Natsurv

Improving water management in South African industry

2024

WATER RESEARCH COMMISSION

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INTRODUCTION

Industries around the world (including South Africa) are beginning to understand the crucial role that water plays in production and profitability.

In the Eighties the Water Research Commission (WRC) and the (then) Department of Water Affairs embarked on a series of National Industrial Water and Wastewater Surveys (NATSURVs) for a number of industries. These so-called NATSURV reports played a significant role in focusing the attention on water and wastewater management in these sectors.

However, South Africa and its industrial sectors have either grown or, in some cases, shrunk considerably since the Eighties. The landscape has changed, and new technologies and systems have been adopted by some of the industries. Thus, some of the information contained in the national surveys can be considered out of date. Furthermore, initiatives such as the UN CEO mandate, water stewardship, water allocation and equity dialogues, amongst others suggests growing awareness related to: water use, water security, and waste production. Thus, it is considered an opportune time to review the water and wastewater management practices of the different industrial sectors and make firm recommendations.

The new round of NATSURVs is revisiting the original industrial sectors to provide a latter-day comparison to determine whether improvements have been made in the area of industrial water management. To date, a number of new NATSURVS have been published.

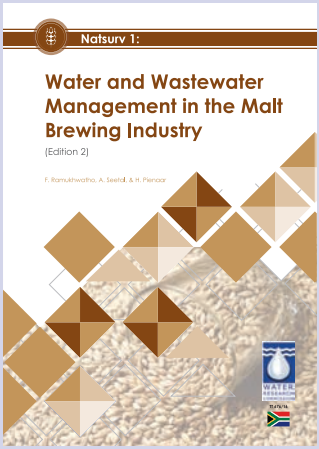
This booklet provides a summary of each of the published NATSURVS, while the reports themselves can be downloaded from the links provided below each report summary.

The following NATSURVs are available at present:

No.	Title	Year	Report number
1	NATSURV 1: Water and wastewater management in the malt brewing industry (Edition 2)	2016	TT 676/16
2	NATSURV 2: Water and wastewater management in the metal finishing industry (Edition 2)	2016	TT 644/15
3	NATSURV 3: Water and wastewater management in the soft drink industry	2016	TT 640/15
4	NATSURV 4: Water and wastewater management in the dairy industry (Edition 2)	2023	TT 928/23
5	NATSURV 5: Water and wastewater management in the sorghum brewing industry (Edition 2)	2016	TT 692/16
6	NATSURV 6: Water and wastewater management in the edible oil industry (Edition 2)	2016	TT 702/16
7	NATSURV 7: Water and wastewater management in the red meat abattoir industry (Edition 2)	2016	TT 701/16
8	NATSURV 8: Water and wastewater management in the laundry industry (Edition 2)	2016	TT 703/16
9	NATSURV 9: Water and wastewater management in the poultry industry (Edition 2)	2017	TT 730/17

No.	Title	Year	Report number
10	NATSURV 10: Water and wastewater management in the tanning and leather finishing industry (Edition 2)	2017	TT 713/17
11	NATSURV 11: Water and wastewater management in the cane sugar processing industry (Edition 2)	2017	TT 721/17
12	NATSURV 12: Water and wastewater management in the paper and pulp industry (Edition 2)	2016	TT 704/16
13	NATSURV 13: Water and wastewater management in the textile industry (Edition 2)	2017	TT 724/17
14	NATSURV 14: Water and wastewater management in the fruit and vegetable processing industry (Edition 2)	2021	TT 863/21
15	NATSURV 15: Water and wastewater management in the oil refining and re-refining industry (Edition 2)	2023	TT 927/23
16	NATSURV 16: Water and wastewater management in the power generating industry (Edition 2)	2021	TT 853/21
17	NATSURV 17: Water and wastewater management in the iron and steel industry	2017	TT 705/16
18	NATSURV 18: Water and wastewater management in the pelagic fish and fish processing industry (Edition 2)	2021	TT 839/20
19	NATSURV 19: Water and wastewater management in the winery industry	Due 2024	TBC

NATSURV reports accompanying this booklet



Water and wastewater management in the malt brewing industry (Edition2)

Report No. TT 676/16

This NATSURV follows on the 1986 edition of water and wastewater management in the malt beer brewing industry. Since this time the industry had undergone a number of significant changes. Owing to sustained increases in the costs of fuel oil, raw materials (including freshwater), the discharge of waste and effluent treatment, the brewing industry has been compelled to reduce production costs by intensifying and optimising their production processes. Since the publication of the first Natsurv the number of breweries in South Africa has increased from seven breweries to more than 150, as have production volumes. The study methodology included a review of the current literature, an assessment of industry reports and a questionnaire survey undertaken among the small local breweries. Water used by the local breweries is variously obtained from four main sources: borehole, municipal, rainwater and freshwater springs. The majority of breweries in South Africa use municipal water and the municipal-sourced water quality show little variation at the different breweries.

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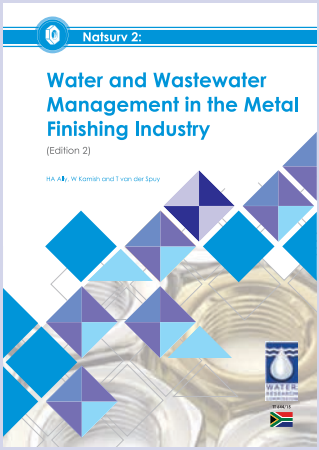

Water and wastewater management in the metal finishing industry (Edition 2)

Report No. TT 644/15

The aim of this project was to undertake a survey of the South African metal finishing industry in order to obtain an overview of operations, specific water use, specific effluent volume and the extent to which best practice is being implemented. This was achieved through a review of the appropriate legislature, holding workshops, interviewing companies and undertaking site visits. A previous survey of this industrial sector was conducted in 1987. Since this time, the industry has undergone a number of significant changes, such as new legislation, updated technology as well as the introduction of new processes and environment-friendly chemicals. In addition, there is growing awareness of the need to optimise water use and reduce the production of waste. The specific water intake results indicate that water in the sector is being used more efficiently. In fact, the international benchmark of 40 L/m^2 is improved on by several of the companies surveyed. Data collected on cleaner production, however, indicates that the uptake of cleaner production is very slow. This could be attributed to financial reasons and the current skill level of operators in the sector. The significant financial risk associated with the instability of the economy does not justify the investment in expensive capital equipment nor the hiring of highly skilled labour.

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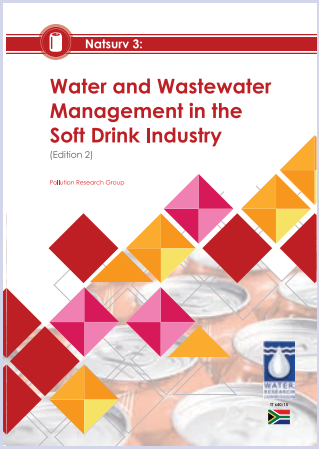
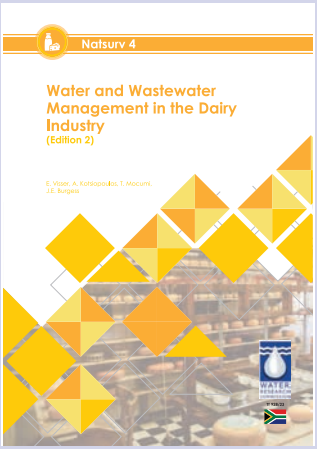


Water and wastewater management in the soft drink industry (Edition 2)

Report No. TT 640/15

The aim of this project was to undertake a survey of the South African soft drink industry in order to obtain an overview of operations, specific water use, specific effluent volume and the extent to which best practice is being implemented. This was achieved through a review of the appropriate literature, holding workshops, interviewing companies and undertaking site visits. A previous survey of this industrial sector was undertaken in 1987. Since this time, the industry has undergone a number of significant changes such as new legislation, new markets, social attitudes, change in ownership, etc., as well as the use of updated technology. The average specific water intake has decreased from 2.7 litres water per litre product to 1.6 litres water per litre product with a lower range of values. It appears that while the soft drink sector is consuming more water, this water is being used more efficiently than in the past. With regards to best practice, a comparison of specific water intake to benchmark figures shows that the South African companies are operating at a lower specific water intake.

To download the report, click here

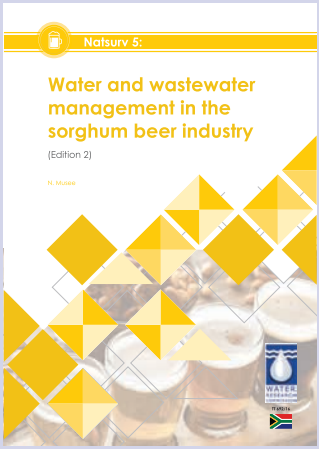


Water and wastewater management in the dairy industry (Edition 2)

Report No. TT 928/23

South Africa contributes approximately 0.4% of the global milk production. Furthermore, similar to South Africa, countries such as India, the United States, and Germany saw an increase in milk production between 2014 and 2020. The dairy industry's landscape has experienced significant changes following the publication of the first edition NATSURV 4 in 1989. For example, certain companies have embraced new technologies and systems, accompanied by heightened awareness of water consumption and wastewater management. As a result, certain aspects of the original NATSURV 4 are now considered obsolete, thereby presenting an opportunity to review the dairy sector's water and wastewater management practices and make firm recommendations. This report revises, updates, and expands on the content of the first edition.

To download the report, click here

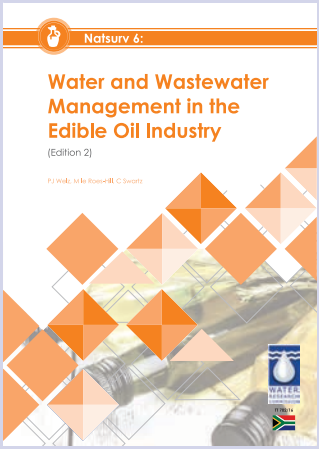


Water and wastewater management in the sorghum beer industry (Edition 2)

Report no. TT 692/16

This guideline aims to update the First Edition of the National Survey of 1989 on aspects related to resources management in the traditional sorghum beer industry. Sorghum beer is a sub-category of the beverage industry, and therefore, resources such as water, agricultural-based raw material (sorghum cereals), energy and waste management are essential to achieve optimal operations and viability. The guideline outlines industrial operations, the degree to which various resources have been managed based on a set of indicators per unit of production (e.g. specific water intake, specific effluent volume etc.), best practices adopted or currently under implementation, and, finally, an outline of recommendations on probable improvements that can further enhance resources utilisation in the sorghum beer industry. One key feature on the changes observed in this industry is its significant decline both in size (e.g. number of malting and brewing plants) and volume of beer produced annually since the first NATSURV report was published in 1989.

To download the report, click here



Water and wastewater management in the edible oil industry (Edition 2)

Report no. TT 702/16

Vegetable oil extraction and refining consume large volumes of water and energy, and are waste intensive. The report includes information stemming from an audit of the industry from both a local and global perspective. Limited information about the local edible oil industry was obtained using combined desktop, site-visit, and laboratory-based approaches. In addition to water and wastewater management, the document includes a section on energy audits adoption/non-adoption of sustainable procedures by the industry at large. To assess changes in the industry, information was compared with that which was published in the previous Natsurv in 1989. For example, since that time there has been a notable increase in the cultivation of olives for olive oil, and soybeans and Canola seeds for oil and oil cakes. This document is a comprehensive guide and benchmark tool for local governments, industry players, academics, researchers and engineers.

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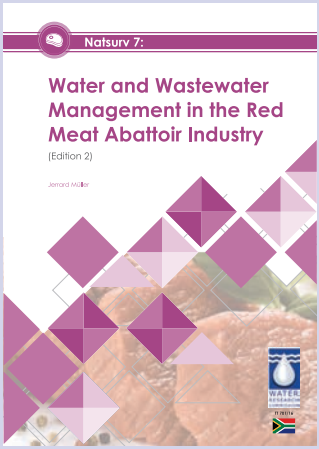

Water and wastewater management in the red meat abattoir industry (Edition 2)

Report no. TT 701/16

Internationally, red meat abattoirs are known to be high volume water consumers. Similarly, they are also serious polluters of wastewater. The increasing demand of domestic water consumers, in addition to the limited supply of water in a semi-arid South Africa focuses the attention on high-volume industrial consumers to assist in reducing water consumption. During the first NATSURV on the abattoir industry, completed in 1988, there were 25 registered abattoirs throughout South Africa, of which ten were large metropolitan abattoirs. The deregulation of the South African meat industry in the Eighties resulted in most of the large abattoirs closing down. The markets opened up and smaller abattoirs proliferated. Management staff of smaller abattoirs is quite often not seriously concerned with water consumption and wastewater quality, as they focus on the quality of meat, which is their core business. Water consumption per slaughter unit (SU) increases inversely to the abattoir slaughter capacity. Average consumption for large abattoirs is 0.91 kl/SU, increasing to 2.04 kl/SU for small abattoirs.

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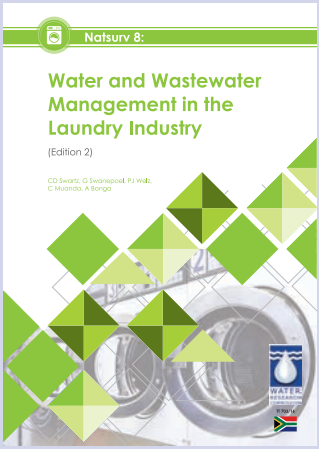

Water and wastewater management in the laundry industry (Edition 2)

Report no. TT 703/16

In South Africa 360 million tons of textiles are processed every year by the laundry industry. This figure is bound to increase, with the growth rate of the industry currently at 6%. This project was concerned with the water and wastewater management of the laundry industry. The first NATSURV document of this industry presented data collected from 16 laundries, excluding laundromats. In this edition, data from laundromats as well as data previously collected from domestic/household laundries are included. The report emphasises that the application of water-conservation techniques should enable commercial laundries to have specific water intakes of 12-15 L/kg and 1.5-4.5 L/kg for washer-extractors and continuous batch washers, respectively. Water consumption must be accurately monitored and ultimately compared with theoretical, programmed water use. When the comparison reveals that more water is used than required, it will then be possible to start identifying causes.

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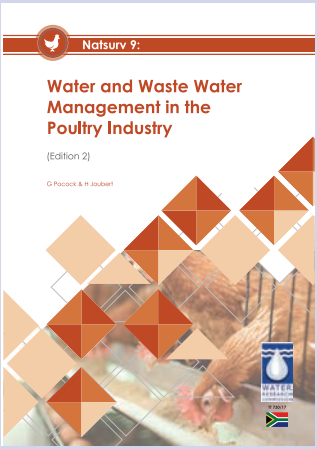

Water and wastewater management in the poultry industry (Edition 2)

Report no. TT 730/17

The aim of this project was to undertake a survey of the South African poultry industry to obtain an overview of operations, specific water use, specific effluent volume and the extent to which best practices are being implemented. This was achieved by reviewing appropriate literature, disseminating questionnaires, holding workshops, interviewing companies and undertaking site visits. This study follows on a previous NATSURV published in 1989. Since this time the industry has undergone several significant changes such as new legislation, new markets, social attitudes and change in ownership as well as the use of updated technology. In addition, there is growing awareness of the need to optimise water and energy use and reduce the production of waste, and this should be reflected in the specific water consumption and effluent production. It was therefore considered an opportune time to review the water and wastewater management practices of the poultry industry and identify the changes that have been made since the 1989 survey.

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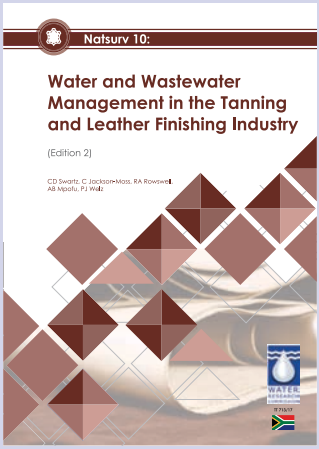

Water and wastewater management in the tanning and leather finishing industry (Edition 2)

Report no. TT 713/17

This project was concerned with the water and wastewater management of the tannery and leather finishing industry. The first NATSURV document (published in 1980) presented data collected during visits to 11 of the 20 tanneries in South Africa at the time. The number of tanning and leather finishing industries had increased to 35 at the time of this research. Ten tanneries were visited, representing all the different types, categories and sizes of industry in this sector, namely bovine, ovine and exotic hides and skins, blue tanning, retanning, full-house tanning and leather finishing. The main aims of the project were to provide a detailed overview of the tanning and leather finishing industry in South Africa and its changes since 1980; determine the water consumption and specific water consumption in the industry; determine wastewater generation and typical pollutant loads; and provide recommendations on best practises for the tanning industry. The range of the specific water intake for full tanning was found to be 170 to 550 L/hide, compared with the 320-744 L/hide reported in the first NATSURV.

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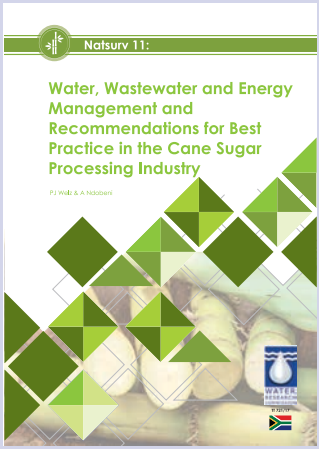

Water, wastewater and energy management and recommendations for best practice in the cane sugar processing industry (Edition 1)

Report no. TT 721/17

The main aim of the NATSURV series is to serve as guides and benchmark tools for stakeholders, including local governments and industry players. The aims of this publication were to provide an overview of the sugar processing industry in South Africa, highlighting changes that have taken place since the previous NATSURV was published in 1990; to provide information about generic industrial processes, with an emphasis on water use and wastewater generation and treatment; and to provide information about relevant national and local legislation and bylaws pertaining to water usage and wastewater generation. Similar to other NATSURVs this publication also provides water consumption, specific water consumption and wastewater generation data. Furthermore, it recommends best practices for water use, including intake, treatment and discharge.

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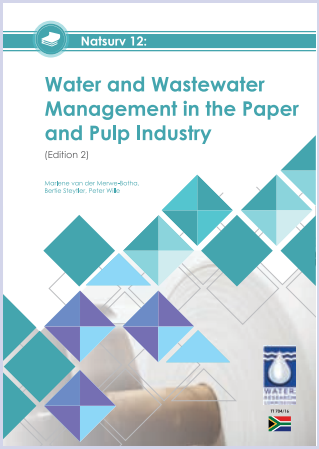

Water and wastewater management in the paper and pulp industry (Edition 2)

Report No. TT 704/16

This NATSURV reviewed the status of the South African paper and pulp industry with specific focus on national production capacity, specific water use and effluent generation rates, specific energy consumption rates and best practices in the management of water and effluent. The study provides an overview of the most pertinent legislation that regulates the industry on national and local levels. The research confirmed that 29 paper and pulp mills are operational in South Africa. The bulk of production is performed by the five largest paper and pump manufacturers. Raw water intake to the manufacturing process is usually derived from a water resource where the abstraction is authorised by the Department of Water and Sanitation, or from the local municipality. The specific water intake for the 22 participating sites varied between 3.5 and 76.1 m^3/t. This represented a marked decrease from the previous Natsurv, conducted in 1990. Different volumes and quality of wastewater (effluent) is produced during the manufacturing process. Effluents are treated via a range of treatment technologies, including clarification, activated sludge, dissolved air flotation, and belt presses. The treated effluents are discharged to the receiving environment or reuse/recycled to the manufacturing process where technically feasible. The specific effluent volume generated varied between 0.08 and 84.5 m^3/t.

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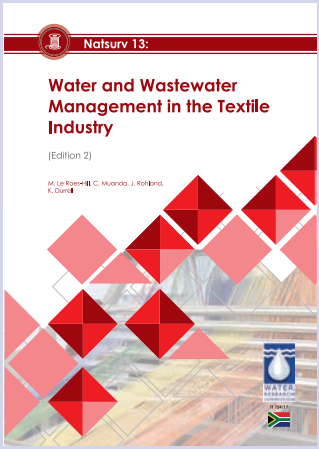

Water and wastewater management in the textile industry (Edition 2)

Report no. TT 724/17

This document forms part of a series of NATSURVs that are focused on the water use and wastewater management practices of various industries in South Africa. It aims to update the information that was presented in the 1993 survey document, specifically focusing on the water use, wastewater management, energy use and energy management practices in the South African textile industry. The information presented in this document was obtained via desktop research, site visits, and questionnaires. To determine whether there have been any changes in the industry since 1993, the information obtained was compared to the data presented in the previous survey. In the case of the textile industry, there have been significant changes in the industry; the industry has moved away from a focus on general apparel to mostly technical textiles, and many companies have consolidated different process steps, combining raw material processing, dyeing and the production of the final textile-based product. The specific water intake reported in this survey differs from the average specific water intake reported in 1993, indicating a decrease in the intake of water.

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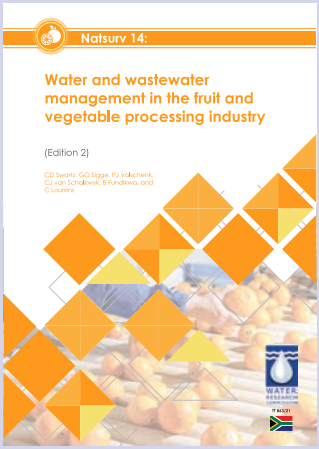
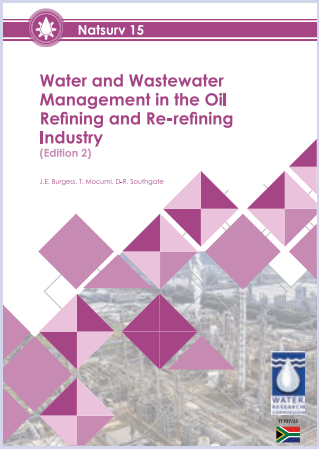


Water and wastewater management in the fruit and vegetable processing industry (Edition 2)

Report no. TT 863/21

Fruit and vegetable processing industries produce effluent streams that contain high pollutant loadings with a very negative impact on the environment if not treated effectively and satisfactorily before discharged into public water sources or municipal sewage systems. Ineffective treatment or process operations may also lead to serious odour problems. High organic loadings in the effluent streams from the fruit processing activities present considerable problems for municipalities and the environment. Any improvement in water management and minimisation of pollutant loads in these effluent streams will be invaluable in helping contribute to improved water demand management and pollution control in our water-scarce country. This project is a revision and update of one of the NATSURV reports, namely 'NATSURV 14: Water and Wastewater Management in the Fruit and Vegetable Processing Industry'.

To download the report click here



Water and wastewater management in the oil refining and re-refining industry (Edition 2)

Report no. TT 927/23

The oil refining and re-refining industry encompasses the transformation of crude oil and used oil into various products, including fuels, lubricants, chemicals, and plastics. While traditional refineries use virgin crude oil as feedstock, re-refineries recycle used oil. The industry's scope covers traditional crude oil refineries, Gas-to-Liquid refineries using natural gas, and Coal-to-Liquid refineries using coal. These refineries contribute to diverse petroleum product production, addressing energy demands and environmental concerns. This project involved updating and expanding the first edition of NATSURV 15, which recorded the norms and standards for water management in oil refining in South Africa in 2005. The objectives included providing an industry overview, evaluating production processes, assessing water consumption and wastewater generation, and recommending future targets or best practices to lower water consumption and better manage wastewater. However, one refinery has announced closure, another has ceased processing oil, a gas to liquid plant placed on care and maintenance and the future of the remaining two oil refineries are uncertain, some objectives have been replaced. These new objectives focus on understanding the future business plans of remaining refineries, exploring the situation in the Southern African Development Community (SADC) countries, studying overseas refiners transitioning to non-fossil oils, and providing recommendations for the next NATSURV 15 edition.

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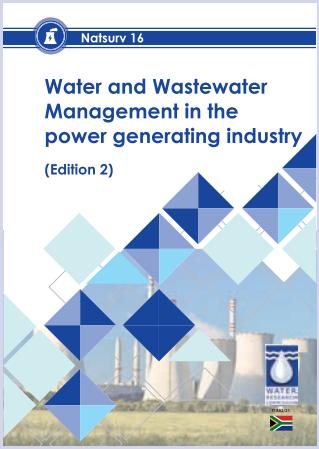

Water and Wastewater Management in the Power Generating Industry

Report no. TT 853/21

This project aimed to review NATSURV 16: Water and Wastewater Management in the Power Generating Industry, to obtain an overview of operations, specific water use, specific effluent volume, and the extent to which best practice is being implemented, when compared to international benchmarks. The previous edition of the power generation NATSURV compiled by van Zyl & Premlall was published relatively recently (2005) compared with many other NATSURV that were published in the 1980s. At the time that the previous NATSURV was written, the industry was starting to show a greater commitment to taking measures to reduce the water intake and pollution potential of power generating stations, including the installation of dry cooling and dry ashing systems, the installation of desalination plants to treat mine water which can be used to supplement raw water sources, as well as improved management and operation of processes such as the Zero Liquid Effluent Discharge philosophy that encompasses a number of measures such as reuse, recycling and cascading water use. Among others, the project found that, on average in South Africa, 1 kWh of electricity consumes about 1.4 l of water across all technologies. This is in line with the world average of 1.2-1.5 l/kWh.

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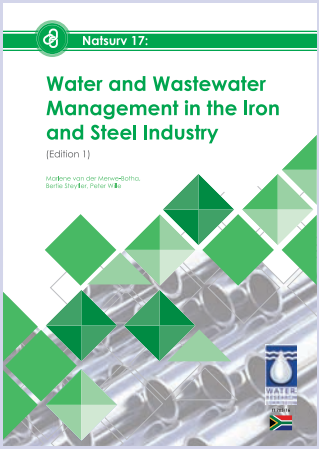

Water and wastewater management in the iron and steel industry (Edition 1)

Report No. TT 705/16

The purpose of this NATSURV was to review the status of the South African iron and steel industry with specific focus on national production capacity, specific water intake and effluent volumes, specific energy consumption rates and best practices in the management of water and effluent. The study includes an evaluation of the most pertinent legislation that regulates the industry on national and local levels. Four of the five companies operating iron and steel mills in South Africa participated in the project. Raw water intake to the manufacturing process is usually derived from a water resource where the abstraction is authorised by the Department of Water and Sanitation, or from the local municipality. The specific water intake for the four sites for which data was received varied between 2.3 and 9.3 m^3/t. The specific effluent volume generated varied between 0.9 and 3.6 m^3/t. Different volumes and quality of wastewater is produced during the manufacturing process. Effluents are treated via a range of treatment technologies which include clarification, activated sludge, dissolved air flotation and evaporation. The treated effluent is discharged to the receiving environment or reused/recycled to the manufacturing process where technically feasible. The variation between water intake and effluent generation is a function of a range of factors, such as age of facility, technology selection and product produced.

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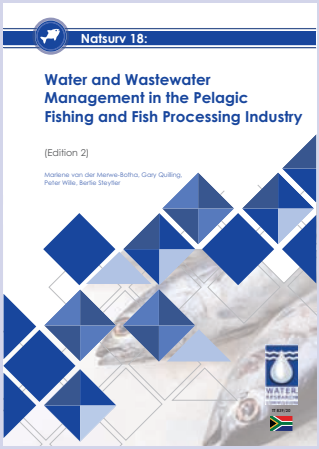

Water and wastewater management in the pelagic fishing and fish processing industry (Edition 2)

Report no. TT 839/20

The purpose of this NATSURV was to review the status of the South African Pelagic Fishing and Fish Processing Industry with specific focus on specific water use and effluent generation rates, specific energy consumption rates and best practices in the management of water and effluent. The study provides an overview of the most pertinent norms and standards, as well as legislation that regulates the industry on international and local levels. Eleven pelagic processing sites were identified, of which 6 sites responded positively. The common denominator to the participating plants was that all own and operate canning plants, where fish is landed, processed, canned, cooked in the can, prepared with sauces, sealed and distributed. Five of the sites have value-add processes, whereby fish are processed to fish oil and fish meal, for distribution as protein source to the animal feed market. The weighted average SWI for the assessed South African sites were found to be 6,82 m^3/t (ranging from 2,42 to 9,14 m^3/t) vs an indicated benchmark of 8,60 m^3/t. The weighted average SWI of the assessed South African sites was at 79% of the derived benchmark value (literature), meaning that the SA industries use less water per ton of product produced than expected. The values ranged from 28% to 205% (achieved SWI vs benchmark).

To download the report, click here