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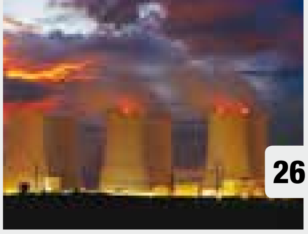

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Average circulation
(Q1 Jan – Mar 2016)
3 630

Chemical Technology is endorsed by The South African Institution of Chemical Engineers

and the Southern African Association of Energy Efficiency

http://www.chemicaltechnologymagazine.co.za/

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Another perfect storm

by Carl Schonborn, PrEng

The environmentalists, scientists, engineers, pin-striped corporate executives, Paris Protocol attendees, and contrarians, are all mindful of the great debate in the world right now: global warming.

The Paris 2015 COP21 Climate Change Conference agreement commits almost 200 countries to hold the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1,5 °C.

The long-term goal also states that in the second half of this century the world should be at a stage where the net emissions of greenhouse gases be zero. The agreement consists of the 196 pledges submitted to stop the growth of greenhouse gas emissions, mainly from burning fossil fuels. However, it is not legally binding until ratified by at least 55 countries which together represent at least 55 % of global greenhouse emissions. The agreement needs to be ratified by signing the agreement in New York between April 2016 and April 2017.

Few have ratified the agreement to date. No detailed timetable or country-specific goals for emissions were incorporated into the Paris agreement. 'Greenhouse Gas' means gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation, and includes carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

The pledges made at the Paris Summit on their own will miss the 1,5 °C target by a long way. Also included in the agreement is a rule whereby nations must renew their pledges every five years, each pledge representing a progression. The contributions that each country should make in order to achieve the worldwide goal are determined by all countries individually and called 'nationally determined contributions' (NDCs). There will be no mechanism to force a country to set a target in its NDC by a specific date and no enforcement if a set target in an NDC is not met. There will be only a 'name and shame' system or a 'name and encourage' plan.

The Energy Information Administration estimates that in 2007 the primary sources of energy consisted of petroleum 36,0 %, coal 27,4 %, natural gas 23,0 %, amounting to an 86,4 % share for fossil fuels in primary energy consumption in the world. Non-fossil sources in 2006 included nuclear 8,5 %, hydroelectric 6,3 %, and others (geothermal, solar, tidal, wind, wood, waste) amounting to 0,9 %.

A global movement towards the generation of renewable energy is underway to help reduce global greenhouse gas emissions. However, it can never provide the required base load of energy.

According to the *BP Energy Outlook 2016*, fossil fuels remain the dominant source of energy, accounting for almost 80 % of total energy supply in 2035. Gas is the fastest growing fossil fuel (1,8 % p.a.), with its share in primary energy gradually increasing. In contrast, coal suffers a sharp reversal. After gaining share since 2000, the growth of coal is projected to slow sharply (0,5 % p.a.), such that by 2035 the share of coal in primary energy is at an all-time low, with gas replacing it as the second-largest fuel source.

Among non-fossil fuels, renewables (including biofuels) grow rapidly (6,6 % p.a.), causing their share in primary energy to rise from around 3 % today to 9 % by 2035.

The growth in the global consumption of liquid fuels is driven by transport and industry, with transport accounting for almost two-thirds of the increase, however, this is offset by sustained gains in vehicle efficiency.

Coal demand is projected to fall by more than 50 % in both the US and Europe, driven by plentiful supplies of gas, the falling cost of renewables, and stronger environmental regulation.

Published monthly by:
Crown Publications cc
Crown House
Cnr Theunis and
Sovereign Streets
Bedford Gardens 2007
PO Box 140
Bedfordview 2008
Tel: +27 (0) 11 622-4770
Fax: +27 (0) 11 615-6108

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www.crown.co.za
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Carl Schonborn, PrEng
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Glynnis Koch
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Advertising:
Brenda Karathanasis
Design & layout:
Colin Mazibuko
Circulation:
Karen Smith
Publisher:
Karen Grant
Deputy Publisher:
Wilhelm du Plessis
Printed by:
Tandym Print - Cape Town

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FILTECH 2016, taking place from 11- 13 October 2016 in the city of Cologne in Germany, will turn into the top- meeting-place for all those involved with filtration and separation and adjacent sectors.

The largest filtration show worldwide will take place for the first time at the new venue KoelnMesse Cologne, where 350 companies will present their cutting-edge products and innovations for the chemical, mining and metallurgy industry as well as other sectors. FILTECH is a global solution provider for all filtration and separation tasks covering all industries.

The chemical industry, as well as related industries such as food and beverage, minerals processing, pulp and paper, waste management, water treatment, environmental engineering and petrochemicals, need cost-effective processing structures as well as reduced risks. Sophisticated and state of the art filtration and separation solutions play a key role in these industries.

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Noora Blasi, Marketing Manager, Ahlstrom Filtration

Global solution provider

FILTECH 2016 will feature innovative companies and market leaders from the worldwide filtration and separation industry, including both a strong line-up of returning companies as well as an impressive collection of first-time exhibitors.

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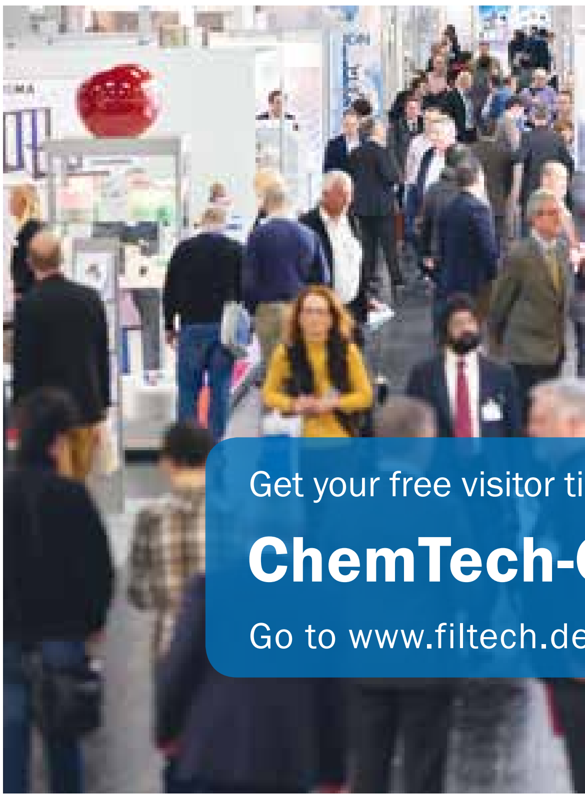

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The
Draft Carbon Tax Bill

Part 3 - Fugitive emissions and industrial emissions

by Carl Schonborn Pr Eng

In November, 2015, the South African National Treasury published for comment the Draft Carbon Tax Bill. To enable engineers to better understand the Bill, its contents have been edited for brevity and examples included to introduce the structure of the Bill as a commentary. This is the last of a three-part series.

Part 1 (How the tax is calculated based on CO_2 equivalent emissions for stationary and non-stationary/mobile sources) appeared in the February issue. Part 2 – Allowances and offsets, was published in the March issue. Where reference is made to Schedule 2 in this commentary, it refers to Schedule 2 in the Draft Bill or as published in Part 2 of this series.

The numbering used in this commentary will correspond to the Sections in the Draft Bill. Certain items in the tables have been deleted from the original text for the sake of brevity and included where the examples draw factors from the table.

Tax base (Section 4 of the Draft Bill)

(b) Fugitive emissions from which the greenhouse gas is emitted. Numbers determined by:

F = (N x Q) where N is either tonnes of solid fuel or m^3 other than solid, emitting the greenhouse gas. Q is the emission factor from Table 2. (Discussion of emission factors typically referenced from [1])

(c) Industrial Process and Product Use (IPPU) (emissions)

P = (G x H) where G is the mass of each raw material used or product produced expressed in tonne in respect of the greenhouse gas emitted. H is greenhouse gas emission factor from Table 3.

Example 3

(b) Industrial Process and Product Use (IPPU) emissions

As an example of IPPU emission a typical smaller cement plant would produce about 1 425 000 tonnes per annum of clinker. (Cement is 95 % clinker.)

From Table 3 the GHG emission factor is 0,5200 for clinker. Annual carbon tax liability will be 1 425 000 x 0,5200 = 741 000 tCO_2e

741 000 CO_2e x R120 = R88 920 000

Allowance for industrial process emissions

8(1) A taxpayer that conducts an activity in respect of industrial process emissions that is listed in Schedule 2 in the column 'Sector' may receive an allowance in respect of those emissions, determined in terms of subsection (2).

8(2) The percentage of the allowance referred to in subsection (1) must be calculated by matching the line in which the activity is contained in the column 'Sector' with the corresponding line in the column "Basic tax-free allowance for process emissions %" in Schedule 2 of the total percentage of greenhouse gas emissions in respect of a tax period in respect of that activity.

From Schedule 2 from the Sector Column, Cement

Production, there are the following allowances each year until the year 2020.
70 % for a Basic Tax free allowance for Process,
10 % for Trade Exposure, section 10 below,
5 % for Z factor or Performance Allowance, section 11 below,
5 % for Carbon Budget, section 12 below,
and 5 % for Offset allocation, section 13 below,
a total of a 95 % allowance of the tax payable in the first year until the year 2020.
So payment in first year will be 5 % of **R88 920 000 = R4 446 000**

Example 4
Fugitive emission

As for the typical coal-fired power station, assume a dedicated coal mine adjacent to the power station.
It is estimated that a modern coal-fired power station requires around 8,3 tonnes of coal per day per MW. It will operate 365 days per year for its 4 800 MW maximum capacity. This equation is shown below: (Calculation is for underground post-mining emission)
8,3 x 4 800 x 365 = 14 600 000 tonnes of coal per annum
14 600 000 tonnes x 0,1187 (**underground coal mining**, GHG emission factor CO_2e per tonne from table) = 1 733 020 tCO_2e
14 600 000 tonnes x 0,0277 (**underground post-mining**, GHG emission factor CO_2e per tonne from table) = 404 420 tCO_2e
Annual carbon tax liability will be the sum of the two:
1 733 020 + 404 420 = 2 137 440
2 137 440 CO_2e x R120 = R256 492 800

Allowance in respect of fugitive emissions

(1) A taxpayer that conducts an activity that is listed in Schedule 2 (for Fugitive Emissions from Fuels) in the column 'Sector' may receive an allowance in respect of fugitive emissions in a percentage determined in terms of subsection (2).
(2) The allowance referred to in subsection (1) must be determined by matching the line in which the activity is contained in the column 'Sector' with the corresponding line in the column "Fugitive emissions allowance %" in Schedule 2 in respect of the total percentage of greenhouse gas emissions in respect of the tax period in respect of that activity.

From Schedule 2 from the Sector Column, Coal Mining and Handling, there are the following allowances for Solid Fuels.
60 % for Basic Tax free allowance for fossil fuel
10 % for fugitive emissions, section 9 below

Table 2: Fugitive emission factors

Source category activity solid fuels (M^3 /tonne)	GHG emission factor (CO_2e)/tonne
underground coal mining	0.1187
underground post-mining (handling & transport)	0.0277
surface coal mining	0.0000
surface post-mining (storage and transport)	0.0000
Oil and natural gas (gg/ 103m³ total oil production)	
Gas production (gg/ 106m³ total oil production)	
Gas processing (gg/ 106m³ raw gas feed)	
Gas transmission & storage (gg/ 106m³ marketable gas)	
Gas distribution (gg/ 106m³ of utility sales)	
Natural gas liquids transport (gg/ 103m³ condensate and pentanes+)	
Oil production (gg/ 103m³ conventional oil production)	
Oil production (gg/ 103m³ heavy oil production)	
Oil production (gg/ 103m³ thermal bitumen production)	
Oil production (gg/ 103m³ syncrude production from oilsands)	
Oil production (gg/ 103m³ total oil production)	
Oil upgrading (gg/ 103m³ oil upgraded)	
Oil transport (gg/ 103m³ oil transported by pipeline)	
Oil transport (gg/ 103m³ oil transported by tanker truck)	
Oil transport (gg/ 103m³ oil transported by tanker ships)	
Oil refining (gg/ 103m³ oil refined)	

Table 3: Industrial Process and Product Use (IPPU) emission factors (only part of the table is shown for brevity. The complete Table 3 can be found in the Draft Carbon Tax Bill as published.)

Source category activity / Raw material /product	GHG emission factor (CO_2e) per tonne
Cement production (per tonne of clinker)	
Cement	0.5200
Lime production (per tonne of lime)	
Glass production (per tonne glass)	
Ceramics (per tonne carbonate)	
Other uses of soda ash (per tonne carbonate)	

10 % for Trade Exposure, section 10 below
5 % for Z factor or Performance Allowance, section 11
5 % for Carbon Budget, section 12 and 5 % for Offset allocation, section 13, a total of a 95 % allowance of the tax payable in the first year and until the year 2020.
So payment will be 5 % of **R256 492 800 = R12 824 640**

The allowances for these categories defined in the Draft Carbon Tax Bill are as follows:
Trade exposure allowance (numbering in accordance with Draft Carbon Tax Bill)
10 A taxpayer that is liable for the carbon tax in respect of greenhouse gas emissions in respect of the export of goods out of the Republic may receive an allowance in respect of a tax period in respect of those greenhouse gas emissions which is the lower of —
(a) an amount that must be determined in accordance with the formula:
X = A× B
(ii) **'A'** represents the number 0,4;
(iii) **'B'** —
(aa) represents a % as the same ratio as the revenue received from goods that are exported to the total revenue received from goods that are sold by that taxpayer; and
(bb) must be deemed to be nil if the number determined in terms of sub paragraph *(aa)* is lower than 5 %.
or
(b) 10 % of the total greenhouse gas emissions.

Performance allowance (or Z-factor allowance)

11 (1) A taxpayer that has implemented additional measures to reduce greenhouse gas emissions in respect of a tax period may receive an allowance not exceeding 5 % of the total greenhouse gas emissions determined in accordance with the formula:
Z = (A / B – C) x D
in which formula—
(b) 'A' represents—
(i) the sector or sub-sector greenhouse gas emissions intensity benchmark (as defined in Part1, definitions); or
(ii) where no value is prescribed as required by subparagraph (i), the number zero;
(c) 'B' represents the measured and verified greenhouse gas emissions intensity of a taxpayer in respect of a tax period;
(d) 'C' represents the number 1; and
(e) 'D' represents the number 100.
(2) For the purposes of this section "additional measures" include voluntary action taken to reduce greenhouse gas emissions in respect of a tax period.

Carbon budget allowance

12 A taxpayer that conducts an activity that is listed in Schedule 2 in the column 'Sector', and participates in the carbon budget system during or before the tax period, may receive an additional allowance of 5 % of the total percentage of greenhouse gas emissions in respect of a tax period.

Offset allowance

13 (1) Subject to subsection (2), a taxpayer may reduce the amount in respect of the carbon tax for which the taxpayer is liable in respect of a tax period by utilising carbon offsets as prescribed by the Minister.
(2) The reduction of the liability for the carbon tax allowed in terms of subsection (1) may not exceed so much of the percentage of the total greenhouse gas emissions of a taxpayer in respect of a tax period as is determined by matching the line in the column 'Sector' with the percentage in the corresponding line of the column "Offsets allowance %" in Schedule 2.

Limitation of allowances

Limitation of sum of allowances
14 A taxpayer may only receive the sum of the allowances contemplated in Part II of the Bill in respect of a tax period to the extent that the sum of those allowances does not

exceed 95 % of the total greenhouse gas emissions of that% taxpayer in respect of that tax period as determined in terms of the column "Maximum total allowances %" in Schedule 2.

PART IV (of the Bill)
Administration, tax period and payment of tax

Administration

15 (1) The Commissioner must administer the provisions of this Act as if the carbon tax were an environmental levy as contemplated in section 54A of the Customs and Excise Act, 1964 (Act No. 91 of 1964), that must be collected and paid in terms of the provisions of that Act.

(2) For the purposes of subsection (1), administrative actions, requirements and procedures for purposes of submission and verification of accounts, collection and payment of the carbon tax as an environmental levy or the performance of any duty, power or obligation or the exercise of any right in terms of this Act are, to the extent not regulated in this Act, regulated by the Customs and Excise Act, 1964.

Tax period

16 (1) A taxpayer must pay the carbon tax for every tax period.

(2) A tax period in relation to a taxpayer is—
(a) the period commencing on 1 January 2017 and ending on 31 December 2017; and
(b) subsequent to the period contemplated in paragraph (a), the period commencing on 1 January of each year and ending on 31 December of that year.

Payment of tax

17 (1) A taxpayer must submit six-monthly environmental levy accounts and payments as prescribed by rule in terms of the Customs and Excise Act, 1964, for every tax period commencing on 1 January and ending on 30 June and the period commencing on 1 July and ending on 31 December of that year.

(2) A taxpayer must effect any required adjustments to environmental levy accounts and payments for a tax period in the subsequent environmental levy account and payment of the period commencing on 1 January and ending on 30 June in the following tax period.

Part V (of the Bill)
Impermissible arrangements

Impermissible tax avoidance arrangements

18 (1) If the Commissioner is satisfied that an arrangement—

(a) has been entered into or carried out in a manner that has the effect of providing a tax benefit to a person; and

(b)(i) having regard to the substance of the arrangement—
was entered into or carried out by any means or in a manner which would not normally be employed for purposes other than the obtaining of a tax benefit;

(ii) has created rights or obligations which would not normally be created between persons dealing at arm's length; and

(iii) was entered into or carried out solely or mainly for the purpose of obtaining a tax benefit, the Comissioner may determine the liability for tax imposed under this Act and the amount thereof as if the arrangement had not been entered into or carried out, or in such manner as in the circumstances of the case the Commissioner deems appropriate for the prevention or diminution of that tax benefit.

(2) For the purposes of this section—

'**dealing at arm's length**' means a transaction in the open market in which two or more independent persons acting in good faith, without regard to the liability for tax, would freely and without conflict of interest agree to transact in the ordinary course of business;

'**arrangement**' includes any transaction, operation, scheme or understanding, whether enforceable or not, including all steps and transactions by which it is carried into effect; and

'**tax benefit**' includes—

(a) any reduction in the liability of any person to pay any tax or other amount imposed by this Act;

(b) any increase in the entitlement of any person to an allowance allowed in terms of this Act; and

(c) any other avoidance or postponement of liability for the payment of any tax or other amount imposed by this Act.

PART VI (of the Bill)
Miscellaneous

Reporting

19 The Commissioner must annually submit to the Minister a report, in the form and manner that the Minister may prescribe, within six months from the end of every tax period, advising the Minister of—

(a) the greenhouse gas emissions reported; and

(b) the amount of carbon tax collected, in respect of that tax period.

Regulations

20 The Minister must make regulations in respect of—

(a) the sector or sub-sector greenhouse gas emissions intensity benchmark for the purposes of symbol **'A'** in section 11(1); and

(b) carbon offsets contemplated in section 13.

Amendment of laws

21 The Customs and Excise Act, 1964, is hereby amended to the extent set out in Schedule 3.

Short title and commencement

22 This Act is called the Carbon Tax Act, 2017, and comes into operation on 1 January 2017.

Outotec modular plug-and-play solution for industrial water treatment

In order to be more environmentally sustainable, the mining and mineral processing industry is focusing more on ways to minimise impact on the surrounding environment. Outotec has combined its particular understanding of water treatment, process design, electrolysis and hydrometallurgy into a cost-effective modular product called Outotec® EWT-40.

The Electrochemical Water Treatment process solution is a highly automated process, which minimises the need for personnel while ensuring high quality water treatment performance.

These EWT solutions may be purchased as a process solution island with full maintenance, spare parts and operational support services. Outotec can also offer a complete water treatment solution from test work including: laboratory scale test work to on-site piloting, conceptual and feasibility studies, basic and detailed engineering, as well as developing a solution for the entire process.

Potential sources of water contamination from the mining industry include drainage from surface and underground mines, wastewaters from beneficiation, surface run-off and acid mine drainage (AMD).

Outotec Electrochemical Water Treatment solutions can handle everything from the removal of arsenic, selenium and antimony, to trace metals and organic removal. Customer specific wastewater can also be tested in Outotec's lab in Pori, Finland.

One Outotec EWT-40 module can treat approximately 5-40 m^3/h of wastewater depending on the application. The operation can easily be scaled up as needed simply by adding more modules.

Another benefit of its modular design is the added value it brings to customers; the modules can be easily relocated or resold, protecting the investment beyond plant lifetime. It is also ideal for remote locations with minimum transport and storage needs.

- Fast, efficient water treatment and lower residual impurities compared to conventional processes
- Modular design supports easy relocation and expansion
- Highly automated process minimises personnel requirements and enables remote operation and monitoring
- No need to procure or handle chemicals.

For more information go to:
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A brief history of the Pompetravaini Group

Pompetravaini SpA was founded in 1929 by the late Carlo Travaini, an experienced machinist with solid production experience acquired while working at the company Franco Tosi of Legnano, Italy.

He started his own business under the name of Travaini Mechanical Machining, producing many different types of pumps under private labels with designs and materials supplied by customers. In the following years, the ever growing experience and continued technological updating of the manufacturing plant increased the growth potential forcing a major expansion of the business.

The current President, Ing Mario Travaini, decided in 1968, to rename the company Pompetravaini SpA. With technologically advanced production and a sales network adequate for the times, the company began selling products in the European market under its own label.

Once more the company outgrew its facilities and in 1982 a new site of approximately 8000 m^2 was built in the industrial area of Castano Primo, Milan (Italy).

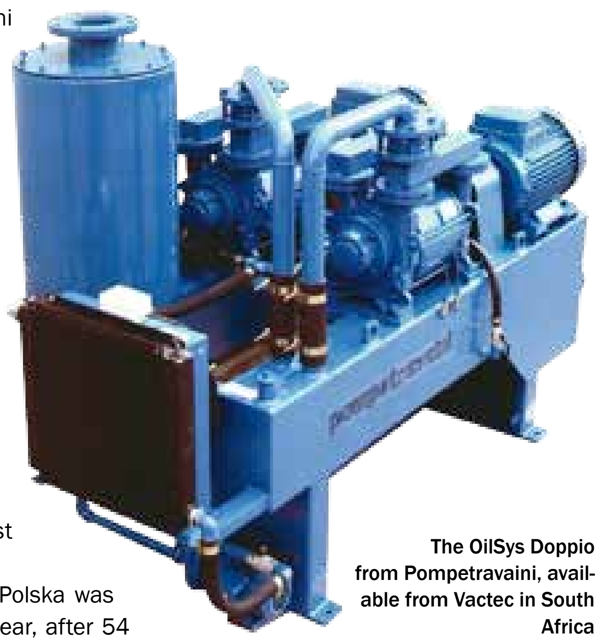
Parallel to the internal growth there has been a marketing expansion into international markets. In 1985 Premier Fluid Systems Canada started operation, followed in 1986 by Travaini Pumps USA. In 1989 Travaini Pompen BeNeLux was founded in the Nederlands and two years laterr, in 1991, Travaini Pumpen GmbH in Germany began operating. In 1999 Pompes Travaini France started in France.

In 2002 there was another addition to the existing plant. A building of approximately 4000 m^2 was added to house a new computerised stock room and assembly room. This futuristic project utilises LGV (laser guided vehicles) to store components, bring them to the assembly area and then bring the assembled pumps to the test room.

In 2007 Travaini Pompy Polska was founded and the following year, after 54 years of total dedication and intense activity as President, Mario Travaini handed over to his son Carlo who has been responsible for the last steps that moved Pompetravaini into a new era with 'state of the art' automation.

Various new acquisitions have taken place since 2012, including NSB gas processing AG and BORA Blowers; and FuturEng, an engineering office for design and construction of skids with rotating equipment, was founded.

Air & Vacuum Technologies have been the sole agents for the full Travaini range for almost ten years now and, according to Mark Burn, managing director, the brand is growing from strength to strength with sales figures growing year on year.



The OilSys Doppio from Pompetravaini, available from Vactec in South Africa

For more information contact:
Mark Burn on 0861 VACTEC (822 832) or tel: +27 11 318 3240-5; email:burnm@vactech.co.za or go to www.vactech.co.za

Veolia helps protect wetland with sewage plant upgrade

With a gradual decrease in bio-diversity at a Ramsar-declared wetland outside Nigel, the East Rand Water Care Company (ERWAT), responsible for a number of wastewater treatment plants in eastern Gauteng, contracted Veolia Water Technologies South Africa to improve the discharge standards and treatment capacity of a sewage plant servicing the Heidelberg and Nigel communities.

The plant, which discharges treated wastewater into the region's surface water system, was not meeting legislated discharge standards due to its activated sludge system being overloaded – a result of surrounding residential area's rapid expansion over recent years. As a cost-effective alternative to constructing a new treatment plant, ERWAT decided to upgrade the existing trickling filter system located at the site. This type of upgrade is the first of its kind in South Africa and marks the start of a trend towards cost-effective infrastructure upgrades across the country.

"The trickling filter treatment system was originally designed to treat 4,5 megalitres per day, but because of the efficiency of our trickling filter technology, we have been able to increase the daily capacity to 6,5 megalitres and still meet the stringent water quality standards," says Ian Lemberger, General Manager at Veolia Water Technologies' Engineered Systems division.

The upgrade has involved replacing the existing trickling filter system's stone carrier elements with new generation plastic honeycomb media that offers a significantly larger surface area for improved biological performance and enhanced flow. "In a trickling filter system, improved flow and more biological growth means more organic matter can be processed by the existing infrastructure," he says.

A similar trickling filter system utilising existing infrastructure, providing a cost-effective solution to increase water treatment capacity.

The plant's two existing structures, each 30 m in diameter and 3,9 m in height, house these new carrier elements, which means minimal civil works or alterations were required to complete the upgrade. To maintain the plant's set minimum treatment capacity during the upgrade, Veolia upgraded each tower separately. Veolia was also responsible for the trickling filter system's mechanical and electrical components, including the installation of civil tanks.

"After having the organic matter broken down in the trickling filter system, the water will pass through clarifiers to remove residual biological solids, and then to chlorination, which disinfects the water before discharge," says Lemberger.

ERWAT awarded Veolia Water Technologies South Africa the upgrade contract based on the success of similar trickling filter projects completed by its Namibian subsidiary, Aqua Services & Engineering (ASE). "It is relatively easy to refurbish and upgrade older trickling filter plants by utilising the existing infrastructure. Under the right circumstances, and in certain conditions, it is possible to complete such an upgrade in less than six months. It is a very cost-effective way to increase treatment capacity," concludes Lemberger.

For more information contact:
Ian Lemberger on tel: +27 11 281 3600; email ian.lemberger@veolia.com; or contact Thabo Mogadima on tel:+ 27 11 663 3600; email thabo.mogadima@veolia.com; or go to www.veoliawaterst.co.za

New heavy-duty magnetic flow meter for mining and wastewater treatment

Instrotech representing ELIS, manufacturer and supplier of flow meters, has launched a special type of magnetic flow meter, the Flonet FS10, with an induction sensor for the precise flow measurement of conductive liquids. The FS10 has a special wear-resistant lining made from natural stone and is fitted with Fisher-Rosemont evaluating electronics.

The ELIS FS10 flowmeter is intended for professional flow-rate measurement of electrically conductive fluids, which may include abrasive particles. It has been specifically designed to work in the most stringent of environments: in wastewater treatment plants, industrial plants, as well as dusty, humid or corrosive atmospheres, such as the mining industry for hard-material dredging, the measuring of ash, various types of ore and very dense liquids, with more than 50 % solids.

The FS10's specifications:

- Suitable for pipes: DN100 to DN450 (4" to 18")
- Pressure ranges: 10 & 16 bar
- Design of sensor: wafer or flanged
- Lining: wear-resistant material
- Liquid temperature scale: 0-150°C
- High accuracy: +0,5% in range to 5 to 100%q 3
- Communication interface: HART protocol

For more information and a full specification of the ELIS FLONET FS10 magnetic induction flow meter, contact:
Instrotech on tel: 010 595 1831 or email sales@instrotech.co.za

Globally Harmonised System (GHS) - Labelling of hazardous substances

The Chemical and Allied Industries' Association has extended an invitation to a one-day training course focusing on Globally Harmonised System (GHS) – Labelling of hazardous substances.

Training will be held on the following dates:

- Durban - 20 July 2015 (Durban Country Club)
- Johannesburg - 7 September 2016 (Johannesburg Country Club)

The only prerequisite for the course is Senior Certificate (Grade 12). No other specific pre-requisites are required for this training, but the trainee needs to be familiar with handling and storage of chemicals and related safety, health and environmental requirements.

The Globally Harmonised System of Classification and Labelling of Chemicals (GHS) is a system that requires all companies to follow the same rules and principles when classifying and labelling hazardous chemicals. When a chemical is classified as hazardous, there are specific requirements to follow when transporting, storing and handling the chemical.

The GHS label provides basic safety, health and environmental information of the hazardous chemical including recommendations on protective measures and emergency actions. It serves as a hazard communication tool and assists with transferring essential hazard information from the supplier of a hazardous chemical to the user of the chemical.

The objective of the GHS is to create consistency when providing information on safety, health and environmental matters for hazardous chemicals. In order to establish uniformity, specific requirements have been laid down as to how information on the hazardous chemical label shall be given.

The target audience for this course includes SHEQ managers and risk professionals; technical and logistics personnel; supervisors and other personnel who handle and classify chemicals; and personnel who need to implement GHS.

Aims include:

1. Recognise and group various items found in the learner's context, according to the impact of their material(s) on health and the environment.
2. Read documented information on materials and understand its purpose and use.
3. Understand the physical properties of the materials and relate them to the way the materials occur or are used.
4. Describe the potential impact of the materials on health and the environment, related to their properties.
5. Use materials in the learner's context.
6. Transport, store and care for materials in the learner's context.

To demonstrate achievement of learning objectives of the GHS training, delegates are required to meet the following criteria and/or provide the following evidence during the preparatory, group work, written assessment and workbook exercises:

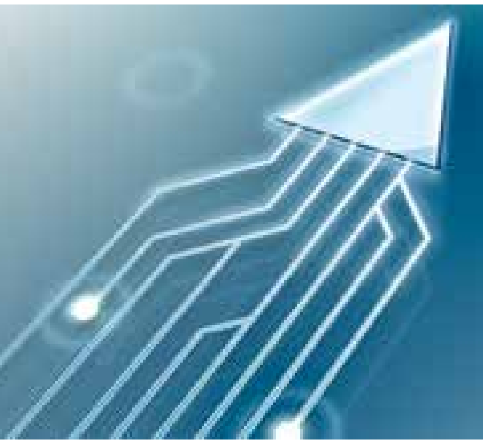
- Be able to recognise and group items found in the learner's context according to the impact of their material/s (eg, hazardous substances or mixtures), on health, safety and the environment.
- Be able to read the documented information (product label) on the hazardous substance or mixture and understand its purpose and use.
- Understand how to group items correctly, and how their component materials (hazardous substance or mixture) should be named correctly using the information on the product label.
- Understand the format/layout and purpose of the documented information (product label) for hazardous substances or mixtures encountered in the learner's context (workplace).

This training Module is in the process of being accredited with CHIETA.

For more information contact:

Brianna Goosen (rcare@caia.co.za)


From Sensor to Boardroom.



Design guidelines **for safety in piping networks**

by Karl Kolmetz and Mee Shee Tiong, both of the KLM Technology Group, and Stephen J Wallace, Wallace Consulting Services, USA

Piping system failures are responsible for many catastrophic accidents in hydrocarbon processing plants. The best tool for preventing future accidents is to review past incidents and incorporate lessons learned into future design and operation of piping systems.

In a hydrocarbon processing plant, the piping network is designed to the most stringent standards and is normally considered the safest part of the plant. However, despite this, reviews of catastrophes indicate that piping system failures represent the largest percentage of equipment failures [1]. Operations, design, and maintenance personnel should understand the potential safety concerns. This article will discuss various case studies that help to illustrate the consequences of inappropriate design, operation, and maintenance of piping systems.

Check valve failures

Check valves are important safety devices in piping. Check valves have been utilised in the process industry for many years to keep material from flowing the wrong way and causing operational or safety concerns. One common mistake is installing the check valve backwards and blocking the process flow. There is normally an arrow on the check valve designating the proper flow direction, indicating the proper installation position. There have been cases where the manufacturer showed the arrow incorrectly, which greatly hindered troubleshooting.

Case 1 – In December 1991, a chemical plant in Saudi Arabia [2] experienced a release of propane gas due to a check valve shaft blowout. The incident followed a process upset in the facility's ethylene plant, where the inadvertent shutdown of a cracked gas compressor resulted in downstream flow instabilities and initiated a 13-hour period of surging in the unit's propane refrigeration compressor.

During this period, the check valves installed in the propane refrigeration compression system slammed closed repeatedly. The shaft of the compressor's third stage discharge valve eventually separated from its disk and was partially ejected from the valve. The shaft was not fully ejected because its path was blocked by an adjacent steam line mere centimetres away from the valve, keeping about 70 mm of the shaft's length within the valve body.

Propane gas began to leak out of the valve around the gap between the shaft and its stuffing box until operators discovered the leak and shut down the compressor. Operators also discovered that the valve's drive shaft counterweights had broken off of the drive shaft and had been propelled approximately 16 m from the valve.

The facility was fortunate that an adjacent steam line kept the shaft from being fully ejected from the valve, thus limiting the leak rate and preventing an accident of potentially greater severity. It was also fortunate that no one was struck by the counterweights when they were propelled from the valve. (See Figure 1 on page 16.)

A subsequent investigation and analysis of the check

valve's internal components revealed that the dowel pin, which secured the drive shaft to the valve flapper, had sheared, and the shaft key had fallen out of its key-way. The investigation report also revealed that facility maintenance records indicated a long history of problems with the check valves installed there. The valves were installed in 1982, and due to continuing valve malfunctions, underwent repair or modification in 1984, 1986, 1987, 1989, and 1990. These repairs and modifications included replacement of damaged counterweight arms, replacement of seals and gaskets, replacement of dowel pins and internal keys, and installation of external shaft 'keepers'.

Case 2 – An incident with a similar failure mechanism occurred in an ethylene plant in Texas in June 1997 [2]. The check valve was on the process gas compressor discharge line, which had high flow, high pressure and high temperature, along with compressor vibration; however, the investigation team found no evidence that these temperature and pressure limits were exceeded at any time prior to or during the accident. The check valve was installed on the fifth stage of the compressor and had an internal diameter of 36 inches and weighed 3,2 tons. The valve had a design limit pressure of 33 barG, and a design limit temperature of 46 °C.

The drive shaft penetrates the pressure boundary through a stuffing box. The exterior portion of the drive shaft is connected to the pneumatic piston and counterweight, and the interior portion of the shaft is coupled directly to the valve disk using a cylindrical hardened steel dowel pin and a steel rectangular bar key. This arrangement provides a counter weight to partially balance the weight of the valve disk, and provides the pneumatic power assist to maintain the valve closed as described above.

This check valve was the same design as the previous check valve and had the same failure mechanism. The pneumatic assist assembly became detached from the check valve, leading to loss of hydrocarbon containment and a major unit fire. The unit was down for several weeks for repair.

This fire resulted in minor process operator injuries, public road closures, and property damage both within the olefin unit and to off-site business. The EPA and OSHA undertook an investigation of this accident because of its severity, its effects on the public, and "the desire to identify those root causes and contributing factors of the event that may have broad applicability to industry, and the potential to develop recommendations and lessons learned to prevent future accidents of this type."

Case 3 – An ethylene plant in Louisiana had a near miss from a check valve failure in 1999. The check valve had an

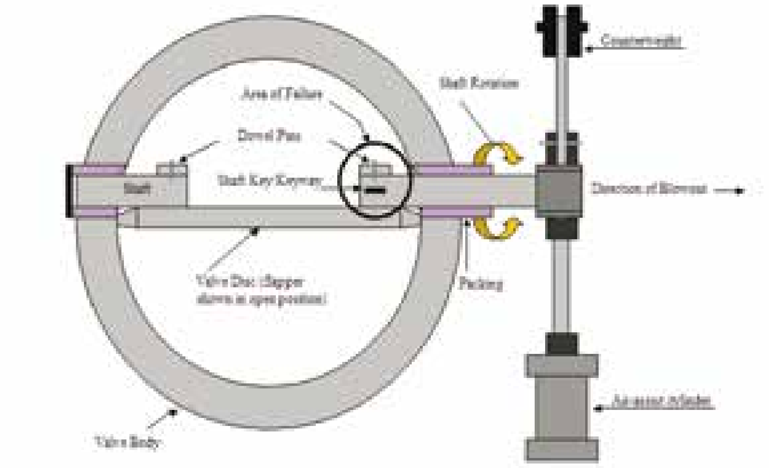


Figure 1: Simplified cross-sectional view of check valve (flow direction is into page)

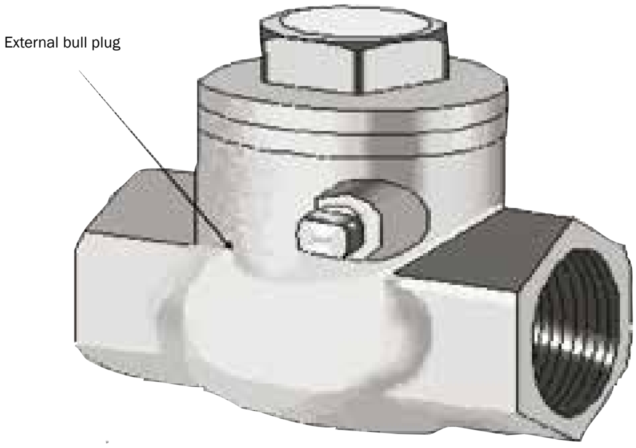


Figure 2: External bull plug

external bull plug, which allowed the check valve swing pin to be installed. The bull plug slowly rotated out over time leading to loss of hydrocarbon containment on a medium pressure ethane feed line. The line was isolated, copious amounts of water were applied to the leak, and fortunately the vapour did not find a source of ignition. (Figure 2.)

This check valve was far away from a source of vibration such as a compressor. The root cause of the incident was not totally identified, but one theory is that normal piping vibration caused the bull plug to rotate. The ethylene plant reviewed all check valves in hydrocarbon service and installed an anti-rotation locking device to prevent the bull plugs from rotating and causing a loss of hydrocarbon containment.

Small bore piping in compressor discharge piping

Case 4 – An ethylene plant in Malaysia had a major near miss from small bore piping on the discharge of a propylene refrigeration compressor in 2002. The compressor discharge piping had very high vibrations from unit commissioning. The original diagnosis of the high vibrations was the piping network, and several solutions were implemented on the piping network without success. The root cause of the high vibrations was eventually found to be the compressor rotor.

One guideline is to restrict the small bore piping to a safe distance from the discharge of the compressor to limit piping fatigue failure. A three quarter inch stub and valve on the fourth stage of the propylene compressor at 15 bar gauge discharge pressure experienced the high vibration from the compressor and failed, leaving an open ¾ inch line. The resulting massive loss of containment went unnoticed because the propylene vapour was at a high temperature 70 °C and did not cause a vapour cloud.

The compressor was shut down and even with the massive loss of containment, greater than 10 tons of propylene in the battery limits of a functioning ethylene plant, the vapour cloud did not find a source of ignition.

Piping low temperature embrittlement

Piping low temperature embrittlement is the loss of ductility, toughness, and impact strength that occurs in some metals at low temperatures. Normal carbon steel piping is rated for -29 °C at atmospheric pressure. This is also about the vaporisation temperature of liquid propane and propylene (-45 °C). In units with propane and lighter components, there is the possibility to exceed the low temperature limit of normal carbon steel.

Carbon steel piping is typically used in services with temperatures above -23 to -29 °C. At temperatures below this, normal carbon steel loses ductility and strength and the metal becomes brittle and can be susceptible to brittle fracture. Impact testing can certify the use of carbon steel piping in services as cold as -45 °C, and is named “killed” carbon steel.

John A. Reid [4] put together a list of ethylene plant hydrocarbon incidents. He noted four incidents where low temperature embrittlement caused line failures. Cases he noted included:

1. 1965 Explosion and Fire due to Cold Brittle Flare Line Fracture at PCI Olefin Unit in Lake Charles, Louisiana.
2. 1966 Flare System Explosion - Monsanto’s Chocolate Bayou Olefin Unit
3. 1975 DePropanizer - Explosion in a Naphtha Cracking Unit – Dutch State Mines – 14 fatalities
4. 1989 Cold Brittle Line Fracture Results in Gas Leak, Explosion and Fire at Quantum’s Morris Illinois Ethane/Propane Cracker – two fatalities.

Case 5 – An incident occurred in January 2002 at an ethylene plant in Louisiana. The ethylene plant published the incident in the AIChE Ethylene Producers Conference in 2004 [5] and in a conference in Asia in 2002 [6] to increase safety awareness in the process industry.

The event sequence was as follows: the ethylene product went off specification on acetylene and initiated flaring of liquid ethylene product. The acetylene converter outlet analyser was in error, which allowed the ethylene splitter inventory to be contaminated with acetylene prior to corrective action being taken. A portion of the off spec liquid ethylene product was consumed by internal customers, with the balance being flared via the cold flare drum. Malfunction of the cold flare drum vaporiser and super heater allowed the cold flare drum overhead line temperature to fall sharply.

A low temperature alarm sounded as the overhead flare line temperature fell to -18 °C, and the thermocouple went bad at a value of -25 °C. With the cold flare drum overhead line running below its minimum design temperature of -23 °C, the pipe ruptured, resulting in loss of hydrocarbon containment. The hydrocarbon released found an ignition source, resulting in an explosion and fire.

Pipe rupture

The plant was an olefins ethane cracker with a flow scheme of the demethaniser first and a back end acetylene converter. An off-spec event on 1/4/02 at the acetylene converter led to flaring of ethylene product via the unit cold flare drum. Through a sequence of events, the cold flare drum overhead line fell to below its minimum design metallurgy temperature. On 1/5/02, the cold temperatures led to brittle fracture of the cold flare drum overhead line, loss of hydrocarbon containment, and ultimately an explosion and fire.

Cold flare drum

The cold flare drum contents are vaporised and super-heated with a closed loop propanol system. Heat is supplied to the propanol system with 70-pound steam, which is about 132 °C. The vaporiser and super-heater heats the cold flare drum material from cryogenic temperatures to above the minimum design metal temperature of the cold flare drum carbon steel overhead piping.

The root causes of the incident included the vaporiser and super-heater exchanger fouling, which had reduced heat transfer capacity of the cold flare system. Once flaring began, the cold flare drum overhead line experienced low temperature, resulting in the brittle fracture of the cold flare drum overhead piping, due to operation below the minimum design temperature of the carbon steel line.

The final stress that ultimately caused the brittle fracture of the piping has not been identified, but could have been any number of internal or external stresses. 1) External stress - Hard rain that came at the time of event; 2) Internal stress - Contraction of the cold flare line due to temperature gradient.

The incident caused an explosion and damage to equipment, but no first aid or recordable incidents to personnel were reported. As a result of the incident, the ethylene plant upgraded many carbon steel systems to stainless steel, which has a lower temperature limit.

Guidelines

These case studies provide many insights into piping safety concerns. Petroleum plant personnel should review these case studies and consider implementing the guidelines, where applicable, for increased safety.

1. Check valve installations: Review large and small check valve installations for potential release scenarios. For large high-pressure check valves, review the internals and the cited case study failure mechanism. Install anti-rotation devices on external bull plugs.
2. Small bore piping on compressor discharge piping: Review and reduce small-bore piping on compressor discharge piping. One guideline is to restrict the small-bore piping to a safe distance from the discharge of the compressor to limit piping fatigue failure.
   Vibration levels imparted to the piping adjacent to compressor/pump units should be monitored and managed. Piping configurations potentially at risk should be investigated and modified to manage any vibration, which may impact the pipe and associated junctions.
3. Low temperature embrittlement concerns: Understand piping low temperature embrittlement concerns and potential release scenarios. There have been multiple piping failures and hydrocarbon releases from piping low temperature embrittlement. Review the process temperatures and the piping metallurgies where the temperatures are below -45 °C, which is approximately liquid propane/propylene.

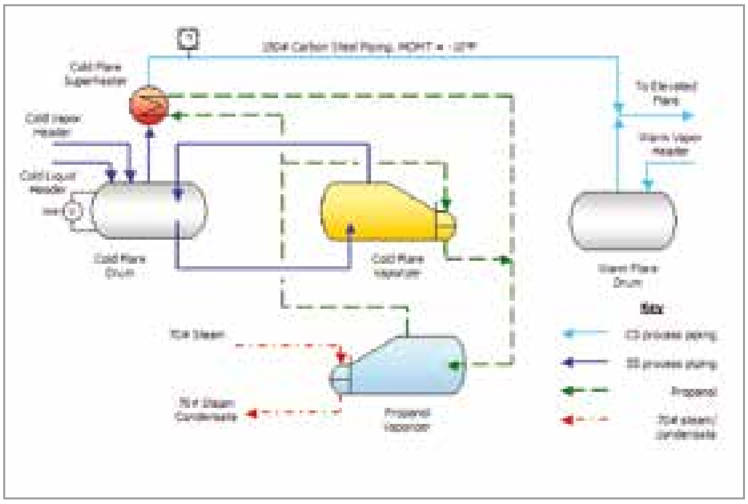


Figure 3: Flare drum system overview original system

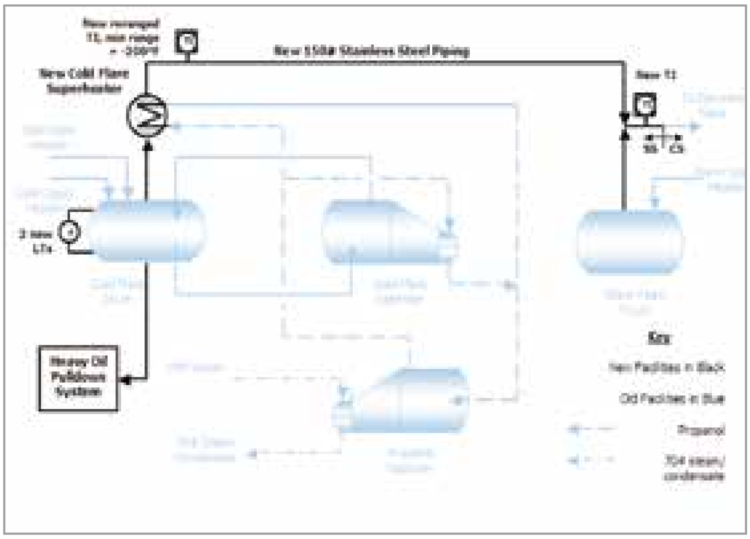


Figure 4: Flare drum system modifications

Conclusions

Piping network safety is a concern for all hydrocarbon producers even though piping may be the considered the safest part of the plant. The authors' goals and hopes are that these case studies and guidelines provide additional safety insight into piping design, operation and prevention of future incidents.

References

References for this article are available from the editor at chemtech@crown.co.za

Fuchs Lubricants South Africa wins big supply tenders

Fuchs Lubricants South Africa has won both Mercedes Benz and Scania Trucks private label OEM supply tenders.

John Anderson, automotive sales manager at Fuchs Lubricants South Africa, commented: "Mercedes Benz is the world's oldest automotive brand and the world's leading luxury vehicle supplier. Swedish Truck and Bus manufacturer, Scania, markets their commercial vehicles across the African continent with market leadership positions in numerous African countries.

"The success of Fuchs Lubricants South Africa in these tenders can be attributed to a number of factors. Both tenders were multi-country contracts with Mercedes Benz tendering for ten countries across Africa, South East Asia and Australasia. Scania tendered all six southern Africa countries and awarded all countries to Fuchs Lubricants South Africa.

"Another factor was our communication between global tender teams and local tendering countries giving the ability to respond quickly and accurately to changing tender demands," he said.

Anderson added that Fuchs Lubricants South Africa's local manufacturing facilities were also recognised. Local manufacture means shorter lead times and quicker response to changing order patterns with product quality levels required to be the same throughout the world.

"Mercedes Benz immediately felt the benefit from day one, with demand starting off at 15 tons per day and increasing to a monthly average of 18 tons per day. This makes it one of the biggest direct accounts Fuchs Lubricants South Africa has ever supplied," said Anderson.

"Scania started with a soft launch from early April and steady demand. The Scania tender has the added challenge of delivery through our partners in neighbouring countries, all of whom were supportive in assisting us to deliver Scania product to remote locations where Scania services its vehicles."

Mercedes Benz and Scania join an extensive list of other OEM private label products that are produced at Fuchs Lubricants South Africa including John Deere, Honda, Suzuki, Kubota and MTU.

For more information contact:
John Anderson on tel: +27 11 565-9600; email Johna@fuchsoil.co.za or go to www.fuchsoil.co.za

The Society of Petroleum Engineers' Annual Technical conference 2016

The Society of Petroleum Engineers (SPE) recently announced that its Annual Technical Conference and Exhibition (ATCE) will take place under the patronage of the Vice President and Prime Minister of the United Arab Emirates and Ruler of Dubai, His Highness Sheikh Mohammed bin Rashid Al Maktoum.

ATCE will take place at the Dubai World Trade Centre from 26–28 September 2016, the first time that it will be held in the Middle East in its 92-year history.

This is by no means the only break from tradition. Among the new features at this year's ATCE are two Plenary Sessions, in which industry leaders will explore the conference theme 'E&P 2.0: Transforming and Shaping the Future.' Six interactive Panel Sessions will offer a chance to hear from IOCs, NOCs and service providers on topical industry issues including talent management, improving efficiency, project management, collaboration and innovation.

The conference also will offer 13 Special Sessions, a mixture of technical and strategic in nature, which will address challenges, opportunities, innovative and emerging technologies from around the world.

There will be some familiar features as well, principally a technical programme of the highest calibre. Over 2 000 papers were submitted for this year's event, of which 540 will be presented in 58 technical sessions, covering all phases of oil and gas exploration and production.

ATCE is expecting more than 10 000 attendees, who will also have the opportunity to visit a world-class exhibition with more than 250 exhibitors showcasing state-of-the-art technologies.

Bearing in mind the increased focus on costs across the oil and gas industry at present, ATCE has secured discounted rates with Emirates, its official airline partner, as well as with 23 hotels in Dubai.

For more information and to register:
please go to www.spe.org/atce

Food waste to value-added product process – **Continuous distillation on a budget**

by Willie Coetzee

In our consumerist society with its desire for perfect products, most consumers are generally not aware of the wastage they are causing by rejecting less than 'perfect' goods, such as broken chocolate bars.

So called 'damaged' products, or those that have exceeded their sell-by date, cannot be sold anymore and must be returned to the manufacturer, who in turn contracts a waste treatment company to collect and dispose of the 'food waste'. Value chains where damage to goods can potentially occur include: manufacturing; transportation; intermediary storage; sales; and in the case of online shops, final delivery.

The wastage associated with consumerism is what drove my partner, Neels Welgemoed, and me to start a sustainability venture which would later become TerraServ (Pty) Ltd, a South African-based company. We developed and piloted a process to convert food waste into value-added products such as hand sanitisers, whiteboard cleaners and window cleaners, which sold as our EcoEth™ range of products. Wasted foodstuffs are used to create products, which in turn are sold, and hence help stimulate the economy.

We also noticed that many products contain hazardous components either associated with the active ingredients, or originating from the production process of an apparently non-hazardous active ingredient. Applying our knowledge, accumulated from working in the petrochemical industry for years, we made one of goals to keep everything as 'natural' as possible while maintaining their efficacy.

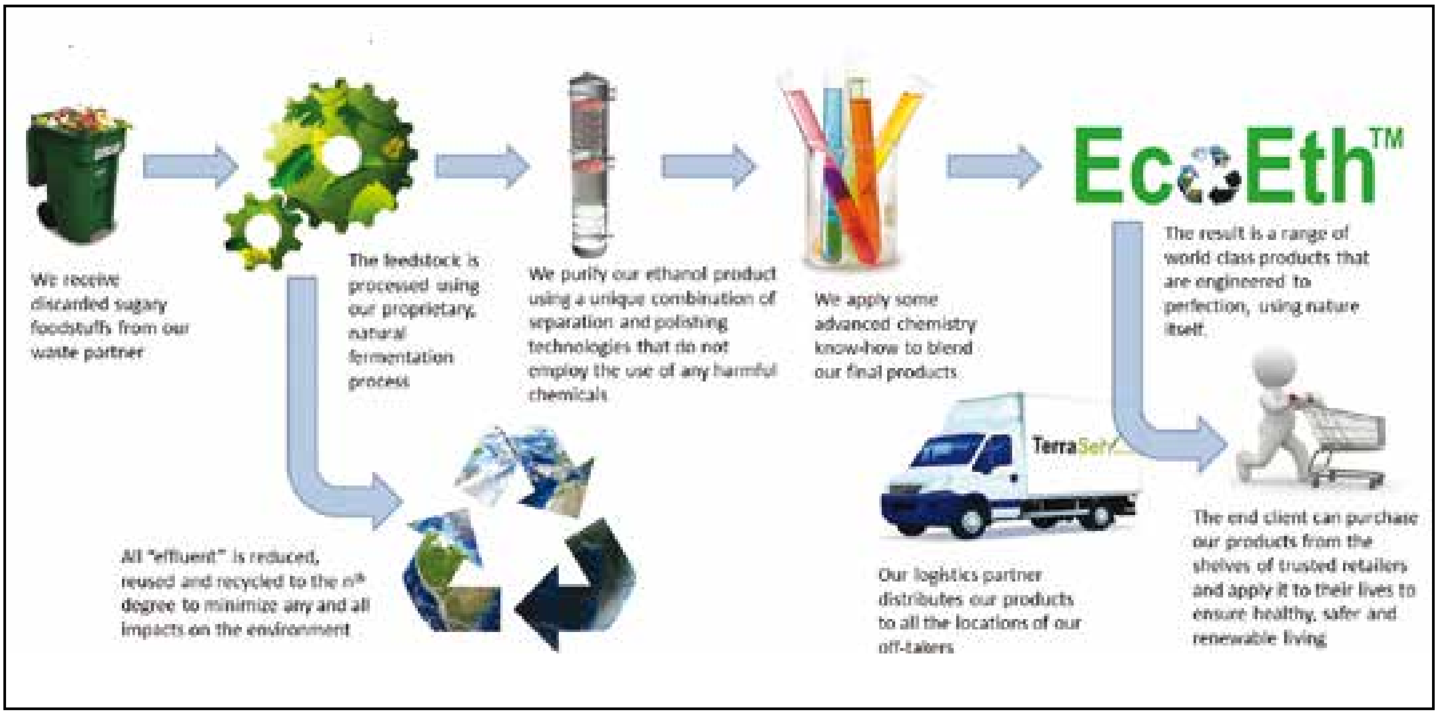
This article focuses, in the main, on the practical experience gained in wrestling with a continuous distillation column that had little or no electronic controls. Batch distillation, as opposed to fully continuous distillation, would have solved many of these issues, however, it was of cardinal importance to me that I went through the exercise in order to learn the best way not to do continuous distillation when you are on a budget.

Overall process

Our process involves our proprietary fermentation system, including vacuum extraction of ethanol as our first purification step. Next we apply packed bed distillation, avoiding extractive distillation as we do not wish to introduce harmful solvents into our products. (See business flow diagram).

Before final blending and packaging we filter our product to remove any remnant odours. Our process is built upon efficient use of resources and hence we recycle water as effectively as possible. In addition to this we aim to implement an optimum amount of solar heating to further reduce our carbon footprint, which is already positive due to the significant reduction in CO_2 equivalent emissions that our process has on the lifecycle of sugary food waste.

Damaged food (waste) becomes products such as sanitisers (left) and cleaners.



Business flow diagram

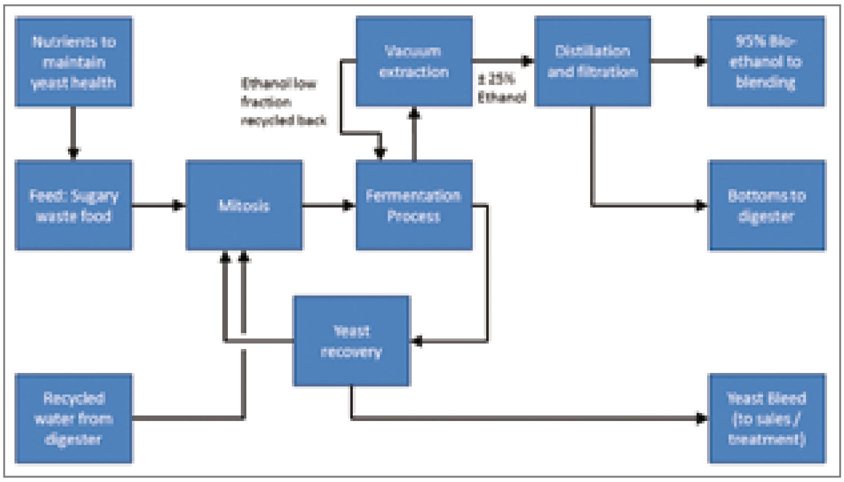


Figure 1: High level process block flow diagram

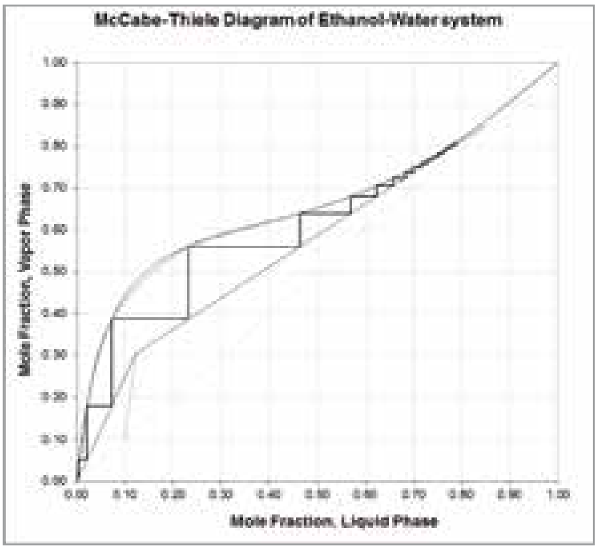


Figure 2: Example of a McCabe-Thiele diagram of an ethanol-water system, indicating typical operating lines and stages.

Distillation 101

No doubt most chemical engineers have had good, hands on exposure to distillation, most of which, I believe, is obtained from industry wherein multiple layers of controls are available to ensure the column does what it should. Our business was started using our own funds and hence we had to cut costs as far as possible. Even when progressing to the next step, which is commercialisation, we wanted to keep the capital to a minimum which meant that the pilot plant could not be fitted with electronic controls and the commercial plant would only feature the bare minimum of controls.

Operating a continuous distillation column without automated controls is challenging to say the least. The benefit, however, is that you very quickly realise where you really need controls, as opposed to where it would be 'nice to have' controls.

I went through the normal motions of designing and sizing a column, including compilation of VLE data, determining the required theoretical stages to achieve the desired separation, doing the capacity calculations to determine the required column diameter and then translating this all to column height, based on the dimension range of my column (HETP = ±1 – 2 Column Diameters).

Over and above the differences I observed between hydraulic calculations and actual performance (due to using small bore pipes), one of the biggest mistakes I made was with regard to the expected heat loss from the column. Due to the large area to volume ratio of the system I had a lot more heat loss than expected, with the result that I did not obtain the required reflux rate and hence sacrificed on separation efficiency. As Norman Lieberman would say, "reflux comes from the reboiler", so I corrected the issue by increasing my reboiler duty and ensuring that I insulated my system more diligently.

Controlling separation

For my initial design I used a polycarbonate tube for the column since I did not have any controls on the column and therefore needed to operate the column using a visual aid. The question however arises: how does the transparent column help you optimise separation? What would your control levers be? Typically, a range of temperatures, temperature differences and compositions would be controlled and manipulated to achieve good performance. I had, however, very little to work with. I had temperature measurements on the boiler, the overheads of the column and the condenser, but I did not have efficient means to control these variables in real time.

Added to this, I was working with a fairly binary system, not a petroleum feedstock which has a range of different components and hence reacts well to adjustment of above-mentioned temperatures. The fact is that I wanted to ensure that my boiler temperature was as close to 100 ˚C as possible (which it naturally reaches when attaining good separation), my overheads as close to the azeotropic boiling point of ethanol/water solutions as possible, which is around 78 ˚C, and my condenser operating between the latter-mentioned temperature and that of methanol, to ensure that I could purge any small amounts of methanol that might have formed in the fermentation process.

I was left with a grand total of one operating lever: the heat input. Reflux is the one variable (save for changing the column length) that affects separation efficiency most. With my fairly binary system, the reflux was the main variable that affected efficiency and as I mentioned previously, reflux comes from the reboiler, so, logically, reboiler duty was the only variable that I could use to control my system, given my constraints. How to do this without online analysers becomes a horse of a different colour.

Conventional wisdom suggests that a packed column should be operated at a vapour velocity of roughly 40 – 80 % that of the flooding velocity. The most direct measurement of this would be pressure drop over the column, as a higher vapour linear velocity would induce increased pressure drop over the packing. When referring to Lieberman's books on process trouble shooting and optimisation, he calls this the "optimum point", or "incipient flooding point" of the column, ie, the point where increased reflux and reboiler duty increases do not improve the fractionation or even worsen it. As Lieberman says: This is typically reached at 80 – 90 % of the calculated jet flooding point and most columns are most efficient at 60 – 70 % of flood.

Incidentally, some research revealed that the common method of controlling columns during the days when automated controls and online analysers were not as prevalent, was to control heat input using ΔP as a measured variable. This is certainly not the most energy-efficient way of controlling a column, however, when you have little or few controls, I can definitely vouch for the effectiveness of this method. When one considers Figure 3, it is obvious that this regime is somewhat unstable, however, it is also obvious that this is where the column will separate best. From personal experience, I was able to operate at this point with only manual control, albeit very involved manual control. In short, it should be very manageable with a basic electronic control system.

I have posed the question of how to practically operate a column at the "optimum point", given that you do not have any automated controls, as well as whether the column would be controllable using this strategy. If the ΔP is an indirect indication of the vapour flow in the column, then the liquid hold up, or "partial flooding" of the column would be the second order indication of our desired controlled variable.

Using the transparent column, one is able to control the visible loading of the packing by physically monitoring the "liquid level" of the column. We originally used glass marbles as a packing medium, due to the difficulty of sourcing such small amounts of more conventional packing. By manipulating the reboiler heat input, using a variable resistor combined with manual on/off system, I was able to operate the column in a very effective manner.

Taking into consideration the fact that we used sub-optimal packing, had no electronic controls and only used the visually obvious liquid loading of the packing as guideline, I was able to produce ethanol very close to the azeotropic point of roughly 95 % by mass. To be exact, I achieved 93,5 % by mass with this system, which if you consider the McCabe-Thiele diagram earlier included is quite a feat.

The value of piloting

Piloting has to add value to a commercial application for it to be worthwhile. For our venture we experienced several benefits from piloting. These included:

- The ability to perfect the process and to refine designs;
- The possibility of accurately determining required duties and equipment capacities;

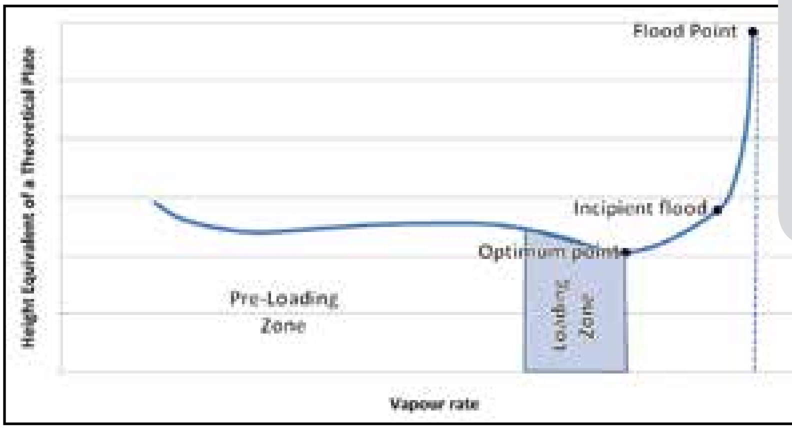


Figure 3: Typical HETP vs vapour rate, indicating pre-loading and loading zones as well as optimum, incipient flood and flood points.

- The ability to develop and test our range of products; and,
- Allowing for the identification of the critical control requirements in terms of our distillation system.

The last-mentioned point becomes very important for this scale of implementation as instrumentation and controls can very easily exceed the costs of equipment. I can confidently say, having manually controlled a fully continuous distillation column, that if I had to rely on a single control loop, that controlling the ΔP over the column using the reboiler heat input would be the bare minimum. Application of this knowledge has enabled us to cut our costs by 30 – 50 % and, in my mind, has proven to be more than worthwhile.

Conclusion

Two main points need to be made: firstly, humankind is an extremely wasteful species, thus ventures such as the one we have embarked on, need the support of consumers in order for the total lifecycle efficiency of goods to be improved. Secondly, I feel it prudent to share our positive experience with process piloting. Front end loading, specifically piloting, even on a small scale, is more often than not value-adding and, if purposefully executed, is never a waste of time. In spite of sometimes seemingly overwhelming obstacles, consistently doing the right thing is working well for us. We are currently in the process of obtaining investment to take our initiative to the next level and trust that our products will be on every shelf in South Africa sooner, rather than later.

Products on the shelf at Super Spar in Gansbaai.

Enzyme-aided recovery methods' help in extracting protein from rapeseed press cake

One third of cold-pressed rapeseed press cake consists of nutritionally valuable protein that could have many other uses besides animal feed. For her doctoral dissertation, Katariina Rommi, Research Scientist at VTT Technical Research Centre of Finland, developed enzyme-aided methods for rapeseed protein enrichment. Her study also provides estimates of the costs of different protein extraction schemes.

Katariina Rommi, MSc, Research Scientist at VTT *(photo: VTT)*

The purpose of Katariina Rommi's doctoral dissertation was to develop simple, water-saving methods for turning vegetable oil industry co-streams into protein ingredients suitable for food or cosmetic products and thus help to satisfy the increasing global demand for protein.

Globally, around 34 million tonnes of rapeseed press cake is produced annually as rapeseed oil by-product. At present, it is primarily used as feed for production animals. In Finland, the majority of oil mills use cold pressing in rapeseed oil production. The by-product of this method, rapeseed press cake, contains between 32 and 36 % of nutritionally valuable protein. The marketing of rapeseed press cake as novel food was approved by the EU in 2014.

Several technologies based on alkaline or saline extraction have been developed for enrichment of rapeseed protein, but high energy and water consumption due to dilute conditions and multiple processing steps limit their profitability.

As part of the work done for her doctoral dissertation, Katariina Rommi developed enzyme-assisted methods for the enrichment of rapeseed protein and studied the factors influencing protein extractability and the properties of the obtained protein-rich fragments. An enzyme that breaks down pectin was shown to be particularly effective in facilitating protein extraction at reduced water content and without chemicals such as alkali or salt.

A techno-economic evaluation of different extraction schemes also suggested substantial reduction of energy costs when the extraction was carried out at 20 % solid content. The results indicate that enzyme-aided methods are well suited to rapeseed enrichment and may offer a techno-economically feasible alternative to alkaline or saline extraction.

The results may be applied to the manufacturing of rapeseed-based protein ingredients in food, feed and other industries. In the study, bioactive rapeseed peptide fragments were also extracted from rapeseed press cake by proteolytic enzyme treatment; these fractions have novel application potential in skin care products.

The dissertation is available online at http://www.vtt.fi/inf/pdf/science/2016/S130.pdf

For more information, please contact:
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FILTECH 2016 October 11–13, 2016

The FILTECH 2016 Conference features close to 200 technical papers, a Plenary Lecture and six Keynote Lectures presented by leading experts. Delegates profit from high-level knowledge transfer and learn about future trends and perspectives

The Conference will feature once again the latest advances and techniques in liquid/solid and gas/particle separation (dust, gas and air filtration) in three days of in-depth exposure. Technology and know-how transfer are the main focuses.

An exciting programme gives a representative cross-section of the different procedures and appliances of separation technology as well as across the industry, about the applications, from the preparation of mineral raw materials, the chemistry, environmental technology and water purification down to the pharmacy and biotechnology. The latest results from basic research, innovative equipment-based solutions and procedures will also be presented.

FILTECH 2016 will be held again at the venue Koelnmesse in Cologne. Due to Koelnmesse's central location, which is conveniently situated for all transport links, visitors can quickly reach the exhibition centre by car, train and plane. High-speed ICE trains connect the airports in Frankfurt (FRA), Düsseldorf (DUS), Cologne-Bonn (CGN) directly to the exhibition center via Köln Messe/Deutz station.

Registration includes lunch and refreshments during breaks; entrance to the FILTECH 2016 Exhibition (October 11 – 13, 2016); the FILTECH 2016 Exhibition Catalogue; and a welcome reception on October 11, 2016.

The Conference registration additionally includes Conference Proceedings featuring all papers in an abstract book and full paper versions on an USB stick, as well as a Cologne Public Transport Ticket for the period October 11 – 13, 2016.

The Short Course registration includes extensive Short Course Notes and a Cologne Public Transport Ticket for October 10 – 13, 2016.

Register online at:
www.filtech.de

Ionic Liquids conference

The 3rd International Conference on Ionic Liquids in Separation and Purification Technology (ILSEPT) will take place from 8 - 11 January, 2017 at the Renaissance Kuala Lumpur Hotel, Kuala Lumpur, Malaysia.

The aim of the 3rd International Conference is to provide a forum for researchers in academia and industry to share and discuss their 'cutting edge' results on the use of ionic liquids in separation applications.

The scientific program will offer plenary lectures, submitted oral presentations and poster sessions. Outside the session lecture theatres, you will also find numerous exhibitors presenting their contributions.

Present your research; Submit abstracts by 15 July 2016. Abstracts for oral and poster presentations are invited and should be submitted using the online abstract submission system.

For more information on the conference and to sign up for email updates, visit: www.ilsept.com.

Tasteful water: iron control optimised

Endress+Hauser complements its analyser portfolio for drinking water and process water monitoring. The new Liquiline System CA80FE colorimetric analyser offers precise monitoring of dissolved iron content in water and supports plant managers in complying with stipulated limit values.

Drinking water not only has to be free from harmful substances and tolerable but must be aesthetically pleasing and tasteful. With the Endress+Hauser Liquiline System CA80FE, waterworks and plant managers can rely on high-precision online monitoring of iron. The analyser uses the standardised ferrozine method to deliver regulation-compliant measured values and features detailed logbooks that allow comprehensive documentation of the iron values. Plant managers are well prepared for audits and can prove compliance to water authorities at any time.

Iron removal is achieved by oxidising iron to form iron oxide hydrate which is insoluble and can be removed by filtration or sedimentation. Liquiline System CA80FE monitors the iron removal online and delivers measured values fast – helping to optimise the control of air blowers and thus save energy in the oxidation process

Liquiline System analysers are designed with highly precise dispensers for reagent and standard dosing guaranteeing reduced consumption and low operating costs. Automatic cleaning and calibration functions ensure that the analyser and its sample preparation and reagents work reliably and without manual intervention over a longer period of time. Maintenance tasks can be carried out easily and with minimal tools, reducing maintenance costs and increasing process uptime.

The self-priming version of Liquiline System CA80 is the best choice for particle-free water. It is ready for operation without any additional settings. For applications where sample preparation is needed, the CAT810/ CAT820 sample preparation systems are available. They are fully controlled by the analyser via Memosens communication und thus easy to commission and operate.

For more information contact: Jan Swart on tel: +27 11 262 8000;
email Jan.Swart@za.endress.com or go to http://bit.ly/1SPqnDx or www.za.endress.com

The effects of **atomic radiation**

The United Nations Scientific Committee on the Effects of Atomic Radiation undertook a broad review of the sources and effects of ionising radiation. The sessions of the Committee were attended by representatives of the World Health Organization and the International Atomic Energy Agency.

Also represented were the International Commission on Radiation Units and Measurements and the International Commission on Radiological Protection. New challenges as regards global levels of radiation exposure continue to arise and new biological information on the effects of radiation exposure is becoming available. Moreover, the potential risks from low-level radiation exposure, that is, exposure to radiation comparable with natural background radiation, are the cause of lively debate and controversy. The Committee responded to those challenges and will do so further with new initiatives to be included in its future assessments of radiation sources, levels and effects.

Governments and organisations throughout the world rely on the Committee's evaluations of the sources and effects of radiation as the scientific basis for estimating radiation risk, establishing radiation protection and safety standards and regulating radiation sources. Within the United Nations system, those estimates are used by the International Atomic Energy Agency in discharging its statutory functions of establishing standards for the radiation protection of health and providing for their application. The Committee is proposing a renewed programme of work to fulfil its obligations to the General Assembly.

The effects of radiation exposure

Radiation exposure can damage living cells, causing death in some of them and modifying others. Most organs and tissues of the body are not affected by the loss of even considerable numbers of cells. However, if the number lost is large enough, there will be observable harm to organs that may lead to death. Such harm occurs in individuals who are exposed to radiation in excess of a threshold level. Other radiation damage may also occur in cells that are not killed but modified. Such damage is usually repaired. If the repair is not perfect, the resulting modification will be transmitted to further cells and may eventually lead to cancer. If the cells modified are those transmitting hereditary information to the descendants of the exposed individual, hereditary disorders may arise.

Radiation exposure has been associated with most forms of leukaemia and with cancers of many organs, such as lung, breast and thyroid gland. However, a small addition of radiation exposure (eg, about the global average level of natural radiation exposure) would produce an exceedingly small increase in the chances of developing an attributable cancer. Moreover, radiation-induced cancer may manifest itself decades after the exposure and does not differ from cancers that arise spontaneously or are attributable to

other factors. The major long-term evaluation of populations exposed to radiation is the study of the approximately 86 500 survivors of the atomic bombings of Hiroshima and Nagasaki, Japan. It has revealed an excess of a few hundred cancer deaths in the population studied. Since a significant number of that population are still alive, additional study is necessary in order to obtain the complete cancer experience of the group.

Radiation exposure also has the potential to cause hereditary effects in the offspring of persons exposed to radiation. Such effects were once thought to threaten the future of the human race by increasing the rate of natural mutation to an inappropriate degree. However, radiation-induced hereditary effects have yet to be detected in human populations exposed to radiation, although they are known to occur in other species.

Levels of radiation exposure

Everyone is exposed to natural radiation. The natural sources of radiation are cosmic rays and naturally occurring radioactive substances existing in the Earth itself and inside the human body. A significant contribution to natural exposure of humans is due to radon gas, which emanates from the soil and may concentrate in dwellings. The level of natural exposure varies around the globe, usually by a factor of about 3. At many locations, however, typical levels of natural radiation exposure exceed the average levels by a factor of 10 and sometimes even by a factor of 100.

Human activities involving the use of radiation and radioactive substances cause radiation exposure in addition to the natural exposure. Examples are the mining and use of ores containing naturally radioactive substances and the production of energy by burning coal that contains such substances. Nuclear power plants and other nuclear installations release radioactive materials into the environment and produce radioactive waste during operation and on their decommissioning. There are, however, strict emission standards which will be the subject of a later article.

Such human activities generally give rise to radiation exposures that are only a small fraction of the global average level of natural exposure. The medical use of radiation is the largest and a growing man-made source of radiation exposure. It includes diagnostic radiology, radiotherapy, nuclear medicine and interventional radiology. The average levels of radiation exposure due to the medical uses of radiation in developed countries is equivalent to approximately 50 % of the global average level of natural exposure.

Radiation exposure also occurs as a result of occupational

Table 1: Average radiation dose from natural sources

Source	Worldwide average annual effective dose (mSv)	Typical range (mSv)
External exposure Cosmic rays Terrestrial gammarays	0,4 0.5	0,3-1,0 [a] 0.3-0.6 [b]
Internal exposure Inhalation (mainly radon) Ingestion	1,2 0.3	0,2-10 [c] 0.2-0.8 [d]
Total	2,4	1-10

a. Range from sea level to high ground elevation.

b. Depending on radionuclide composition of soil and building materials.

c. Depending on indoor accumulation of radon gas.

d. Depending on radionuclide composition of foods and drinking water.

Table 2: Annual per caput effective doses in year 2000 from natural and man-made sources

Source	Worldwide annual per caput effective dose (mSv)	Range or trend in exposure
Natural background	2.4	Typically ranges from 1-10 mSv, depending on circumstances at particular locations, with sizeable population also at 10-20 mSv.
Diagnostic medical examinations	0.4	Ranges from 0.04-1.0 mSv at lowest and highest levels of health care Has decreased from a maximum of 0.15 mSv in 1963. Higher in northern hemisphere and lower in southern hemisphere
Atmospheric nuclear testing	0.005	Has decreased from a maximum of 0.04 mSv in 1986 (average in northern hemisphere). Higher at locations nearer accident site
Chernobyl accident	0.002	Has decreased from a maximum of 0.04 mSv in 1986 (average in northern hemisphere). Higher at locations nearer accident site
Nuclear power production	0.0002	Has increased with expansion of programme but decreased with improved practice

activities. It is incurred by workers in industry, medicine and research using radiation or radioactive substances, as well as by passengers and crew during air travel. It is very significant for astronauts.

The average level of occupational exposures is generally similar to the global average level of natural radiation exposure. The exposure of workers is restricted by internationally recognised limits, which are set at around ten times the average exposure to natural radiation.

Sources of radiation exposure

Ionising radiation represents electromagnetic waves and particles that can ionise, that is, remove an electron from an atom or molecule of the medium through which they propagate. Ionising radiation may be emitted in the process of natural decay of some unstable nuclei or following excitation of atoms and their nuclei in nuclear reactors, cyclotrons, x- ray machines or other instruments. For historical reasons, the photon (electromagnetic) component of ionising radiation emitted by the excited nucleus is termed gamma-rays and that emitted from machines is termed x-rays. The charged particles emitted from the nucleus are referred to as alpha particles (helium nuclei) and beta particles (electrons).

The process of ionisation in living matter necessarily changes atoms and molecules, at least transiently, and may thus damage cells. If cellular damage does occur and is not adequately repaired, it may prevent the cell from surviving or reproducing or performing its normal functions. Alternatively, it may result in a viable but modified cell.

The basic quantity used to express the exposure of material such as the human body is the absorbed dose, for which the unit is the gray (Gy). However, the biological effects per unit of absorbed dose varies with the type of radiation and the part of the body exposed. To take account of those variations, a weighted quantity called the effective dose is used, for which the unit is the sievert (Sv). In reporting levels of human exposure, the term effective dose is usually used. In the present report, both the absorbed dose and the effective dose are usually simply called "dose", for which the units provide the necessary differentiation. A radioactive source is described by its activity, which is the number of nuclear disintegrations per unit of time. The unit of activity is the becquerel (Bq). One becquerel is one disintegration per second.

To evaluate the effects of exposing a defined population group, the sum of all doses acquired by the members of the group, termed the "collective dose" (in units of man Sv), may be used. The value of the collective dose divided by the number of individuals in the exposed population group is the per caput dose, in Sv.

Natural radiation exposures

All living organisms are continually exposed to ionising radiation, which has always existed naturally. The sources of that exposure are cosmic rays that come from outer space and from the surface of the sun, terrestrial radionuclides that occur in the Earth's crust, in building materials and in air, water and foods and in the human body itself.

Based on new information and data from measurements and on further analysis of the processes involved, the components of the exposures resulting from natural radiation sources have been reassessed and included here.

The annual worldwide per caput effective dose is determined by adding the various components, as summarised in Table 1. The annual global per caput effective dose due to natural radiation sources is 2,4 mSv. However, the range of individual doses is wide. In any large population about 65 % would be expected to have annual effective doses between 1 mSv and 3 mSv, about 25 % of the population would have annual effective doses less than 1 mSv and 10 % would have annual effective doses greater than 3 mSv.

Man-made environmental exposures

Releases of radioactive materials to the environment and exposures of human populations have occurred in several activities, practices and events involving radiation sources. The main man-made contribution to the exposure of the world's population has come from the testing of nuclear weapons in the atmosphere, from 1945 to 1980.

A continuing practice is the generation of electrical energy by nuclear power reactors. Assuming this practice of generation lasts for 100 years, the maximum collective dose can be estimated from the cumulative doses that occur during the period of the practice. The normalised 100-year truncated

figure is 6 man Sv per gigawatt year. Assuming the present annual generation of 250 gigawatt years continues, the truncated collective dose per year of practice is 1 500 man Sv to the world population, giving an estimated maximum per caput dose of less than 0,2 µ Sv per year.

Except in the case of accidents or at sites where wastes have accumulated, causing localised areas to be contaminated to significant levels, there are no other practices that result in important exposures from radionuclides released into the environment.

Medical radiation exposures

The use of ionising radiation for medical diagnosis and therapy is widespread throughout the world. There are significant country-to-country variations in national resources for and practice in medical radiology. In general, medical exposures are confined to an anatomical region of interest and dispensed for specific clinical purposes so as to be of direct benefit to the examined or treated individuals.

Comparison of exposures

Radiation doses from the various sources of exposure received by the world population are compared in Table 2.

By far the greatest contribution to exposure comes from natural background radiation. The annual per caput dose is 2,4 mSv and the range in typical circumstances may be between 1 mSv and 10 mSv.

Radiation-associated cancer

Radiation effects are caused by the damage inflicted in cells by the radiation interactions. The damage may result in cell death or modifications that can affect the normal functioning of organs and tissues. Most organs and tissues of the body are not affected by the loss of even considerable numbers of cells. However, if the number lost becomes large, there will be observable harm to the organ or tissue and therefore to the individual.

Radiobiological effects after low doses of radiation

The UN Committee reviewed the broad field of experimental studies of radiation effects in cellular systems and in plants and animals. Damage to deoxyribonucleic acid (DNA) in the nucleus is the main initiating event by which radiation causes long-term harm to organs and tissues of the body.

Numerous genes are involved in cellular response to radiation, including those for DNA damage repair and cell-cycle regulation. Mutation of those genes is reflected in several disorders of humans that confer radiation sensitivity and cancer proneness on the individuals concerned. For example, mutation of one of many so-called checkpoint genes may allow insufficient time to repair damage, because the cell loses its ability to delay progression in the cell cycle following radiation exposure.

Combined effects

Combined exposures to radiation and other physical, chemical or biological agents in the environment are a characteristic of life. Therefore, in spite of the potential importance of combined effects, results from assessments of the effects of single agents on human health are generally deemed applicable to exposure situations involving multiple agents.

Because exposure to both cigarette smoke and radon is so prevalent, that combined effect is of special importance.

The Chernobyl accident

The UN Committee gave special attention to the accident at the Chernobyl nuclear reactor that occurred on 26 April 1986. It was the most serious accident ever to occur in the nuclear power industry. The reactor was destroyed in the accident, considerable amounts of radioactive materials were released to the environment and many workers were exposed to high doses of radiation that had serious, even fatal, health consequences.

Release of radionuclides

The accident at the Chernobyl reactor happened during an experimental test of the electrical control system as the reactor was being shut down for routine maintenance. The operators, in violation of safety regulations, had switched off important control systems and allowed the reactor to reach unstable, low-power conditions. A sudden power surge caused a steam explosion that ruptured the reactor vessel, allowing further violent fuel-steam interactions that destroyed the reactor core and severely damaged the reactor building.

It is noteworthy that an earlier accident in 1979 at the Three Mile Island reactor in the United States of America also resulted in serious damage to the reactor core but without a steam explosion. In that case, however, the containment building surrounding the reactor prevented the release of all but trace amounts of radioactive gases. The Chernobyl reactor lacked the containment feature. Following the explosions, an intense graphite fire burned for ten days. Under those conditions, large releases of radioactive materials took place.

The deposition of radionuclides was governed primarily by precipitation occurring during the passage of the radioactive cloud, leading to a complex and variable exposure pattern throughout the affected region.

Exposure of individuals

The radionuclides released from the reactor that caused exposure of individuals were mainly iodine-131, caesium-134 and caesium-137. The isotopes of caesium have relatively longer half-lives. These radionuclides cause longer term exposures through the ingestion pathway and through external exposure from their deposition on the ground. Many other radionuclides were associated with the accident, which have also been considered in the exposure assessments.

Average doses to those persons most affected by the accident were about 100 mSv for 240 000 recovery operation workers, 30 mSv for 116 000 evacuated persons and 10 mSv during the first decade after the accident to those who continued to reside in contaminated areas. The exposures were much higher for those involved in mitigating the effects of the accident and those who resided nearby.

Health effects

The Chernobyl accident caused many severe radiation effects almost immediately. Of 600 workers present on the site during the early morning of 26 April 1986, 134 received high doses (0,7-13,4 Gy) and suffered from radiation sickness. Of these, 28 died in the first three months and another two soon afterwards. In addition, during 1986 and 1987, about 200 000 recovery operation workers received doses of between 0,01 Gy and 0,5 Gy.

Apart from the increase in thyroid cancer after childhood exposure, no increases in overall cancer incidence or mortality have been observed that could be attributed to ionising radiation. The risk of leukaemia, one of the main concerns (leukaemia is the first cancer to appear after radiation exposure owing to its short latency time of 2-10 years), does not appear to be elevated, even among the recovery operation workers.

There is a tendency to attribute increases in the rates of all cancers over time to the Chernobyl accident, but it should be noted that increases were also observed before the accident in the affected areas.

The present understanding of the late effects of protracted exposure to ionising radiation is limited, since the dose-response assessments rely heavily on studies of exposure to high doses and animal experiments; extrapolations are needed, which always involves uncertainty.

This article is based on the 'Report of the United Nations Scientific Committee on the Effects of Atomic Radiation' to the General Assembly. The 1993, 1994 and 1996 reports, with scientific annexes, were published as Sources and Effects of Ionizing Radiation (United Nations publication)

The 1993, 1994 and 1996 reports, with scientific annexes, were published as Sources and Effects of Ionizing Radiation (United Nations publication, Sales Nos.E.94.IX.2, No.E.94.IX.11 and E.96.IX.3, respectively).

Appendix I Members of national delegations attending the forty-fourth to forty-ninth sessions

Appendix II Scientific staff and consultants cooperating with the United Nations Scientific Committee on the Effects of Atomic Radiation in the preparation of the present report.

Removing tritium from Fukushima's contaminated water

The capital costs of developing a commercial installation to remove tritium from liquid radioactive waste (LRW) at Japan's Fukushima-Daiichi NPP can be reduced by 50 %, according to Sergey Florya, head of the innovative development project office of Russian waste management company RosRAO. He told journalists during the International Forum ATOEXPO 2016 in Moscow on 30 May that RosRAO had delivered a science and technology report to Japan on experiments at a demonstration facility and a feasibility study on the large-scale installation for clean-up of the tritium-contaminated LRW.

The aim of the demonstration projects is to verify the tritium separation technology and assess the construction and operating costs for full-scale implementation of the technology at Fukushima Daiichi. The technology must be capable of removing tritium from water with concentrations of 0,6 m and 4,2 m bequerels per litre and to be expandable to process more than 400 m³ a day.

A fund to subsidise the projects is being managed by the Mitsubishi Research Institute on behalf of the Agency for Natural Resources and Energy, part of METI. The current decontamination equipment at Fukushima Daiichi - EnergySolutions' Advanced Liquid Processing System (Alps) - is able to remove some 62 nuclides from contaminated water, but not tritium.

For more information go to:
http://www.neimagazine.com/news/newsremoving-tritium-from-fukushimas-contaminated-water-4915827

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SAIChE IChemE Gauteng Members Group Dinner and AGM

On the evening of the 4th May 2016, some of the brightest minds in Johannesburg gathered together at the Wanderers to hold the AGM of the SA Institute of Chemical Engineers (SAIChE) IChemE Gauteng Members Group. Everything was beautifully set up, and we welcomed over 50 members of the Institute who all thoroughly enjoyed themselves.

What struck us this year was the number of new faces and members we encountered and managed to get to know a little bit better. The food was delicious, and the guest speaker, Dr Kelvin Kemm, the highlight of the evening. With the subject of energy always being very topical, it was fitting that the guest speaker spoke on this.

Dr Kemm is the current chairman of the South African Nuclear Energy Corporation (NECSA), the recipient of the Lifetime Achiever's Award in Science and Technology. He has shared his views with us about the past, present and likely future of the South African New Nuclear Build Programme. He gave a most interesting speech and is indeed a motivational figure for all South Africans.

The takeaway message from the presentation was that countries all over the world are using South African skills in the nuclear industry. Dr Kemm stated that engineers in this country have a great deal of experience and knowledge to share.

During the AGM Lizelle van Dyk gave her outgoing President's report, the financial statement was discussed with the Treasurer, and the new members of the committee for the upcoming year were elected. Carl Sandrock was elected as the new President of the Gauteng members group. The 2016/2017 Gauteng committee also includes Linda Jewel, Danielle Bearman, John Bewsey, Nigel Coni, Dominique Tharandt, Nirvanna Rampersad, Shaan Oosthuizen, with the new committee members being Zita Harber, Michael Daramola and Qasim Fakar.

The Gauteng committee is planning meaningful seminars and interesting presentations, at least every two months, so please do come and join us for one or all of these upcoming events:

- June 30th – We have arranged a panel to discuss the new ECSA NRS registration process;
- August 31st – Carl Sandrock is showing off some really 'cool' apps specifically aimed at making a chemical engineer's life easier; and
- October 26th – The South African Association of Food Science and Technology will discuss the chemical engineers' role in the food industry.

The events also serve as excellent networking opportunities and always have plenty of good food and wine available whilst one has stimulating conversations. Everybody is welcome, so please do pass on the event notices to anybody that you might think would be interested and benefit from attending. We look forward to welcoming you! If you have any ideas for new events then please also do let us know via saiche@mweb.co.za

In closing, we would like to thank our members for their support and attending the dinner and AGM.

Written by Dominique Tharandt on behalf of SAIChE IChemE Gauteng Members Group.

Michelle Low interviews Team Extragreen

From left to right: Charlene Makita, Dr David Ming, Prof Luke Chimuka and Maletsatsi Kgatitsoe. *(Photo of team Extragreen courtesy of the The Innovation Hub, Pretoria, South Africa)*

The Gauteng Accelerator Programme (GAP) innovation competition (now in its fourth year) presented its awards to its best innovators and entrepreneurs nationally, in late November 2015. The event took place at The Innovation Hub in Pretoria. The award categories consisted of the Biotech Fundi Awards, and the Gauteng Accelerator Programme (GAP) Innovation Competitions Awards, which consisted of four categories: medical, ICT, Green and Biosciences.

Dr David Ming (AIChemE and lecturer) was part of the winning team for the GAP Biosciences category. This University of the Witwatersrand, Johannesburg, team was led by Professor Luke Chimuka. The other team members included two students from the School of Chemistry, Charlene Makita (PhD student), and Maletsatsi Kgatitsoe (MSc student), as well as Yvonne Saini from the Wits Business School. They were awarded first prize of R500 000 for a water-based Moringa extract innovation that is extracted through their patented extraction technology.

ML: How did you hear about the competition?

EG: A Wits team (Smart Spot) won the GAP competition in 2014 and Prof Chimuka was invited as a guest to attend the ceremony at the Innovation Hub. Prof Chimuka has been actively involved with Moringa for over three years in the School of Chemistry and Wits University, researching its use and efficacy with the prospect of extracting the vitamins and minerals from Moringa into a high quality liquid extract.

We were encouraged to participate in the competition in 2015, with the business idea to scale up the laboratory extraction process into a commercial plant that could produce high concentrate Moringa extract in large volumes for various consumer health and cosmetic applications.

ML: What is your project about?

EG: Our project aims to produce a high concentrate liquid extract from the Moringa plant containing all the unique minerals, salts and proteins in the leaf without the bitterness. The Moringa plant is known to contain many vitamins and minerals and is an excellent source of Iron, vitamin C, Calcium and protein.

ML: What was involved for the GAP innovation competition?

EG: We needed to create a business plan of our proposed extraction business building an extraction plant and selling the product for use in different food products.

The actual outcomes of the completion required us to attend a week long business training, with guest lectures from Emory University, a five-minute 'elevator pitch' promotional video and a detailed business plan explaining our target market, our product and a profitability analysis.

ML: Why such a diverse team of specific backgrounds?

EG: Although the core idea is relatively simple (extract Moringa), the process of scaling up the technology and turning it into a business requires a lot of expertise in different fields. This is particularly true in the food and health market, as we need to complete with well-established organisations which have a lot more in the way of resources, IP and manpower than we do. The core idea is founded in the chemistry; the scale up of the chemistry needs chemical engineering expertise; and the market analysis and business strategy requires business experience.

ML: Any advice for researchers entering the entrepreneurship space?

EG: Entrepreneurship is quite exciting in that it teaches researchers to look at the business aspect of their research and anyone who think has a novel idea should think of doing it. However, it requires extra effort, passion and dedication to balance the demands of academic life such as teaching and publishing.

For more information on Team Extragreen go to
http://www.extragreen.co.za or
email: David.Ming@wits.ac.za
Alternatively go to:
http://www.itweb.co.za/office/theinnovationhub/PressRelease.php?StoryID=263189

SUDOKU NO 115

Complete the grid so that every row across, every column down and every 3x3 box is filled with the numbers 1 to 9. That's all there is to it! No mathematics are involved. The grid has numbers, but nothing has to add up to anything else. You solve the puzzle with reasoning and logic. For an introduction to Sudoku see http://en.wikipedia.org/wiki/Sudoku

		2		1		4		
			5				2	
1		7	6					
	8		1		6	5		3
	6						8	
		1		8	9			
4								2
		8			5			
6	9						3	

Solution for SUDOKU 114

3	6	5	1	2	9	8	4	7
8	7	2	3	4	5	6	9	1
4	1	9	8	7	6	2	3	5
7	9	6	5	3	2	4	1	8
5	4	8	9	1	7	3	2	6
1	2	3	4	6	8	7	5	9
2	8	1	7	9	3	5	6	4
9	3	7	6	5	4	1	8	2
6	5	4	2	8	1	9	7	3