Abrasive	-
Faces	SIC/TC//TC/C	Seal Chamber Pressure	-

Chemical

Case No. 1996K

In a chemical plant in North Vancouver, a 1.875” CDSA™ was installed on a Durco horizontal end suction ANSI pump pumping caustic. The seal with TC/TC/TC/CB faces, Aflas® and EPR elastomers and 316SS wetted parts was used in conjunction with an SW2™ water management system. Substantial water savings were experienced and the seal life was greatly enhanced.

(Please contact Peter Karakuc for further information.)

Industry	CHEMICAL	Elastomers	AFLAS® / EPR
Area Of Plant	CAUSTIC PRODUCTION	ATEX Compliance	NO
Product	CAUSTIC	Temperature	115°F
Machine Type	HORIZONTAL END SUCTION ANSI PUMP	Concentration	1.6%
Manufacturer	DURCO	Shaft RPM	1,750 RPM
Z/Standard	STD	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 1.875”	Bulk Temperature of System	-
Wetted Parts	316SS	Abrasive	YES & CRYSTALLISING
Faces	TC/TC//TC/CB	Seal Chamber Pressure	15 PSI

Chemical

Case No. 2156L

In a chemical plant in the North East of England, a DMSF™ was installed in January 2003 to replace a competitor’s seal which was supported through Plan 54. The seal was supported using an SW2™ water management system. A Return on Investment calculation showed an anticipated break even point of 13 to 14 months with an anticipated annual saving of £1,265.00.

Please contact Richard AL Smith at the North East Office for further information.)

Industry	CHEMICAL	Elastomers	K6375 / EPR
Area Of Plant	AN6 PLANT	ATEX Compliance	NO
Product	ACRYLONITRILE SLOP WATER	Temperature	50°C
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	KSB	Shaft RPM	2,900 RPM
Z/Standard	STD	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	-
Seal Type & Size	DMSF™ 1.625”	Bulk Temperature of System	-
Wetted Parts	316L	Abrasive	-
Faces	SIC/TC//TC/C	Seal Chamber Pressure	-

Chemical

Case No. 2292L

At a chemical plant in the North East of England, a DMSF™ and an SW2™ water management system were installed in January 2003 to replace a competitor's seal which used the quench to drain method. The competitor's seal lasted 12 months on average. A Return on Investment calculation performed in June 2004 shows an actual saving of £1,318.75 with the breakeven point being reached after only 6 months. The total water savings to date are 2,978 M^3 (£595.60).

(Please contact Richard Smith at the UK North East Office for further information.)

Industry	CHEMICAL	Elastomers	K6375 / AFLAS®
Area Of Plant	NYLON PLANT	ATEX Compliance	NO
Product	SODIUMHYDROGEN / ORTHOPHOSPHATE, SODIUM TERABORATE	Temperature	55°C
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	DURCO	Shaft RPM	1,450 RPM
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	DMSF™ 1.875"	Bulk Temperature of System	-
Wetted Parts	316L ST.ST	Abrasive	-
Faces	SIC/TC//TC/C	Seal Chamber Pressure	-

Chemical

Case No. 2306L

In a chemical plant in the North East of England, an SW2™ water management system replaced an existing Plan 54 to drain. The system was installed in February 2002, and a Return on Investment report performed in December 2003 shows a total saving of £4,758.24. The total water saved was calculated to be 6,351M^3.

(Please contact Richard Smith at the UK North East Office for further information.)

Industry	CHEMICAL	Elastomers	-
Area Of Plant	-	ATEX Compliance	NO
Product	MPK KETONE 85% & ALCOHOL 15%	Temperature	15 - 55°C
Machine Type	-	Concentration	-
Manufacturer	-	Shaft RPM	-
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CDM™	Bulk Temperature of System	-
Wetted Parts	-	Abrasive	-
Faces	-	Seal Chamber Pressure	-

Chemical

Case No. 2314L

At a chemical plant in Ireland AESSEAL® fitted 2 off 4.250" DMSC™ seals on to a Hazelton split case double suction pump on 13/02/02. The water management systems used were SW2™ water management systems. This pump had been gland packed for years using the flush method at approximately 9 bar pressure to seal both sides of this pump. The amount of water taken in to the pump with this arrangement would be 1.5 m^3 per hour. As this pump runs 24 hours a day the amount of water used is approximately 36 m^3 per day and 13,140 m^3 per year. Every 1 m^3 per hour of gland water used in the plant costs €23.5k per year in direct costs to the company. The pump has now been running for over 2.5 years without using gland water. The plant engineer has commented that the pump has had no maintenance or repair work carried out since the mechanical seals were fitted. Before the seals were fitted, this pump required attention every 3 months. AESSEAL® are now converting more of these pumps on site.

(Please contact John Smiddy, AESSEAL MCK, for further information.)

Industry	CHEMICAL	Elastomers	-
Area Of Plant	-	ATEX Compliance	NO
Product	-	Temperature	-
Machine Type	SPLIT CASE DOUBLE SUCTION PUMP	Concentration	-
Manufacturer	HAZLETON	Shaft RPM	-
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	DMSC™ 4.250"	Bulk Temperature of System	-
Wetted Parts	STAINLESS STEEL	Abrasive	-
Faces	-	Seal Chamber Pressure	-

Clay Production

Case No. 2076K

In a China Clay Bleaching plant in the United Kingdom, an 85mm CDSA™ was fitted to a Warman 4X3 DAH centrifugal pump. The duty being pumped was clay slurry at an inlet pressure of 1 bar and an outlet pressure of 2.5 bar. The seal faces were SIC/SIC//CROX/C, with Viton® elastomers and 316L wetted parts. The double mechanical seal was used in conjunction with an SW2™ water management system, using water at a pressure of 3.5 bar. The seal was installed in 2000 and was still running in July 2003 and major water savings have been experienced over this time.

(Please contact Samantha Dixon for further information.)

Industry	CLAY PRODUCTION	Elastomers	VITON®
Area Of Plant	-	ATEX Compliance	NO
Product	SLURRY	Temperature	-
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	WARMAN	Shaft RPM	-
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 85mm	Bulk Temperature of System	-
Wetted Parts	316L	Abrasive	-
Faces	SIC/SIC//CROX/C	Seal Chamber Pressure	-

Clay Production

Case No. 2083K

In a UK China Clay Refinery, a 60mm CURE™ was fitted to a Warman 3x2 CAH centrifugal pump. The duty was China Clay residue which is an aqueous solution containing sand, quartz, mica, feldspar etc being pumped with an outlet pressure of 5 bar. The seal faces were SIC/SIC//CROX/C with Viton® elastomers and 316L wetted parts. The double mechanical seal was supported using an SW2™ water management system. This arrangement saved thousands of liters of water compared to other support methods available. The mechanical seal and support system were fitted in September 1999 and the mechanical seal lasted for 3 years.

(Please contact Mark Waterfield (AESSEAL UK Sales Engineer) for further information.)

Industry	CLAY PRODUCTION	Elastomers	VITON®
Area Of Plant	CHINA CLAY	ATEX Compliance	NO
Product	CHINA CLAY	Temperature	-
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	WARMAN	Shaft RPM	-
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CURE™ 60mm	Bulk Temperature of System	-
Wetted Parts	316L	Abrasive	-
Faces	SIC/SIC//CROX/C	Seal Chamber Pressure	-

Clay Production

Case No. 2089K

In a UK China Clay Refinery, an SW2™ water management system was fitted to a JCentriquipe CQ55 Centrifuge. Site engineers estimated that the water consumption of these machines was costing in excess of £2,000 per year per machine. The water management system worked well, but due to a poor lip seal arrangement water was lost to drain after a short period of running. Several lip seals of differing compounds were tried without success. An AESSEAL® MagTecta™ has now been installed and the complete solution is proving to be a great success.

(Please contact Samantha Dixon for further information.)

Industry	CLAY PRODUCTION	Elastomers	VITON®
Area Of Plant	-	ATEX Compliance	NO
Product	CHINA CLAY	Temperature	-
Machine Type	CENTRIFUGE	Concentration	-
Manufacturer	CENTRIQUIPE	Shaft RPM	-
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	MAGTECTA™	Bulk Temperature of System	-
Wetted Parts	316L S/S	Abrasive	-
Faces	CAR/TC/CAR	Seal Chamber Pressure	-

Food and Beverage

Case No. 1601K

A Lurgi Discharge pump in a Food Manufacturing Plant in South Africa was installed with a competitor's double mechanical seal with a pumping ring installed inside the stuffing box. This seal needed replacing every two weeks due to various factors. This seal was replaced with a CDP™ double mechanical seal supported with an SW2™ water management system. The shaft sleeve needed to be machined down to 1.750" from 45mm to standardise the plant. This seal has been in operation now for almost 1 Year (as of Mid May 2003) and there have been considerable water savings

(Please contact Bevan B, AESSEAL Pty (South Africa) for further information.)

Industry	FOOD	Elastomers	VITON®
Area Of Plant	REFINERY	ATEX Compliance	NO
Product	FATS, OILS, CITRIC ACID	Temperature	-
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	KSB	Shaft RPM	-
Z/Standard	N/A	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDP™ 1.750"	Bulk Temperature of System	-
Wetted Parts	316L	Abrasive	-
Faces	SIC/SIC//SIC/C	Seal Chamber Pressure	-

Food and Beverage

Case No. 2000K

In a food & beverage plant in Canada, a 2.000" CDM™ was installed on a Lightnin mixer which was pumping melted raw liquid sugar. The seal has TC/TC//TC/CB faces, 316SS wetted parts and Aflas® elastomers and was used in conjunction with an SW2™ water management system in order to eliminate water wastage.

(Please contact Peter Karakuc for further information.)

Industry	FOOD & BEVERAGE	Elastomers	AFLAS®
Area Of Plant	SUGAR PROCESSING/REFINING	ATEX Compliance	NO
Product	MELTED RAW LIQUID SUGAR	Temperature	95°F
Machine Type	MIXER	Concentration	100%
Manufacturer	LIGHTNIN	Shaft RPM	420 RPM
Z/Standard	STD	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDM™ 2.000"	Bulk Temperature of System	-
Wetted Parts	316SS	Abrasive	YES
Faces	TC/TC//TC/CB	Seal Chamber Pressure	5 PSI

Mineral Processing

Case No. 1605K

In a Mineral Processing Plant in Rustenburg, a total of 56 CDP™ double mechanical seals were installed in various locations on chemical off-loading pumps. These seals were installed over 1 Year ago (around April 2002) and are still running well. This was a new project. A number of flow control devices called “The Flow” were also installed to the mechanical seals in order to limit the water consumption.

(Please contact Bevan B. (AESSEAL Pty) South Africa for further information.)

Industry	MINERAL PROCESSING	Elastomers	KALREZ® 4765/AFLAS®
Area Of Plant	CHEMICAL OFF-LOADING	ATEX Compliance	NO
Product	SODIUM ISO BUTYL XANTHATE (SIBX)	Temperature	24-60°C
Machine Type	CENTRIFUGAL PUMP	Concentration	100%
Manufacturer	RAPID ALL WEILER	Shaft RPM	1,450 & 2,900 RPM
Z/Standard	N/A	System Type	“THE FLOW”
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDP™ 30 & 40mm	Bulk Temperature of System	-
Wetted Parts	316L	Abrasive	NO
Faces	SIC/SIC//SIC/CARBON	Seal Chamber Pressure	-

Mineral Processing

Case No. 1606K

In a Mineral Processing Plant in Rustenburg, a number of CDP™ double mechanical seals were installed in a Frother and Promoter application. These seals were installed over 1 Year ago (around April 2002) and are still running well. These seals were part of a large expansion for one of the the biggest Platinum producers in the world. Flow control devices were used in conjunction with these seals in order to save water consumption.

(Please contact Bevan B. (AESSEAL Pty) South Africa for further details.)

Industry	MINERAL PROCESSING	Elastomers	KALREZ® 4765/AFLAS®
Area Of Plant	CHEMICAL OFF-LOADING	ATEX Compliance	NO
Product	FROTHER AND PROMOTER	Temperature	24-60°C
Machine Type	CENTRIFUGAL PUMP	Concentration	100%
Manufacturer	RAPID ALLWEILER	Shaft RPM	1,450 & 2,900 RPM
Z/Standard	N/A	System Type	“THE FLOW”
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDP™ 30 & 40mm	Bulk Temperature of System	-
Wetted Parts	316L	Abrasive	NO
Faces	SIC/SIC//SIC/CARBON	Seal Chamber Pressure	-

Nuclear Power

Case No. 2100K (Plan 53)

In an Atomic Research Site in Lyon (France), two 30mm CAPI™ A1 dual mechanical seals were supported as per the API Plan 53 configuration using an AESSEAL® AS28-SC™ vessel. This arrangement was applied to a prototype screw conveyor for atomic research. This method saved huge quantities of water compared to alternative arrangements and ensured that the Mean Time Between Failure was optimised.

(Please contact Mike Collins for further information.)

Industry	NUCLEAR POWER	Elastomers	-
Area Of Plant	-	ATEX Compliance	NO
Product	WATER WITH WOOD SPLINTS	Temperature	50°C
Machine Type	SCREW CONVEYOR	Concentration	100%
Manufacturer	-	Shaft RPM	50 RPM
Z/Standard	-	System Type	AS28-SC™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CAPI™ A1 DUAL 30mm	Bulk Temperature of System	-
Wetted Parts	316L ST.ST	Abrasive	NO
Faces	ANT/SIC//ANT CAR/SIC	Seal Chamber Pressure	40 BARG

Nuclear Power

Case No. 2101K (Plan 53)

In an Atomic Research Site in Lyon (France), a 50mm CAPI™ A1 dual mechanical seal was supported as per the API Plan 53 configuration using an AESSEAL® AS28-SC™ vessel. The arrangement was applied to a prototype screw conveyor for atomic research. This method saved huge quantities of water compared to alternative methods and ensured that the Mean Time Between Failure was optimised.

(Please contact Mike Collins for further information.)

Industry	NUCLEAR POWER	Elastomers	-
Area Of Plant	-	ATEX Compliance	NO
Product	WATER WITH WOOD SPLINTS	Temperature	50°C
Machine Type	SCREW CONVEYOR	Concentration	100%
Manufacturer	-	Shaft RPM	50 RPM
Z/Standard	-	System Type	AS28-SC™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CAPI™ A1 DUAL 50mm	Bulk Temperature of System	-
Wetted Parts	316L ST.ST	Abrasive	NO
Faces	ANT/SIC//ANT CAR/SIC	Seal Chamber Pressure	40 BARG

Offshore

Case No. 1591K

An API 610 (6th Edition) mechanical seal was installed to a TEG Booster pump in South Africa. The mechanical seal was supported using a buffer reservoir water management system which employs the same thermosyphon principle as the SW2™ water management system, although it is not pressurized. The seal life was extended and water management was optimised due to the system type.

Industry	OFFSHORE	Elastomers	VITON®
Area Of Plant	TEG BOOSTER PUMP	ATEX Compliance	NO
Product	TEG	Temperature	AMBIENT
Machine Type	CENTRIFUAL PUMP	Concentration	100%
Manufacturer	APE PUMPS	Shaft RPM	2,900 RPM
Z/Standard	N/A	System Type	BUFFER RESERVOIR
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	API 610 6TH EDITION	Bulk Temperature of System	-
Wetted Parts	316L	Abrasive	NO
Faces	ANT/SIC//ANT CAR/SIC	Seal Chamber Pressure	-

Pulp & Paper

Case No. 1695K

In early 2003, a 1.625” TC/TC//TC/Car CDSA™ double mechanical seal in conjunction with an SW3™ water management system was installed in a Pulp and Paper plant in south-western Virginia in south-eastern USA. The mechanical seal was sealing Black Liquor on a Labour pump rotating at 1,460 rpm. Phenomenal amounts of water were saved, and the seal life was considerably extended.

(Please contact Charles Lynch (AESSEAL USA Sales Engineer) for further details.)

Industry	PULP & PAPER	Elastomers	AFLAS® / VITON®
Area Of Plant	EVAPORATOR	ATEX Compliance	NO
Product	BLACK LIQUOR	Temperature	150°F
Machine Type	CENTRIFUAL PUMP	Concentration	-
Manufacturer	LABOUR	Shaft RPM	1,460 RPM
Z/Standard	STD	System Type	SW3™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 1.625”	Bulk Temperature of System	-
Wetted Parts	316L S/S	Abrasive	-
Faces	TC/TC//TC/CB	Seal Chamber Pressure	-

Pulp & Paper

Case No. 1722K

In a paper mill on the west coast of the United States of America, DMSF™ seals and (SSE25) SW3™ water management systems were installed on an Alhstrom APT31-4 pump. The pump rotates at 1,800 rpm and handles black liquor from No 4 tank to the dust recycle accumulation tank. Seal failure was mainly due to the poor quality of water supplied to the seal. The (SSE25) SW3™ systems now maintain a good quality barrier fluid to the seal thus extending seal life. The customer has been extremely pleased with this solution and especially with the water savings experienced. The seal and system were installed in December 1999 and were still working in June 2003.

(Please contact Fred Osborn, (email fosborn@aesseal.com) for further details.)

Industry	PULP & PAPER	Elastomers	AFLAS®
Area Of Plant	ACCUMULATION TANK	ATEX Compliance	NO
Product	BLACK LIQUOR	Temperature	-
Machine Type	PUMP	Concentration	-
Manufacturer	AHLSTROM	Shaft RPM	1,800 RPM
Z/Standard	5119	System Type	(SSE25) SW3™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	DMSF™ 50mm	Bulk Temperature of System	-
Wetted Parts	316L S/S	Abrasive	YES
Faces	TC/TC//TC/CAR	Seal Chamber Pressure	-

Pulp & Paper

Case No. 1741K

In a paper mill on the west coast of the United States of America, CDSA™ seals were installed into Goulds 3196MTX pumps. The water management systems used in conjunction with these seals were SW2™ Systems. The pumps rotate at 1,755 rpm and handle Green Liquor from Transfer Tank No 2. Seal failures were mainly due to the poor quality of water supplied to the seals. The SW2™ systems now maintain a good quality barrier to the seals, thus extending seal life and reducing water consumption. The customer has been extremely pleased with this solution. The seals and systems were installed in March 2002 and were still working in June 2003.

(Please contact Fred Osborn, (email fosborn@aesseal.com) for further details.)

Industry	PULP & PAPER	Elastomers	AFLAS®
Area Of Plant	TRANSFER TANK NO. 2	ATEX Compliance	NO
Product	GREEN LIQUOR	Temperature	-
Machine Type	PUMP	Concentration	-
Manufacturer	GOULDS	Shaft RPM	1,755 RPM
Z/Standard	STD	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 1.750”	Bulk Temperature of System	-
Wetted Parts	316L SS	Abrasive	YES
Faces	TC/TC//TC/CAR	Seal Chamber Pressure	-

Pulp & Paper

Case No. 1795K

At a paper mill in Florida USA, two CDSA™ seals were installed into Worthington 4CNG-104 pumps. The water management systems used in conjunction with the seals were SW2™ systems. The pumps handle Green Liquor and are situated in the power house. The SW2™ systems maintain a good quality barrier to the seal thus extending seal life, and reduce water consumption. The seals and systems were installed in July 1998 and were still working in June 2003.

(Please contact AESSEAL Inc, knxadmin@aesseal.com, for further information.)

Industry	PULP & PAPER	Elastomers	AFLAS®/VITON®
Area Of Plant	POWER HOUSE	ATEX Compliance	NO
Product	GREEN LIQUOR	Temperature	-
Machine Type	PUMP	Concentration	-
Manufacturer	GOULDS	Shaft RPM	-
Z/Standard	-	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™	Bulk Temperature of System	-
Wetted Parts	316L SS	Abrasive	YES
Faces	TC/TC//TC/CAR	Seal Chamber Pressure	-

Pulp & Paper

Case No. 1801K

A paper mill situated in the South of the USA has two paper machines, a bleach plant and a ground wood mill. The seal installed was a CDSA™ and the system used in conjunction with the seal was an SW3™ water management system. To date the seal water system has saved 5,256,000 gallons of water to this one pump. This mill values water at $100.00 per million gallons, so in the past five years the seal water system has saved $525.60 in clean seal water alone. This does not account for the cost of disposal which is as much or even more. Each seal replacement covers the cost of the SW3™ system. The seal and system were installed in May 1998 and were still working in July 2003.

(Please contact AESSEAL Inc, email knxadmin@aesseal.com, for further details.)

Industry	PULP & PAPER	Elastomers	AFLAS®/VITON®
Area Of Plant	BLEACH PLANT	ATEX Compliance	NO
Product	BLACK LIQUOR	Temperature	230°F
Machine Type	PROCESS PUMP	Concentration	-
Manufacturer	WORTHINGTON	Shaft RPM	1,750 RPM
Z/Standard	STD	System Type	SW3™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 1.750”	Bulk Temperature of System	-
Wetted Parts	316 SS	Abrasive	YES
Faces	TC/TC//TC/CB	Seal Chamber Pressure	-

Pulp & Paper

Case No. 1848K

In a Tissue Mill in the south east of the United States of America, 3 Sulzer Ahlmix Units were sealed with AESSEAL® CDSA™ seals. These cartridge seals replaced the competitor's redi-fit seals which ran water to drain. The AES seals were installed with SW2™ water management systems and have been in service since November 2002. A huge amount of water has been saved and seal life has been considerably extended.

(Please contact Jerome Moore (AES USA Sales Engineer) for further information.)

Industry	PULP & PAPER	Elastomers	AFLAS®
Area Of Plant	STOCK PREP	ATEX Compliance	NO
Product	PAPER STOCK (PULP <6%)	Temperature	150°F
Machine Type	CENTRIFUGAL PUMP	Concentration	6%
Manufacturer	SULZER	Shaft RPM	1,800 RPM
Z/Standard	9092	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 50mm	Bulk Temperature of System	-
Wetted Parts	316L SS	Abrasive	NO
Faces	TC/TC//TC/CB	Seal Chamber Pressure	-

Pulp & Paper

Case No. 1937K

In a pulp plant in Canada, a 50mm DMSF™ was installed on an Ahlstrom pump, which was pumping condensate. The seal with TC/C/TC/C faces, EPR elastomers and stainless wetted parts was used in conjunction with an SW2™ water management system. Seal life and water consumption were optimised.

(Please contact Brian Hupka for further information.)

Industry	PULP & PAPER	Elastomers	EPR
Area Of Plant	POWER & RECOVERY	ATEX Compliance	NO
Product	CONDENSATE	Temperature	243°F
Machine Type	PUMP	Concentration	N/A
Manufacturer	AHLSTROM	Shaft RPM	1,800 RPM
Z/Standard	5119	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	DMSF™ 50mm	Bulk Temperature of System	-
Wetted Parts	STAINLESS	Abrasive	NO
Faces	TC/C//TC/CB	Seal Chamber Pressure	30 PSI

Pulp & Paper

Case No. 2283L

A paper mill in Johnsonburg has several Warman pumps in service utilising pump packing and one competitor's OEM seal. In May of 2004 AESSEAL® converted a 6x4 DAH to a CDSA™, in conjunction with an SW2™ and full Warman conversion kit. The customer states that the complete AES solution was priced less that the competitor's single seal. As well the price difference, the competitor's seal failed within 2 weeks of installation. The packed pumps leaked to such an extent that an Asphalt barrier was placed around the remaining 8 Warman pumps to stop the flow of Calcium Carbonate across the plant. The AES solution has been in service since 5/18/04 and seven more conversions are planned to install CDSA™ seals and SW2™ systems. The customer states that current savings are at $1,000 per month on product loss, water and clean up.

(Please contact Chris Stanton-Pittsburgh, PA Direct Sales Engineer for further information.)

Industry	PULP & PAPER	Elastomers	AFLAS®
Area Of Plant	COATINGS PLANT	ATEX Compliance	NO
Product	CALCIUM CARBONATE SLURRY	Temperature	AMBIENT
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	WARMAN	Shaft RPM	1,100 RPM
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 85mm	Bulk Temperature of System	AMBIENT
Wetted Parts	STAINLESS	Abrasive	NO
Faces	TC/TC//TC/CB	Seal Chamber Pressure	50 PSI

Slurry

Case No. 1685K

A calcium carbonate plant in Alabama USA is always looking for ways to improve their efficiency, in other words lower their product loss. Three of their pumps which used to be sealed using pump packing were retrofitted with the CDSA™ double mechanical seal in April of 2003. The support method was a water PUMPPAC™ System (API Plan 54). This system forces water from it's own reservoir, through the seal, and back into the same reservoir. Hence there is little or no water consumption. The seals are currently working leak free.

(Please contact Matt Stallworth (AESSEAL USA) for further details.)

Industry	PULP & PAPER	Elastomers	AFLAS®
Area Of Plant	STOCK PREP	ATEX Compliance	NO
Product	PAPER STOCK (PULP <6%)	Temperature	150°F
Machine Type	CENTRIFUGAL PUMP	Concentration	6%
Manufacturer	SULZER	Shaft RPM	1,800 RPM
Z/Standard	9092	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 50mm	Bulk Temperature of System	-
Wetted Parts	316L SS	Abrasive	NO
Faces	TC/TC//TC/CB	Seal Chamber Pressure	-

Water & Waste

Case No. 1838K

In a Waste Water Plant in the South East of the United States of America, two 50mm CDSA™ double mechanical seals and SW2™ water management systems were installed on Wemco Hidrostal 2K5 centrifugal pumps which pump heated waste water sludge through the thickening process. Previously the pumps had been sealed with a competitor's split seals which lasted approximately 1 year but added 5 gallons per minute of flush water to the sludge which in turn had to be evaporated back out of the final product. The AESSEAL® CDSA™ seals and water management systems have been in service since February 2003, and have reduced the water consumption to less than 17 gallons per year.

(Please Contact Jerome Moore (AES USA Sales Engineer) for further information.)

Industry	WATER & WASTE	Elastomers	AFLAS®
Area Of Plant	SLUDGE DIGESTING	ATEX Compliance	NO
Product	WASTE WATER/SLUDGE	Temperature	160°F
Machine Type	CENTRIFUGAL PUMP	Concentration	7% SOLIDS
Manufacturer	WEMCO	Shaft RPM	1,200 RPM
Z/Standard	-	System Type	API PLAN 54
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 50mm	Bulk Temperature of System	90°F
Wetted Parts	316SS	Abrasive	YES
Faces	TC/TC//TC/CB	Seal Chamber Pressure	40 PSI

Water & Waste

Case No. 1839K

In a Waste Water Plant in the South East of the United States of America, two 80mm CDSA™ double mechanical seals and SW2™ water management systems were installed on Wemco Hidrostal 2K6 centrifugal pumps which pump heated waste water sludge through the thickening process. Previously the pumps had been sealed with a competitor's split seals which lasted approximately 1 year but added 5 gallons per minute of flush water to the sludge which in turn had to be evaporated back out of the final product. The AESSEAL® CDSA™ seals and water management systems have been in service since February 2003 and have reduced the water consumption to less than 17 gallons per year.

(Please Contact Jerome Moore (AES USA Sales Engineer) for further information.)

Industry	WATER & WASTE	Elastomers	AFLAS®
Area Of Plant	SLUDGE DIGESTING	ATEX Compliance	NO
Product	WASTE WATER/SLUDGE	Temperature	160°F
Machine Type	CENTRIFUGAL PUMP	Concentration	7% SOLIDS
Manufacturer	WEMCO	Shaft RPM	1,200 RPM
Z/Standard	-	System Type	API PLAN 54
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 80mm	Bulk Temperature of System	90°F
Wetted Parts	316SS	Abrasive	YES
Faces	TC/TC//TC/CB	Seal Chamber Pressure	40 PSI

Wet Corn Milling

Case No. 1490K

A CDSA™ double mechanical seal and an SW2™ water management system were installed on the 15th October 1999 at a Wet Corn Milling Plant in the UK on a Durco pump. The pump circulates sodium bisulphate around the plant. The seals are running leak free and the amount of water being used is being kept to an absolute minimum.

(Please contact John Pedder, AESSEAL UK Sales for further information.)

Industry	WET CORN MILLING	Elastomers	-
Area Of Plant	REFINERY - 122 PU180	ATEX Compliance	NO
Product	SODIUM BISULPHITE	Temperature	40°C
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	DURCO	Shaft RPM	2,900 RPM
Z/Standard	STD	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 1.875”	Bulk Temperature of System	-
Wetted Parts	-	Abrasive	-
Faces	-	Seal Chamber Pressure	-

Wet Corn Milling

Case No. 1493K

A CDSA™ double mechanical seal and an SW2™ water management system were installed on the 5th September 1999 at a Wet Corn Milling Plant in the UK. The product was corn steep liquor. Large water savings were noticed, and the seals are running leak free.

(Please contact John Pedder, AESSEAL UK Sales for further information.)

Industry	WET CORN MILLING	Elastomers	-
Area Of Plant	-	ATEX Compliance	NO
Product	CORN STEEP LIQUOR	Temperature	50°C
Machine Type	-	Concentration	-
Manufacturer	IDP	Shaft RPM	2,900 RPM
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™	Bulk Temperature of System	-
Wetted Parts	-	Abrasive	-
Faces	-	Seal Chamber Pressure	-

Wet Corn Milling

Case No. 1494K

A CDSA™ double mechanical seal in conjunction with an SW2™ water management system were installed at a Wet Corn Milling Plant in the UK on the 30th September 1999. The pumped product is hot gluten, which was causing the previous seals to fail. The new double mechanical seals are running leak free and the water consumption is virtually zero.

(Please contact John Pedder, AESSEAL UK Sales for further information.)

Industry	WET CORN MILLING	Elastomers	-
Area Of Plant	REFINERY	ATEX Compliance	NO
Product	GLUTEN	Temperature	60°C
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	DURCO	Shaft RPM	2,900 RPM
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™	Bulk Temperature of System	-
Wetted Parts	-	Abrasive	-
Faces	-	Seal Chamber Pressure	-

Wet Corn Milling

Case No. 1499K

A CDSA™ double mechanical seal and an SW2™ water management system were installed on the 29th of August 1999 at a Wet Corn Milling Plant in the UK. The pump is fed from a holding tank and the seals are running leak free with negligible water consumption.

(Please contact John Pedder, AESSEAL UK Sales for further information.)

Industry	WET CORN MILLING	Elastomers	-
Area Of Plant	WET MILL	ATEX Compliance	NO
Product	CORN STEEP LIQUOR	Temperature	50°C
Machine Type	CENTRIFUGAL PUMP	Concentration	-
Manufacturer	IDP	Shaft RPM	2,900 RPM
Z/Standard	-	System Type	SW2™
Dry Running	-	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™ 55mm	Bulk Temperature of System	-
Wetted Parts	316L SS	Abrasive	-
Faces	-	Seal Chamber Pressure	-

Wet Corn Milling

Case No. 1500K

A CDSA™ double mechanical seal in conjunction with an SW2™ water management system were installed at a Wet Corn Milling Plant in the UK on the 27th of July 1999. The pump is a discharge pump, which transports Resin. Since the installation, the water usage has reduced dramatically and the mechanical seals are running leak free.

(Please contact John Pedder, AESSEAL UK Sales for further information.)

Industry	WET CORN MILLING	Elastomers	-
Area Of Plant	REFINERY	ATEX Compliance	NO
Product	GLUTEN	Temperature	50°C
Machine Type	-	Concentration	-
Manufacturer	DURCO	Shaft RPM	2,900 RPM
Z/Standard	-	System Type	SW2™
Dry Running	NO	Barrier Fluid Type	WATER
Seal Type & Size	CDSA™	Bulk Temperature of System	-
Wetted Parts	316L SS	Abrasive	-
Faces	-	Seal Chamber Pressure	-

All information featured in these case histories has been obtained directly from Plant Engineers.

Although we have confidence in the accuracy of this information, it is not offered as a guarantee for seals manufactured by AESSEAL®

Any prospective user of our product should verify the information stated to their own satisfaction.

Further information is available on all the case histories contained in this booklet upon request.

Issue 'K' refers to information which was current on 31st. March, 2003.

Issue 'L' refers to information which was current on 31st. March, 2004.

Where the statement 'the seals are still working' is made, this means that the customer is or was still using AESSEAL® mechanical seals at the time the case history was updated: as denoted by either Issue 'K' or Issue 'L'.

For more detailed information, please contact our Applications Department.

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