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AESABESP COMPENDIUM 2021

BB EDITORA 3ª EDIÇÃO



SÃO PAULO 2022













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Editorial

In 2021, we experienced the second year of one of the most impactful pandemics in human history: Covid-19. In Brazil alone, more than 650,000 lives were lost. Worldwide, it amounted to more than 6 million. A deep feeling of sadness due to those interrupted lives was left for those who remained. Nonetheless, a stronger commitment to change this reality was left for us. Amid this environment of changes, we chose "Environmental Sanitation in a world in transformation" as the theme for the 32nd Technical Meeting (Brazilian Congress of Sanitary and Environmental Engineering) and Fenasan/2021 (Brazilian Exhibition on Sanitation and Environment Services), held from September 14 to September 16. This theme was intended to stress how environmental sanitation is crucial for a world in transformation.

This event was 100% online, just like the one from the previous year, ensuring the safety and well-being of all the attendants. And it was also a success. This virtual event lasted through more than 18 hours. Businesspeople, professionals, authorities, scholars, managers, students and technicians from that field from all regions in Brazil and also from abroad could benefit from the many discussions held in 12 round tables, 8 panels, 3 business lectures and the presentation of 98 technical papers (in total, there were 206 enrollees). That platform also offered a new feature: a complete tour throughout Sabesp, in two virtual technical visitations, which were accessed by 535 people. In total, there were 77,645 pages accessed, 10,800 visitations to the platform, 21 countries present (out of which: the United States, Austria, Netherlands, United Kingdom, France, Japan, Ireland, Finland and Germany), 22 Brazilian states present, 207 cities and more than 7,000 chat interactions. Regarding the virtual Fenasan, 59 exhibitors attended, there were 2,678 online users and 33 supporting institutions.

This edition was special for all of us as it coincided with AESabesp's 35th anniversary, which occurred in September 15 in that year. For celebrating this brand, the opening of the event featured the participation of distinguished figures such as Marcos Penido, Sanitation, Infrastructure and Environment Secretary of the Government of the State of São Paulo: Marcos Monteiro, Municipal Secretary of Urban Infrastructure and Construction of São Paulo; Luciomar Santos Werneck, then President of the Organizing Committee for the Technical Meeting and Fenasan, Director of Fenasan and Director of Innovations for the Association; and Olavo Sachs, Director of the Technical Meeting and Technical Director of that organization. Moreover, Viviane Borges, then AESabesp's president, had a highly fruitful conversation with one of the most import businesswomen in Brazil, Luiza Trajano, in order to discuss the world in transformation: post-pandemics, the importance of sanitation, an organization's resilience, among other things.

Besides her, this event also featured other very special figures, which helped to add even more to the brilliance of the event. One of them was the poet Bráulio Bessa, an artist from Alto Santo, Ceará, which began his incursions through poetry very early, at 14. Then, he shared experiences and lessons from his life with his audience. Likewise, the audience could also expand its perception through a special guest who shared her knowledge by the end of the event. Monja Coen Roshi addressed the importance of water in life, sharing her experience in Asia with the attendants. There, she learned to save water in different moments of her daily practices. She also addressed themes that are very dear to us, such as the need for depolluting water, the fight against global warming, the conservation of forests, and called upon every one to embrace their role in such important changes.

At the closing ceremony, AESabesp's traditional Young Professional Award was held.

This award is intended to acknowledge talents that have shared its research and discoveries with the public. So in this edition, the first place was won by Isabela Cristina Ferreira Faria, which presented the paper "Norms, projects and economic viability of the non-potable water reuse system: a review." During the event, the prize was also awarded to the winners of the Championship of Operators - Sabesp 2021, which gathers professionals from the Board of Regional Systems (R), the Metropolitan Board (M) and the Business and Customer Relationship Board (CM in specific tests that test their abilities.

A solemnity to award AESabesp's Unidade Mais Trophy was also held. It was intended to acknowledge the superintendency of Sabesp which had presented the largest number of technical papers that year. In that edition, the winning unit was the Southern Business Unit. In parallel, in another edition, AESabesp awarded its AESabesp Compendium 2020, developed in partnership with



BB Editora, a publication that stresses this association's commitment to spread and share information, year after year, in order to enable knowledge on environmental sanitation to expand.

AESabesp Compendium 2021

Just like in the previous edition, the AESabesp Compendium in your hands right now is the result of an extremely favorable combination of factors for the development of discussions on environmental sanitation. In its versions in Portuguese and English, this publication was committed to report the main themes that were the focus of the discussions that occurred throughout the 12 round tables and the 8 thematic panels. Themes such as water reuse, energy efficiency, startups, water security, urban drainage, charges in services of solid waste management, public health, the Legal Framework for Sanitation, Sustainable Development Goals (SDGs), ESG, sanitation and pandemics, circular economy, rural sustainability, new technology, engineering, sanitation in Latin America, environmental management and so many other matters had a place reserved in this material so that readers may deepen their knowledge on different themes and current perspectives.

Likewise, in this edition, the Panorama of Sanitation was developed, gathering many up-to-date data from the sanitation field, collected in the main channels of information on sanitation in Brazil, such as the Brazilian Sanitation Information System (SNIS) and the Trata Brasil Institute. This space gathers an outlook on water supply, sanitary sewage, urban drainage, urban solid waste management, as well as information on the health issue in Brazil (related to sanitation) and more up-to-date data on sanitation worldwide.

Good reading!

Luciomar dos Santos Werneck AESabesp's President (Management 2022-2024)





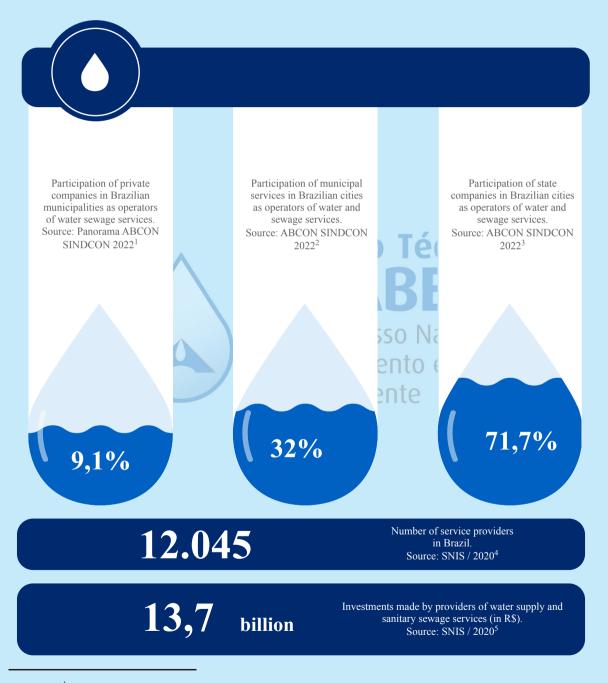




Sanitation Panorama	12
Roundtables	28
Panels	86



With the purpose of contributing for the register of up-to-date data from the sanitation sector, this edition of the Compendium presents a Panorama of Sanitation, a space dedicated to the dissemination of the current profile of Sanitation in Brazil, data on water supply, sewage systems, urban drainage, solid urban waste, data on health in Brazil and a short panorama of the world.



¹ https://www.abconsindcon.com.br/panorama

² https://www.abconsindcon.com.br/panorama

³ https://www.abconsindcon.com.br/panorama

 $^{^4\,}http://snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-setor-saneamento$

⁵ http://www.snis.gov.br/downloads/diagnosticos/ae/2020/DIAGNOSTICO TEMATICO VISAO GERAL AE SNIS 2021.pdf

219.68

Average investment on water and sewage connections by private companies in 2020 (R\$/connection).

Source: Panorama ABCON SINDCON 2022⁶

167.20

Average investment on water and sewage connections by state companies in 2019 (R\$/connection).

Source: Panorama ABCON SINDCON 2022⁷

67.30

Average investment on water and sewage connections by municipal services in 2019 (R\$/connection).

Source: Panorama ABCON SINDCON 20228

4.63

Average fee charged by private sanitation companies in 2019 (R\$/m³). Source: Panorama ABCON SINDCON 20229

4.72

Average fee charged by state sanitation companies in 2019 (R\$/m³). Source: Panorama ABCON SINDCON 2022¹⁰

2.77

Average fee charged by state sanitation services in 2019 (R\$/m³). Source: Panorama ABCON SINDCON 2022¹¹

⁶ https://www.abconsindcon.com.br/panorama

⁷ https://www.abconsindcon.com.br/panorama

⁸ https://www.abconsindcon.com.br/panorama

⁹ https://www.abconsindcon.com.br/panorama

¹⁰ https://www.abconsindcon.com.br/panorama

¹¹ https://www.abconsindcon.com.br/panorama



WATER SUPPLY DATA

33,102,066 (15,9%)	Population without access water (number of people Source: SNIS - 2020 ¹²	
15 million	Share of the urban population access to water (number of possible Source: UNICEF 2020 ¹	eople).
25 million	Share of the rural populat access to basic water service of people). Source: UNICEF 202	es (number
2.3 million	Share of the population that sources unsafe for human cons for their personal and domes (number of people Source: UNICEF 202	sumption and tic hygiene).
3,000	Municipal schools in Braz Source: 2020 School Cent	il without water. sus - UNICEF ¹⁶
21,000	Municipal schools with access to Source: 2020 School Census	
out of 7	1 out of 6	14.3%

brazilian women do not have access to water.

Source: Trata Brasil Institute - 2018¹⁸

brazilian men do not have access to water. Source: Trata Brasil Institute - 2018¹⁹ of children and teenagers do not have access to water. Source: 2018 Child Poverty - UNICEF 20

6.8%

of children and teenagers do not have a water system at home. Source: 2018 Child Poverty - UNICEF²¹

7.5%

of children and teenagers have water at home but it does not come from a safe or filtered water source. Source: 2018 Child Poverty - $UNICEF^{22}$

¹² https://www.painelsaneamento.org.br/localidade/index?id=0

¹³ https://www.unicef.org/brazil/media/9721/file/nota-tecnica-saneamento-higiene-na-resposta-a-covid-19.pdf

 $^{^{14} \,} https://www.unicef.org/brazil/media/9721/file/nota-tecnica-saneamento-higiene-na-resposta-a-covid-19.pdf$

 $^{^{15}\,}https://www.unicef.org/brazil/media/9721/file/nota-tecnica-saneamento-higiene-na-resposta-a-covid-19.pdf$

¹⁶ https://www.unicef.org/brazil/comunicados-de-imprensa/unicef-lanca-campanha-aguahigienenasescolas-e-faz-webinario-sobre-o-tema

¹⁷ https://www.unicef.org/brazil/comunicados-de-imprensa/unicef-lanca-campanha-aguahigienenasescolas-e-faz-webinario-sobre-o-tema

 $^{^{18}\,}https://www.tratabrasil.org.br/pt/saneamento/principais-estatisticas/no-brasil/agua$

¹⁹ https://www.tratabrasil.org.br/pt/saneamento/principais-estatisticas/no-brasil/agua

²⁰ https://www.tratabrasil.org.br/pt/saneamento/principais-estatisticas/no-brasil/agua

²¹ https://www.tratabrasil.org.br/pt/saneamento/principais-estatisticas/no-brasil/agua

²² https://www.tratabrasil.org.br/pt/saneamento/principais-estatisticas/no-brasil/agua

152.1 liters

Daily average consumption of water in Brazil per capita. Source: SNIS / 2020²³

7,500

olympic pools of wasted water every day. Source: 2021 Water Loss - Trata Brasil Institute (SNIS - 2019)²⁴

175.5 million - 84,1%

Total share of the population with access to the water supply network (number of people). Source: SNIS / 2020²⁵

6.02 billion

Investments on water systems in 2020 (in R\$). Source: SNIS / 2020²⁶

728.000 km

The range of the water supply network in Brazil. Source: SNIS / 2020²⁷

61.7 million

Number of existing water connections in Brazil. Source: SNIS / 2020²⁸

40.1%

Share of losses at water distribution. Source: SNIS / 2020²⁹

²³ http://snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-abastecimento-agua

²⁴ https://tratabrasil.org.br/images/estudos/Perdas_d%C3%A1gua/Estudo_de_Perdas_2021.pdf

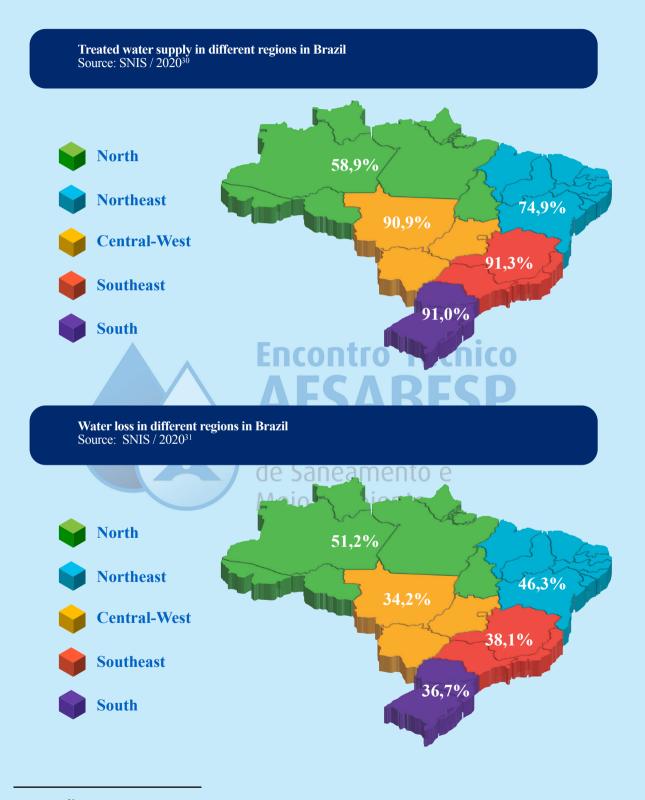
 $^{^{25}\,}http://snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-abastecimento-agua$

 $^{^{26}\,\}text{http://snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-abastecimento-agua}$

²⁷ http://snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-abastecimento-agua

 $^{^{28}\,}http://snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-abastecimento-agua$

²⁹ http://snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-abastecimento-agua



 $^{^{30}\,}hhttp://snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-abastecimento-agua$

 $^{^{31}\,}https://www.tratabrasil.org.br/pt/saneamento/principais-estatisticas/no-brasil/agua$



SEWAGE SYSTEM DATA

93,938,133 (45%)

Number of people with no access to sewage collection. Source: SNIS / 2020^{32}

5.3 million Olympic pools

non-treated sewage released on nature in Brazil in 2020. Source: <u>Trata Brasil Institute³³</u>

4 million

brazilian people do not have access to a bathroom. Source: Trata Brasil Institute 2021³⁴

5,140,596.32

thousand cubic meters of non-treat sewage. Source: SNIS / 2020³⁵

50.8%

Rate of treated sewage compared to water consumption.

Source: SNIS / 2020³⁶

3.1%

of children and teenagers do not have a bathroom at home. Source: Trata Brasil Institute³⁷

50.8%

Share of treated sewers in Brazil. Source: SNIS / 2020³⁸

114.6 million - 55%

Total share of the population with access to the sewage network (number of people). Source: SNIS / 2020³⁹

5.89 billion

Investments on sewage systems in 2020 (in R\$). Source: SNIS / 2020⁴⁰

362.4 mil km

Range of the sewage network in Brazil. Source: SNIS / 2020⁴¹

36 million

Amount of existing sewage connections in Brazil.

Source: SNIS / 2020⁴²

³² https://www.painelsaneamento.org.br/localidade/index?id=0

³³ https://www.tratabrasil.org.br/pt/saneamento/principais-estatisticas/no-brasil/esgoto

 $^{^{34}\,}https://tratabrasil.org.br/pt/saneamento-basico/saude/dia-do-banheiro-milhoes-sem-banheiro$

³⁵ https://www.painelsaneamento.org.br/localidade/index?id=0

 $^{^{36}\,}https://www.painelsaneamento.org.br/localidade/index?id{=}0$

³⁷ https://www.tratabrasil.org.br/pt/saneamento/principais-estatisticas/no-brasil/esgoto

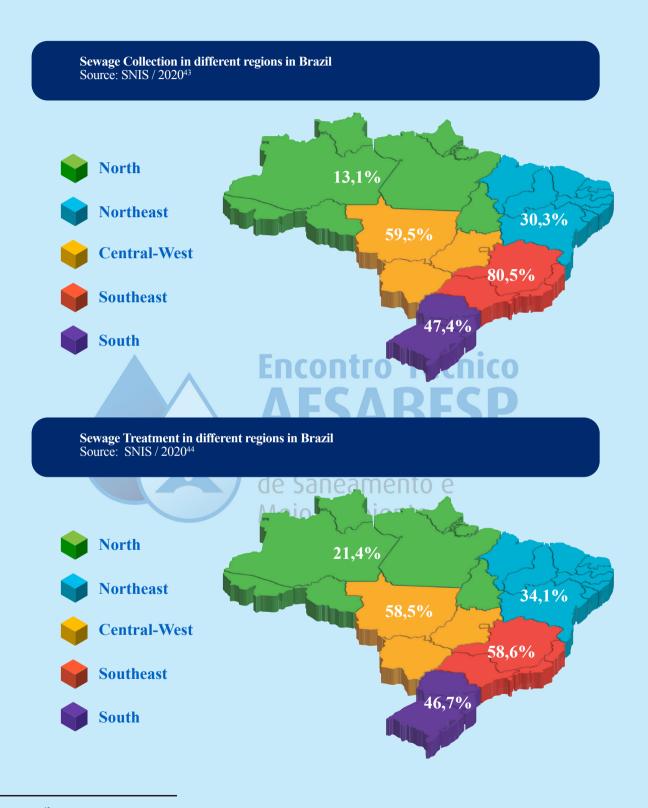
³⁸ http://www.snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-esgotamento-sanitario

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 $^{^{44}\,}https://www.tratabrasil.org.br/pt/saneamento/principais-estatisticas/no-brasil/esgoto$



URBAN DRAINAGE SYSTEM DATA

45.3%

of Brazilian municipalities have an exclusive system for urban rain water drainage. Source: SNIS / 2020^{45}

12%

of Brazilian municipalities have an unitary system (mixed with sanitary sewage system). Source: SNIS / 2020⁴⁶

4.6%

of Brazilian municipalities do not have any kind of treatment for rain water. Source: SNIS / 2020⁴⁷

67.6%

of Brazilian municipalities do not have a map for areas under risk of flood. Source: SNIS / 2020⁴⁸

3.9%

of Brazilian municipalities are under risk of flood.

Source: SNIS / 2020⁴⁹

38.21 /hal

/hab./ano- 55%

of investments per capita on urban rain water drainage and management services (in R\$).

Source: SNIS / 2020⁵⁰

27.99 /hab./ano

of expenditure per capita on water drainage and management services (in R\$).

Source: SNIS / 2020⁵¹

17.4%

of municipalities have a Master Plan for urban rain water drainage and management. Source: SNIS / 2020⁵²

 $^{^{45}\,}http://www.snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-aguas-pluviais$

 $^{^{46}\,}http://www.snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-aguas-pluviais$

⁴⁷ http://www.snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-aguas-pluviais

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⁵¹ http://www.snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-aguas-pluviais

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URBAN SOLID WASTE DATA

82,477,300 tons/year

of urban solid waste generated in Brazil. Source: 2021 Abrelpe Panorama⁵³

76,079,836 tons/year

of residues collected in Brazil. Source: 2021 Abrelpe Panorama⁵⁴

190.9 million (90,5%)

Total population with access to domestic waste collection. Source: SNIS / 2020⁵⁵

36.3%

of Brazilian municipalities with selective waste collection. Source: SNIS / 2020⁵⁶

35.7 mil

Number of waste collectors involved. Source: SNIS / 2020⁵⁷

66.6 million tons

of collected Domestic Solid Waste (DSW) and Public Solid Waste (PSW) mass. Source: SNIS / 2020⁵⁸

1.851 (40,3%)

Number of municipalities with a charge system. Source: SNIS / 2020⁵⁹

1.07 million tons

of urban solid waste recovered through selective collection. Source: SNIS / 2020⁶⁰

⁵³ https://abrelpe.org.br/panorama/

⁵⁴ https://abrelpe.org.br/panorama/

 $^{^{55}\,}http://www.snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-residuos-solidos$

⁵⁶ http://www.snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-residuos-solidos

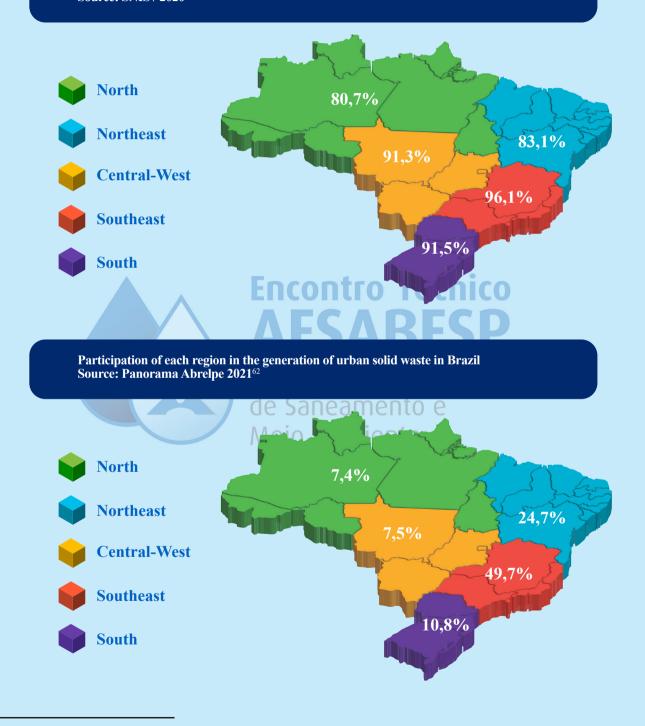
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⁵⁸ http://www.snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-residuos-solidos

⁵⁹ snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-residuos-solidos

 $^{^{60}\,}snis.gov.br/painel-informacoes-saneamento-brasil/web/painel-residuos-solidos$





 $^{^{61}\,}sn is. gov. br/painel-informacoes-saneamento-brasil/web/painel-residuos-solidos$

⁶² https://abrelpe.org.br/panorama/



BRAZILIAN HEALTH DATA

167,513

Number of total hospitalizations for waterborne diseases. Source: DATASUS / 2020⁶³

1,898

Number of deaths for waterborne diseases. Source: DATASUS / 2020⁶⁴

45,629

Number of total hospitalizations from the age of 0 to 4. Source: DATASUS / 2020^{65}

70,356,945.16

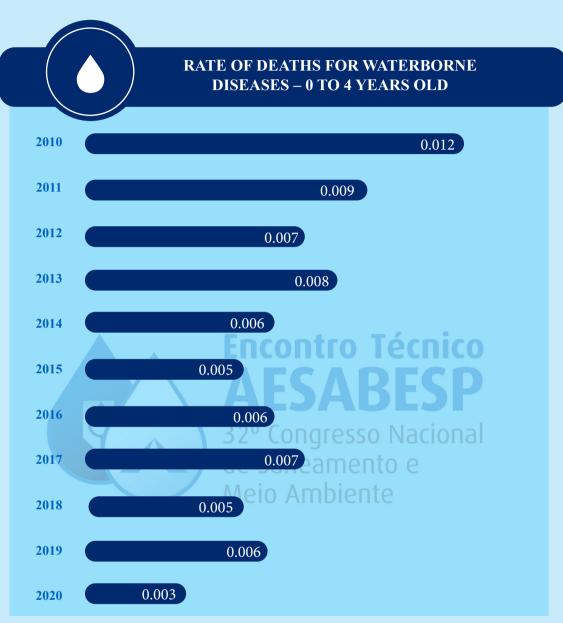
Expenditure on hospitalizations for waterborne diseases (in R\$). Source: DATASUS / 2020⁶⁶

⁶³ https://www.painelsaneamento.org.br/localidade/index?id=0

 $^{^{64}\,}https://www.painelsaneamento.org.br/localidade/index?id{=}0$

 $^{^{65}\,\}text{https://www.painelsaneamento.org.br/localidade/index?id=}0$

 $^{^{66}\,}https://www.painelsaneamento.org.br/localidade/index?id{=}0$



Source: DATASUS 2010-2020 – Rate of deaths for infectious gastrointestinal diseases in the population from the age of 0 to years old – Deaths per 10,000 inhabitants⁶⁷

 $^{^{67} \,} https://www.painelsaneamento.org.br/localidade/evolucao?id=0\&L\%5Bg\%5D=2\&L\%5Bs\%5D=21\&L\%5Bi\%5D=INCIDE_OBITO_00_04_VH$



WORLD SANITATION DATA

3 out of 10

people in the world could not wash their hands with water and soap at home during the Covid-19 pandemics. Source: UNICEF - 2020⁶⁸

1 out of 4

people did not have safely managed drinking water at home. Source: UNICEF - 2020⁶⁹

2 billion

people do not have access to safely managed drinking water at home. Out of these, 1.2 billion people have access to a basic drinking water service. Source: UN-UNICEF 2020⁷⁰

8 out of 10

people that still do not have access to basic drinking water services live in rural areas. Source: UN-UNICEF 2020⁷¹

3.6 billion

people do not have access to safely managed sanitation at home. Source: UN-UNICEF 2020⁷²

494 million

people defecate on the open air. Source: UN-UNICEF 2020⁷³

50%

of the world urban population is supplied with water from subterranean sources.

Source: UN 2022⁷⁴

74%

of the world population uses safely manage drinking water services. Source: UN 2022⁷⁵

56%

of domestic residual water flows were treated with safety in 2020 (extrapolated from data from 128 countries, representing 80% of the global population). Source: UN 2022^{76}

1.7 billion

of diarrhea cases among child under 5 years area registered every year. Source: GBD 2016⁷⁷

446,000

cchildren under 5 years die of diarrhea, especially in low-income and medium-income countries every year. This amounts to 9% of the 5.8 million deaths of children under 5 years old. Source: GBD 2016^{78}

38%

medical assistance installations in 54 countries do not have access do basic water sources. Source: UN-Watera⁷⁹

 $^{^{68} \}text{https://www.unicef.org/guineabissau/pt/comunicados-de-imprensa/bilh\%C3\%B5es-de-pessoas-n\%C3\%A3o-ter%C3\%A3o-acesso-\%C3\%A1gua-pot\%C3\%A1vel-saneamentso-e-higiene-emaily and the same of the sa$

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⁷⁰ https://washdata.org/sites/default/files/2021-07/jmp-2021-wash-households.pdf

⁷¹ https://washdata.org/sites/default/files/2021-07/jmp-2021-wash-households.pdf

⁷² https://washdata.org/sites/default/files/2021-07/jmp-2021-wash-households.pdf

 $^{^{73}\,}https://washdata.org/sites/default/files/2021-07/jmp-2021-wash-households.pdf$

⁷⁴ https://unesdoc.unesco.org/ark:/48223/pf0000380733_por

⁷⁵ https://unesdoc.unesco.org/ark:/48223/pf0000380733_por

⁷⁶ https://www.unwater.org/publications/progress-on-wastewater-treatment-631-2021-update/

⁷⁷ https://www.cdc.gov/healthywater/global/wash_statistics.html

 $^{^{78}\,}https://www.cdc.gov/healthywater/global/wash_statistics.html$

⁷⁹ https://www.tratabrasil.org.br/pt/saneamento/principais-estatisticas/no-mundo/saude



CBH-AT indica aproximadamente R\$ 22,7 milhões para implantação e instrumentalização da Fiscalização Integrada nas Áreas de Proteção e Recuperação dos Mananciais (APRM)

As altas taxas de crescimento demográfico nas áreas onde viriam a constituir a Região Metropolitana de São Paulo (RMSP), a partir da década de 1950, proporcionaram uma elevada demanda por serviços de infraestrutura, como por exemplo, abastecimento de água.

Esse processo motivou, nos anos de 1975 e 1976, a criação de legislações (Lei Estadual nº 898/1975 e Lei Estadual nº 1.172/1976) que buscaram estabelecer um conjunto restritivo de normas e critérios para conter e disciplinar o uso e a ocupação do solo em bacias estratégicas à produção de água para a metrópole.

Entretanto, 20 anos depois e apesar da restrição legal, foi necessária a revisão da legislação visando conter o passivo ambiental gerado nas últimas décadas. Com isso, foi aprovada a Lei Estadual nº 9.866/1997, que dispõe sobre diretrizes e normas para a proteção e recuperação das bacias hidrográficas dos mananciais de interesse regional do Estado de São Paulo.

Atualmente, um dos principais desafios da sociedade e do Poder Público é a contenção de ocupações irregulares que vem avançando sobre as áreas de mananciais, ameaçando a qualidade da água e a biodiversidade. Por esse motivo, o Comitê da Bacia Hidrográfica do Alto Tietê (CBH-AT) e a Fundação Agência da Bacia Hidrográfica do Alto Tietê (FABHAT) têm unido esforços para financiar programas e ações na área de recursos hídricos a partir dos recursos financeiros do Fundo Estadual de Recursos Hídricos (FEHIDRO).

Nos últimos anos, o CBH-AT indicou três empreendimentos ao FEHIDRO (totalizando aproximadamente R\$ 22,7 milhóes) que possuem objetivos especificamente dedicados à implantação e à instrumentalização da fiscalização integrada nas áreas de mananciais.

Desses empreendimentos, dois estáo sob responsabilidade da Coordenadoria de Fiscalização e Biodiversidade (CFB) visando a aquisição de imagens orbitais de alta resolução e ações de desfazimento.

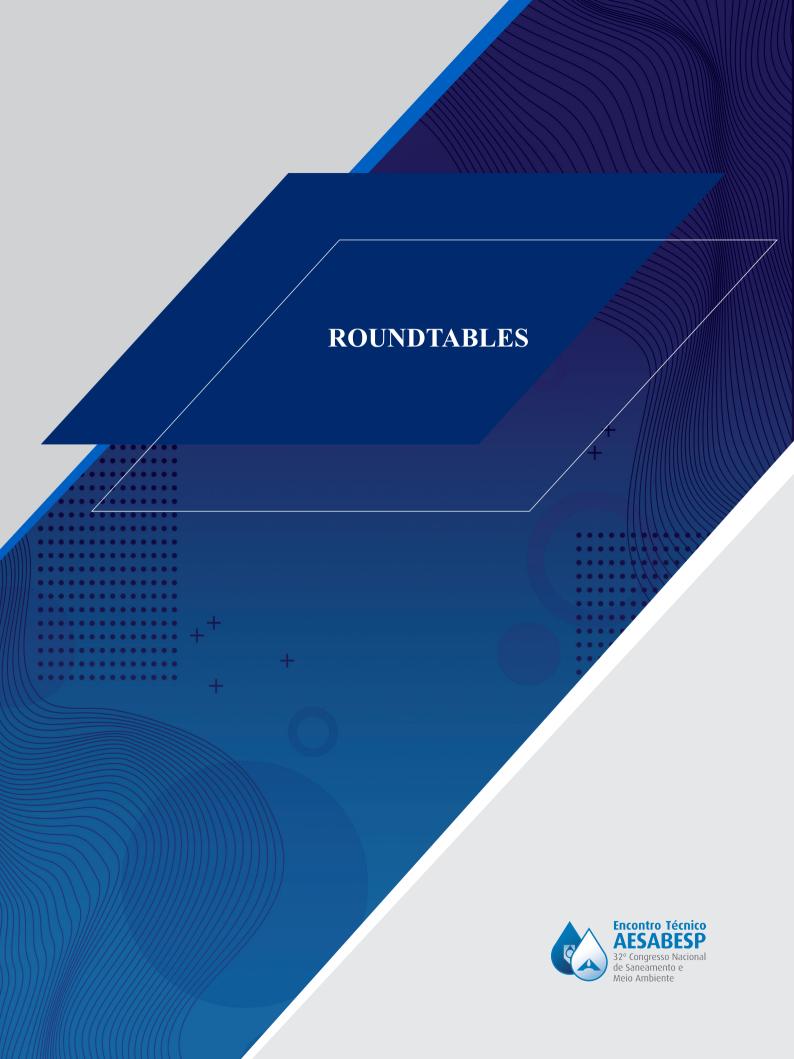
Já o outro empreendimento, tem como tomador a Secretaria de Infraestrutura e Meio Ambiente do Estado de São Paulo (SIMA) e visa estruturar os Grupos de Fiscalização Integrada (GFIs). Essa estruturação será realizada a partir do repasse de recursos para a aquisição de equipamentos (veículos, drones e computadores) e a implantação de um plano de fiscalização customizado para os problemas enfrentados em cada município.

Na bacia do Alto Tietê, pouco mais da metade da sua área (50,5%) corresponde às áreas de mananciais. Essas áreas são regiões ambientalmente sensíveis e legalmente protegidas devido à sua importância na produção hídrica para o abastecimento de água na RMSP.





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MODERADOR:
Fernando
Gomes
Aquapolo



José Carlos Mierzwa CIRRA/USP



Nivaldo R. da Costa Jr.



PALESTRANTE:
André Belarmino
Sousa

ROUNDTABLE: RECYCLED WATER, DIFFERENT DESTINATIONS

Moderator:

Eng. Fernando Gomes - Aquapolo

Speakers:

Eng. José Carlos Mierwza - CIRRA/USP¹ Eng. André Belarmino de Souza - Dupont Eng. Nivaldo Rodrigues - Sabesp²

Coordinator/Evaluator:

Eng. Olavo Alberto Prates Sachs - AESabesp³

Brazil has been going through a period of water crisis again, a scarcity due to an unfavorable rainfall regime. Not only in São Paulo or in its metropolitan region, but it is something that has been happening in several locations. One of the solutions to combat the lack of water resources is reused water⁴, an increasingly common method, which is becoming more and more regulated, but needs greater scope in Brazil. Therefore, the 32nd edition of the AESabesp Technical Meeting organized a roundtable called Waters Recycled, Different Destinations, which addressed the origins, tendencies and challenges of the theme, especially the concept of recycled water, a solution that helps combat water scarcity. For Eng. Fernando Gomes, moderator of the roundtable, this topic is of vital importance in various segments of our society. "This is an exciting subject, it is included in the circular economy and it is unanimous that it should be part of discussions on sustainability," he pointed out.

Eng. José Carlos Mierzwa highlighted that water reuse is a very important point when talking about combating water scarcity,

which occurs as a result of a few factors: phenomena or natural conditions, such as lack of rain in arid regions, which we see in the Brazilian Northeast or even in the Middle East; poor planning of land use and occupation, such as what occurs in metropolises and large cities, which now have concrete and cement as part of the daily scenario, floors that prevent the soil from absorbing water; excessive water demand, which occurs in any metropolitan region in the country and in the world, where the consumption and need for water is greater than the region's natural production; and expansion of water source contamination, something that is increasing in Brazil. "All these issues must be dealt together when it comes to water scarcity. Complex problems require integrated solutions, which is the fact that we all could use the tools available to ensure that water is provided to the regions that suffer," stated Mierzwa.

Currently, one of the most used solutions is the importation of water from other localities. We have examples here in Brazil in the São Paulo Metropolitan Region (RMSP) and in the São Francisco River transposition or even in the United States, where the North region exports water to the South region, among others. However, a very important point – and which should be highlighted – is that the supply capacity of the region that exports cannot be compromised due to this commercialization, failing to meet its domestic demand. At this point, too, the reused water⁵ will be a contributing agent – thus, the location continues to have an abundance of internal supply, which allows for the export of water.

Rationing the use of water is common and there have been campaigns over the last few decades to raise awareness of the issue, but this is not just for the population, but also for all sectors

¹ International Reference Center for Water Reuse of the University of São Paulo.

² Basic Sanitation Company of the State of São Paulo.

³ Sabesp Engineers Association.

⁴ Reuse water is wastewater or lower quality water that has characteristics that can be reused for other purposes, whether potable or not (ÁGUA..., n.d.).

⁵ Brazil is still taking small steps towards the use of reused water. According to the latest published data, only 1% of the total water consumed is reused. By way of comparison, Israel, one of the pioneers in this regard, achieves 70% (BRASIL..., 2021).

of society⁶, according to Mierzwa. Good rationing involves the use of more efficient hydraulic equipment, an industry that develops and sells equipment capable of producing savings or even products that require less water consumption, for example; as well as the improvement of domestic or industrial wastewater treatment technologies. The speaker also highlights that a good part of Brazil's industrial infrastructure refers to a time when rationing and good use of water were not taken into account, as it was not a concern at that time, faced with a plentiful supply.

It is beginning to be observed outside Brazil and the tendency is for the problems of water scarcity⁷ to worsen, especially in urban regions, which will make it necessary to expand sewage collection and treatment, develop and adopt more modern technologies to treat these effluents. The observations, according to the engineer, lead to a glimpse of the possibility of adopting programs for direct drinking reuse. Complementing this, the World Health Organization (WHO) has, since 2017, guidelines for reused water. "There are a few possibilities for this. The Reuse Water Production Unit would send this water to the Supply Water Treatment Station, or to the treated water main, or directly to the Distribution System, without the need. The greatest example of this is the Aquapolo Project8, in São for indirect reuse, which would send the resources to the water source first and then go through this process," said Mierzwa.

Eng. André Belarmino de Souza highlighted that there is currently technology so that all water can be reused, depending only on the engineering used in it. This point may incur more costs and, with each passing year, technological progress makes the amounts involved smaller. In his view, Brazil is taking steps to ensure that direct or indirect water reuse gains greater projections and can reach the tap of the general population, although, personally, he thinks that this point should be more accelerated, even more so when compared to other countries, which have this issue being used with greater amplitude. "After the World Water Forum, held in Brasília, in 2018, in addition to other congresses held in our country, I believed that we would have a violent advance in this regard," said the speaker.

Belarmino presented the three types of reuse forms, starting

with water from unplanned indirect reuse. It is when water used in human activity is discharged into the environment and reused, without any intention or control of reuse. Water is subject to the natural actions of the hydrological cycle, such as dilution and self-purification, for instance. In the case of direct reuse, the effluents are treated and discharged in a planned manner into bodies of water, with controlled and intentional use in order to meet some beneficial need. It is assumed that there is control over new discharges of effluents on the way.

The planned direct reuse of water, as was also highlighted by Mierwza, occurs when the effluents are treated and sent directly to their point of discharge to the reuse site, without being discharged into the environment. This is the case with the highest occurrence, mainly for use in industries. For him, the sector's objective is that these guidelines are completed and viable as soon as possible. "Recycled water in industrial use and in civil construction on a larger scale would be a quite big start for direct reuse in Brazil. We already have some points here, but this would be necessary to expand and gain weight in our country," he declared.

Paulo, which is a milestone in the history of Brazilian sanitation and social either. Able to supply a city of 500,000 inhabitants, it serves customers at the São Paulo Petrochemical Complex only with reused water – a place that had water supply problems. It should be noted that this partnership between the public power and the private sector was fundamental for the permanence of these companies in São Paulo, which, mainly, maintained many jobs in the region. It is the most successful type project in Latin America and one of the 10 largest in the world.

Eng. Nivaldo Rodrigues spoke about Sabesp's challenges in supplying the state of São Paulo and the Metropolitan Region of São Paulo, the seventh most populous region in the world. Every day, 22 million people are supplied by the company, which has 5.8 million water connections and 4.7 million sewage connections in the region. Altogether, the region has 10 Water Treatment Stations (ETAs), with a nominal flow of 82.3 m³, 1,594 km of water mains, 415 reservoirs, 283 pumping

⁶ In Brazil and worldwide, agriculture is responsible for 70% of water consumption, which means that Brazil exports 112 trillion liters of water, present in grains, meats, among other products from agriculture (VOCÊ..., 2016).

The water scarcity, as the name implies, is when there are too few water resources to meet the demand of a region, either through resource management or through severe droughts. In recent years, it has been noted that the levels of reservoirs in the Southeast Region have decreased, largely because of the fact that it does not rain as expected and because of the population density. Interestingly, the Northeast and Southeast regions, which have the greatest drought history, are regions with highly dense cities. In compensation, the North has greater water resources and is the region with the lowest population density in the nation (SANTOS, n.d.).

This is the most successful enterprise for the production of reused water in South America and one of the largest in the world. Developed as a water management solution, the project provides reused water for the Capuava Petrochemical Complex and industries in the ABC Paulista region. It has a capacity of up to 1,000 liters per second (QUEM..., n.d.).

stations and 40,251 km of water network. Still, with this entire infrastructure, it may not be enough. Water reuse becomes fundamental in this region. The water availability is 179 m³/inhab./year and the water sustainability indicated in a guideline established by the United Nations (UN) is 1,700 m³/inhab./year – almost 10 times more than is available in the Metropolitan Region of São Paulo. "It is an area of low water availability and high demand. The population density is very high and we need to look for this distribution as best as possible," he stated.

Sabesp has used water reuse for various purposes: environmental and educational, for the maintenance of aquatic life, unrestricted or restricted recreation, maintenance of the water level in ponds or lakes; for maintenance of flows, when treated sewage is used to maintain minimum flows for various downstream uses. such as navigation, irrigation and industrial use; recharge of underground aquifers, either with infiltration or direct injection, for drinking purposes or not; supply of potable water, either indirect with an increase in surface waters or direct; urban for non-potable purposes, such as irrigation of parks and green areas in general, washing streets and floors, ornamentation, building (discharge of sanitary appliances) and production of concrete; industrial, such as cooling, washing of equipment and installations or application in some processes; and agricultural, used for irrigation. "It's a point that has increased a lot here at Sabesp. During the pandemic, we increased by 40% the urban reuse, for example, used to wash hospital entrances"2 70

The reuse of water for Sabesp is, primarily, a form of respect position of the population, since we are talking about a vital asset for all, and they are focused on three elements: protecting public health, maintaining the integrity of ecosystems and sustainable water use. It is worth mentioning that reuse reduces the withdrawal of raw water from springs and that each reused liter represents one liter for human consumption. For the speakers, reused water will increasingly be part of our daily lives. Faced with so many challenges to manage existing water resources, all participants at the table make it clear that the adoption of reuse water is a trend for the future, emphasizing that there is currently an increasingly strong movement dedicated to the creation of new technologies capable of making reuse more widely in the country.

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Paulo Massato



Alceu Segamarchi



Claudio Stabile



Simões Campos

Copasa

Ricardo Augusto

ROUNDTABLE: NEW HORIZONS OF ENERGY EFFICIENCY

Moderator:

Eng. Paulo Massato Yoshimoto - Sabesp¹

Speakers:

Eng. Alceu Segamarchi Junior - Sabesp

Atty. Claudio Stabile - Sanepar² Eng. Marcus Tulius - Copasa³

Coordinator/Evaluator:

Tech. Antonio Ramos Batagliotti - Sabesp

Energy efficiency⁴ is undoubtedly one of the major trends when it comes to the search for a more sustainable future. Currently, the search for energy alternatives provides solutions that would solve the low supply of electric energy in some regions of the world, as well as in relation to climate change and the growing need to reduce carbon emissions. Naturally, in the sanitation sector, the search for new alternatives for energy generation grows every year in order to optimize energy use in the production of drinking water, sewage treatment or solid waste. With this new scenario in mind, the 32nd edition of the AESabesp Technical Meeting organized a roundtable called New Horizons of Energy Efficiency, addressing the trends and forms of energy generation currently in practice to meet human needs for light, heat and convenience.

According to Eng. Paulo Massato Yoshimoto, the issue of energy efficiency is quite pertinent, especially at this moment. "What are the new horizons for energy efficiency, especially because of the water crisis, which could seriously harm our sanitation sector?" Similarly, Engineer Alceu Segamarchi Junior also highlighted the importance of the topic and stated that the search for energy alternatives is already part of Sabesp's great efforts, especially since electricity represents the company's third largest expense.

Since 2004, Sabesp has been purchasing electric energy in the free market⁵. It develops studies on energy utilization through photovoltaic plants, hydroelectric generation plants, small thermoelectric plants, among others. At the same time, the company invests in energy efficiency with actions to reduce consumption generally. In his presentation, Segamarchi reported the gains with the choice of contracting energy in the free market, called the Free Contracting Environment (ACL). According to him, there were savings of R\$ 107 million compared to what would be spent in the so-called Regulated Contracting Environment⁶ (RCE) and, since the beginning of migrations, in 2004, an accumulated savings of R\$ 1.285 billion were documented.

- 1 Basic Sanitation Company of the State of São Paulo.
- 2 Paraná Sanitation Company.
- 3 Minas Gerais Sanitation Company.
- 4 According to the Brazilian Association of Energy Conservation Service (ABESCO), Energy efficiency (EE) is defined as the relationship between the amount of energy used in an activity and that made available for the performance, rationally applying energy for a given purpose (ABESCO, n.d..).
- 5 According to the Brazilian Association of Energy Traders (Abraceel), the free energy market is an environment where energy can be traded on a voluntary basis, enabling consumers to contract electricity directly with generating and trading companies. There are two types of consumers in the free market: free and special. The free ones must have at least 2,000 kW of contracted energy demand. The special ones must consume 500 kW or more and less than 2,500 kW. In this case, the commercialized energy must come from alternative sources: wind, solar, biomass, etc. "The free market ended the first half of 2020 with 7,222 consumers, of which 938 are free and 6,284 are special customers. In the first six months, 165 new migrations were carried out, an increase of 10.2%" (ABRACEEL, 2020).
- 6 In accordance with Decree No. 5,163, of July 30, 2004, FCE is the environment where the commercialization of electric energy takes place between concessionaires, permit holders and authorized electric services and installations, having its rules and procedures issued by the National Agency of Electric Energy (ANEEL). In the RCE, the market segment in which the purchase and sale of electric energy between selling agents and distribution agents is carried out is preceded by a bidding process, what makes it different from the Free Contracting Environment (FCE) in which operations are carried out through freely negotiated bilateral contracts. (BRASIL, 2004).

Another Sabesp initiative, mentioned by Segamarchi, was the Photovoltaic Energy Distributed Generation Program⁷, where panels were installed in the company's areas and the energy made available in the network started to be injected, generating kilowatt-hour credits to be used to offset the consumption of other units of the company itself, those served by the same distributor (remote self-consumption). "It is a pioneering initiative in sanitation and makes it possible to diversify our energy matrix, exchanging it for clean, renewable energy and in line with the United Nations' Sustainable Development Goals (SDG/UN)".

In this program, Sabesp uses the following contracting model: the first stage (up to 24 months) consists of preparing the documentation, opinion, supply and installation of equipment. The remuneration that the contractor receives is equivalent to 70% of the value of the contract during this period. The other 30% will be received over the next 36 months, considered a kind of assisted operation and maintenance (performance contract). At the end of the term, Sabesp takes over both the operation and maintenance. "There are 30 photovoltaic power systems (PPS) that range from 1 to 4 megawatts (MW), totaling 60 MW of power. When all the works are concluded, it will be equivalent to 4.5% of the company's total consumption. The vast majority of them will be completed by 2023," stated the speaker.

Segamarchi also indicated the Motor Replacement Program conducted by the National Electric Energy Agency (ANEEL), which has shown average efficiency gains of around 5%. He also mentioned the development of a new model for the acquisition of motor pump sets, with selection of the lowest total price that provides for the acquisition of equipment, installation cost and projected energy expenditure according to the efficiency of the set as three selection criteria. "It's not just because of the lower price of equipment. We are considering the savings generated by the efficiency of the motor or pump set".

As well as Sabesp, Sanepar has electric energy as one of its main expenses. In his presentation, Atty. Claudio Stabile spoke about the importance of energy for the sanitation sector, a situation that currently requires greater efforts from organizations to reduce costs in companies. He reinforced the need to adapt to climate change as one of the fundamental approaches within planning in a period as challenging as the one we are experiencing. He mentioned some examples of what the Paraná Company has been developing. "At Sanepar we created the Electricity Invoice Management System (SGF), which evaluates invoice by invoice and each item in it in detail.

This is exceptionally important for us to take faster action." In the SGF, the regionalized management of accounts and contracts, the recalculation of invoiced amounts, updating of registration, study of tariff option, management of additional, among others is made. With this information, Sanepar works on the real-time monitoring of energy management through the Business Intelligence (BI) platform.

Another point raised by Stabile was the issue of water loss. Due to ongoing efficiency work, the speaker stated that, from 1997 to 2019, there was an average savings of 68 million cubic meters per year and an average increase in revenue of approximately 45 million annually. In parallel with the use of technology, Sanepar also began to develop energy efficiency projects in electrical, hydraulic and process systems. It also works in the use of water and sewage treatment stations that, with the use of gravity, develops hydro-energy microgeneration models in distribution networks, such as the equipment used in the São José Airport Water Reservoir, with a power of approximately 18 kilowatt-hours. "After three years of improvement, we are working to replicate this idea throughout the state. This unit alone, at the time of distribution, represents 25% of savings. It is fantastic!".

Sanepar has been advancing in several fields, one of which is wind energy⁸. According to Stabile, this is still not the company's strong point, but it already develops some important projects, such as the work with the Federal University of Technology -Paraná (UTRPR) and the energy company Copel, dedicated to determining the potential for wind energy generation at different points. There are already pilots installed on the coast of the state by means of the sum of wind and solar energy and a parking lot with solar panels and an electric station. The company's own building has already been recognized internationally because of the photovoltaic panels installed and which save one third of the energy used in the building. "Another successful project was the application of photovoltaic panels on the Passaúna Reservoir. After three years of research, this work has reached a certain maturity to be replicated. With the plant on the water, some advantages were identified, such as the cooling of the modules and a longer useful life of the equipment." The speaker also stated that, due to the shading generated by the plate, there is no solar incidence in the water strip. Without this, there is no photosynthesis and, consequently, algae do not affect the equipment.

Stabile explained about the work carried out by the company in relation to the Sewage Treatment Stations (ETEs) and the effort to guarantee the use of the generated residues in their

⁷ In February 2021, Sabesp inaugurated, in Orindiúva, the first Photovoltaic Power Station of the company's Distributed Generation Program, with a capacity of 1 megawatt (MW), with a generation potential of 1.9 million kilowatt-hours (kWh) per year. This volume is enough to supply 780 residences, which corresponds to 44% of the city's population. (SABESP..., 2021).

⁸ Energy generated using winds; wind energy has become a way to address the energy issue in a country that is dependent on hydroelectric plants. Due to the water crisis, new ways of generating energy were discussed and wind energy is considered a favorable alternative for preserving the environment. According to data from ANEEL, in the first half of 2020, the country's electricity matrix was divided as follows: 59.27% hydroelectric plants, 25.56% thermoelectric plants, 8.94% wind farms, 3.08% small hydroelectric power plants (8HPs), 1.55% photovoltaic generating plants, 1.15% thermonuclear plants and 0.46% hydroelectric generating plants. By the end of 2020, the country had 653 wind farms, with 82% of them concentrated in the Northeast region (O QUE..., 2021).

almost completeness, such as the sludge, its transformation into biogas, into fertilizer, etc. "We created a system to measure the gases, quantity, quality and data. Let us imagine that we have a biogas with a quality very close to biomethane, for example. What do we need to do for this purification? Is this the best measure? So, this system brings us the measurement, the quality and the destination that we can use." According to him, the state of Paraná currently has the largest park of anaerobic reactors in the world treating domestic sewage.

According to Eng. Marcus Tulius, the issue of energy and the dialogue about its advances is fundamental, especially given the impact it currently has. "It's the company's second largest expense, not to mention the importance in relation to the environmental context in which it is inserted." Because of this, he said that Copasa seeks to rebalance its energy matrix, working to reduce the share of conventional energy and adding a greater share of clean energy from renewable sources. In the same way, the company has been working on the energy efficiency issue. With great importance in the development of sanitation in the state of Minas Gerais, the company currently distributes over 1 billion cubic meters of water, is present in over 640 concessions, serving 11.8 million inhabitants and 5.5 million savings. In 2020, the company's energy expenditure reached R\$452 million, with a consumption of 913 Gigawatthours.

According to Tulius, the energy issue touches on the different actions undertaken within the company. When designing and formulating engineering projects, the work is developed so that these water supply and sewage projects are guided by the conscious use of energy, eliminating pumping systems, favoring systems that use gravity, making assertive topographic studies regarding the best energy levels, among other precautions. "In addition to the in-house work to change values, we have several actions related to energy efficiency. We are working to migrate some of the company's units to the free energy market in 2023, which would represent around 38% of what is consumed." Tulius also presented a bit of the Electric Energy Control System (SICOE), developed by Copasa. This system links consumer units with provisioning, payment of expenses, tax bookkeeping, in addition to being an important information tool that allows the company to carry out assessments in order to seek the best efficiency ratio in the units.

According to the speaker, the company is currently developing several actions, such as automation appropriate to the size of the system, efficient lighting, initiatives to reduce water losses (with important numbers, such as the reduction of 27.5 liters/ second in Montes Claros), employee awareness, fleet supply project (called Blue Fleet Program), among others. One of the projects mentioned by Tulius is to replace obsolete and

inefficient equipment, carried out in partnership with the German Development Bank (KfW), in which R\$ 12 million were invested to adapt the pumping units, purchase and install equipment. In progress, the initiative has reached 25 consumer units. Another action taken by Copasa is its work of accrediting companies specialized in energy conservation services, which seeks to renew the company's assets and, consequently, greater efficiency in consumer units, reduction of energy and maintenance costs. The company is also active in energy cogeneration at Arrudas STS. The project, which began in 2011, has an installed capacity of 2.4 MW, reaching a total energy production of 3,459 MWh in 2020. Part of the thermal energy of the system is used to heat the sludge, increasing the production of biogas, allowing greater energy generation.

More recently, Copasa has published an initiative for the development of self-production, through an Expression of Interest (EOI). "We left the public notice completely open, both from the point of view of the possible business arrangement – it could be a PPP, a joint venture, a specific proposal company, any arrangement that the legislation allows us to make. At the same time, from a technical point of view, the sky is the limit." In this public notice, the proposals can encompass the search for wind energy, solar energy, biomass originating from sewage treatment plants, both to generate energy and to use biosolid for agricultural purposes, etc. One of the topics highlighted by all speakers was sustainability and the search for alternatives that generate results; benefiting both people and the environment.

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⁹ Since the 1980s, Sanepar has been carrying out actions in favor of the energy use of the gas from the STS. During that period, the company used gas as fuel for institutional vehicles. In 2008, one of its STS was the first in the country to adhere to the electricity compensation system according to ANEEL rules, with energy powered by biogas. "Sanepar has a tradition in the use of biogas and we have great potential to increase this use due to the large volume of biogas that we already produce. This brings benefits to the environment contribute to affordable tariffs, as recommended by the sanitation framework," stated Stabile. For the future, Sanepar is working so that, by 2024, the technology for harnessing biogas for energy generation will be used in eight more Sanepar sewage stations (SANEPAR..., 2021).

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energia-eolica/#:~:text=Energia%20e%C3%B3lica%3A%20 vantagens%20e%20desvantagens&text=Sua%20 fonte%20%C3%A9%20um%20recurso,os%20parques%-20e%C3%B3licos%20s%C3%A3o%20instalados>. Accessed on: Jan. 26, 2022.

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José Geraldo **Portugal**



Luiz **Fialho** ACE Startups



PALESTRANTE: Eder Sá Alves Campo Iguá Saneamento



Martin Luther Candido e Silva

Biti 9 Startups

ROUNDTABLE: STARTUPS AND SANITATION -LOVE OR FRIENDSHIP?

Moderator:

Econ. José Geraldo Portugal - Sabesp¹

Speakers:

Eng. Luiz Fialho - ACE Startups² Econ. Eder Sá Alves Campos - Iguá Saneamento³ Adm. Martin Luther da Silva - Biti9 Startups⁴

Coordinator/Evaluator:

Eng. Luis Felipe Macruz - Sabesp

This word is becoming more and more common in our country, as is the concept behind it. Startups⁵ have been gaining more and more space in our daily lives, as well as a place in the global economy. We're not just talking about the next Unicorn⁶, but also those that come up bringing innovative solutions to our real world. As a result of the New Legal Framework for Sanitation⁷, the sanitation sector is undergoing major transformations, with wide possibilities for improving service provision and increasing competition. Thinking about several joint opportunities for these ecosystems, the 32nd edition of the AESabesp Technical Meeting organized a roundtable called Startups and Sanitation: Love or Friendship? It aimed

to address issues that permeate the culture of startups and how beneficial and effective they can be for the sanitation sector, as well as producing innovative solutions for the segment.

For the Econ. José Geraldo Portugal, moderator at the table, the discussion is important due to a series of factors, starting with the complexity of situations that the sanitation sector will need to fight from now on. However, he welcomes the arrival of startups in the sector, as the new Sanitation Legal Framework will open up greater competition in the area. "Often, sanitation companies still have some procedural flaws. Startups are vectors in the innovation process, which will certainly play an important role in sanitation 4.0, accelerating universalization, providing quality at affordable prices. We have to understand how startups can act in the sanitation area in Brazil and see what the expectations are for the future," declared the moderator.

Eng. Luiz Fialho brought the vision of his experience in startups acquisitions by large corporations in the Corporate Venture Capital (CVC)⁸ format. Contextualizing the scenario, he presented that this type of investment moved around R\$ 3 billion in Brazil in the last two years and that, currently, around the world, 25% of investments in startups are being carried out

- 1 Basic Sanitation Company of the State of São Paulo
- 2 A company that was born as a startup accelerator. In 2019, it changed its strategies and started to act as an investment company, making its full acceleration methodology available for free to the startup ecosystem.
- 3 Sanitation Company present in 39 cities in Brazil, with 18 operations in six Brazilian states.
- 4 A startup specialized in productivity through process automation, which ensures cost reduction and productivity increase in any business activity that is repetitive, scalable and with high volume. With process automation, it is possible to reduce costs and increase the productivity of any business activity that is repetitive, scalable and with high volume.
- According to the Brazilian Startup Association (ABStartups), is a company that was born from an agile and lean business model, capable of generating value for its customer by solving a real problem, in the real world. It offers a scalable solution for the market and, for this, uses technology as its main tool (MAS..., n.d.).
- 6 A startup is called Unicorn when it reaches US\$ 1 billion market value (MAS..., s.d).
- 7 The approval of Law No. 14,026/2020 updated the legal framework for basic sanitation in Brazil. Regulatory action between the National Water and Sanitation Agency (ANA) and the industry will reach a new level, as ANA will issue reference standards, which must be taken into account by sanitation regulatory agencies, whether municipal, intercity, state and district. Some topics addressed in this new legal framework are: tariff regulation of public basic sanitation services; standardization of business instruments for the provision of public sanitation services signed between the public service holder and the delegate; quality and efficiency standards in the provision, maintenance and operation of basic sanitation systems, among others (NOVO..., s.d).
- 8 This is considered the most common way in the relationship between startups and large corporations. The company invests in or acquires startups to, let's say, be part of its journey and processes or its own pool. Currently, a large company is involved in 30% of investments in a startup (CORPORATE..., n.d.).

by large companies. "This love story is already happening. Big corporations already see startups as something that will even help them to look at their own business in a new way," he said.

Large companies not only need to look at the startup as an investment or be close to a trendy concept to convey an innovative image, but in fact have a strategic partnership to incorporate the open innovation model in their company⁹ o matter how big the company, it will never be the holder of all the knowledge. Having strategies, products and channels through third parties, being the next startups, can be a huge solution. "Anyone who can't do that could be pretty dead. It is necessary to leave behind that vision that you can do everything and show that you have partners – not just startups – which are potential value aggregators, positioning themselves on what is best and being able to share their strategies with these partners, who will bring solutions and collaborate with their target," he declared.

According to Fialho, there is still a certain prejudice on the part of large corporations when the subject is startup. Some companies look to the two engineers who created a company in the garage and suddenly it worked. In the speaker's view, they need to see how this type of startup has changed behavior in relation to innovation and how open innovation has been impacting, to the point that these companies that start in the garage make a difference in large companies and also in society. Large corporations, before a major acquisition, need to target a real solution for the business - which can only be achieved through open innovation. Looking together at certain situations can identify the core of the issue, that which has evidently caused a problem. Often, in the urge to internally resolve a given situation, an idea comes up, a department is created, a budget is set and time and resources are spent on something that ended up not being validated – which was not in fact a problem or for not associating with those who already had the solution.

Finally, the speaker highlighted that the market is heated and with a high level of liquidity, which is advantageous for the best startups, which are coming up with increasingly innovative solutions every day. These are not simply waiting for a big investment, but looking for a partner who will also add value to them. Therefore, it is necessary to know how to position

yourself with an interest in innovating and working together to be able to be with the best startups.

The Econ. Eder Sá Alves Campos pointed out that few innovations are perceived in the sanitation sector, unlike other segments. In days like the present, when more and more payment solutions are emerging, the speaker asked about the difficulty consumers have in paying a water bill through other means, such as, for example, the credit card, so common in the daily life of Brazilians. In his view, in a sector like sanitation, which provides continuous services, innovation is needed. "Our challenge is to build maturity in the sanitation innovation ecosystem. Currently, startups are curious about the sector, more than money or investment. We need to introduce ourselves to them," he asserted.

As mentioned before, most of the sanitation companies in Brazil provide continuous services to society and, for Campos, startups can be of added value in terms of internal optimization, operational excellence, simplification and efficiency in processes, allowing for other forms of payments, debt renegotiation, among other things that are part of the daily life of sanitation companies. Aiming at a change in the culture of the sector, the speaker mentioned the launch of the first open innovation program in the segment, IguáLab¹o, in which many opportunities were generated. In two editions, it was shown that startups are not animals from another world. "We challenged the sector and showed that it is easier to go ahead with startups than to continue in the core business. Innovation has to be seen as a process," he said.

The speaker highlighted that embracing open innovation as a process can make a good startup appear on your door any day and that initiatives like this, for the sake of innovation, cannot be seen as competition, but cooperation—highlighting Sabesp's Pitch¹¹, the largest in the sector. This makes startups look not at company A or company B, but at the entire industry. Proof of this is that Iguá gets to know a new startup very two days and tests a solution every 30 days. One of these recent solutions was the new experience in the store queue. The case would be to analyze whether withdrawing the password and waiting to be called would be the best way to answer.

⁹ Open innovation is a management model focused on innovation, but which promotes collaboration between people and organizations outside the company. This, obviously, breaks with the traditional corporate culture and ends secrecy in some strategies and processes, however, it is a response to the company's difficulties in innovating alone (NOVAC O ARRITA 2021)

¹⁰ Open innovation program on behalf of the sanitation sector developed by Iguá in 2018, the first in the sector. Since then, more than 150 startups have signed up for the action, with 15 projects started and over R\$ 1.2 million invested in the last two years. The initiative was recognized as the most innovative idea in the PPP Awards & Conference Brazil 2018 (INOVAÇÃO, s.d).

¹¹ It is a public call to select innovative projects that contribute to the area of basic sanitation, which bring solutions to the most diverse challenges faced by Sabesp and improve the provision of customer service and daily operation (O QUE..., s.d).

The challenge for the sector will be to create demand for the offer of innovation. Campos shared a case of a project that had a purpose and that purpose was used for sanitation. For him, drinking water is still a taboo to be dealt with. Even with companies in the sector delivering potable water to several homes, many people still see and pay more buying water outside. Faced with a startup whose mission was to reduce and reuse the use of plastic, it was suggested that they link to this discourse the valorization of water. Redone, the project delighted the IguáLab bank and ended as one of the winners. RefilMe, as it was called, was accelerated by the company and is currently producing the first Water Replenishment Systems (WRS).

Adm. Martin Luther Candido, who works for a startup that provides services to large corporations, showed the advantages that this partnership can bring. The professional started his lecture by highlighting the necessary of thinking about innovation and that it takes time. For him, there is no way to generate time and no magic hourglass, the best way to have specific periods for this is to remove from the routine of companies activities that do not generate any intellectual benefit, professional development or for the corporation – so he presents his company's solution, which is to transfer those responsibilities to robots. "We believe that this technology can change the productivity of any company in Brazil, from small to giants".

Candido pointed to a basic guide to identify problems and opportunities to help large corporations solve problems, consisting of nine pillars: low rate of productivity or speed of manual execution; professionals who are unmotivated with the execution of repetitive activities and high turnover, commitment of a large volume of people to the execution of the processes and costing them dearly; high error rate in manual execution; delay in the execution of processes manually; large amount of overtime to execute processes; low speed in the addition of new people or overtime costs; low employee adherence to innovation activities; and customization time of current tools is too high and too expensive.

With the resumption of the economy after the crisis caused by the pandemic, there is plenty of work and meetings for companies, so there are many people who are learning to structure themselves in the midst of a new work model (remote, hybrid or face-to-face). How to handle this if there is a large volume of work? Are there new people being rehired, with a sometimes not adequate motivation rate, and a non-ideal productivity and, consequently, a higher error rate? These are factors giving headaches to any management position in companies, but solutions also emerge on a daily basis, with the various tools that can be created to overcome these points, since, for example, it is not possible to double a salary sheet overnight.

"As startups only exist for the gap of transforming the culture of innovation in companies, which we know is not overnight. Startups are born to bring faster results while this process is being matured. Many companies take advantage of this relationship to incorporate a little into the culture of these startups, which must always be up to date and innovate," he pointed out. Starting from the problem identified, a pilot is started to validate the initial hypothesis of the challenge, whether aimed at employees or daily processes, such as, for example, performing a more efficient reading of the water meter. If the pilot is successful, it is time to scale this model – it is necessary to customize the startup's product in response to the corporation's demand, moving towards a middle ground between both.

Once that point is passed, the operating point begins, which is when the relationship between the startup and the large corporation becomes a marriage. There is an accommodation period at the beginning of the process, when startups will have some flaws, but always aiming for improvement. It will settle down, restructure and have the capacity for a quick solution. The beginning of the operation also opens new doors, new opportunities for both — with new processes and businesses in between. From the moment this startup begins to generate value for the corporation, a new strategy will have to be taken. It is necessary to analyze whether there will be an incorporation to develop and grow the startup, becoming a robust supplier for the company (acceleration program¹²) or to incorporate in the Corporate Venture Capital (CVC) company pool.

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¹² Generally, acceleration programs are open to startups, who receive financial support, consultancy, training, participation in events during a specific period, in a period that may vary. In exchange, the accelerators receive an equity interest (MAS..., s.d).

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32° Congresso Nacional

de Saneamento e Meio Ambiente



André Gois Sabesp



PALESTRANTE:

Roseane Maria G.
Lopes de Souza

ABES



Rafael Piovezan

Bárbara d'Oeste



José Vieira

Universidade do Minho - Portugal

ROUNDTABLE: GOOD AND SAFE WATER FOR EVERYONE

Moderator:

Chem. André Luís Gois Rodrigues - Sabesp¹

Speakers:

Eng. José Vieira - APESB²

Biol. Rafael Piovezan - Santa Barbara d'Oeste City Hall Eng. Roseane Maria Gomes Lopes de Souza - ABES³

Coordinator/Evaluator:

Eng. Rosângela Cássia Martins de Carvalho - Sabesp

Water⁴ is one of the most valuable assets for sustaining life on planet Earth. Despite its fundamental role for humanity, the resource continually suffers from the impacts of anthropic action, whether through misuse and/or contamination⁵, causing health risks, including in the short, medium and long term⁶. In view of this, various actions to combat this reality are being implemented around the world. To talk about the progress of these initiatives, at the 32nd edition of the AESabesp Technical

Meeting, a roundtable called Good And Safe Water For Everyone was organized, which aimed to address the current legislation that covers the so-called Water Safety Plan⁷ (WSP) in Brazil, its correlation with health, as well as the difficulties and solutions for implementing the plans in the country. In addition, the roundtable presented the case developed in the city of Santa Bárbara d'Oeste, in the interior of São Paulo.

According to Eng. Roseane Maria Gomes Lopes de Souza, it is essential to advance the universalization of sanitation, since a large portion of the Brazilian population, and even the world population, still suffers from the lack of access to water and sanitation. According to the World Health Organization (WHO), "all people, at any stage of development and in any socioeconomic condition, have the right to have access to an adequate supply of safe and drinking water" (SOUZA, 2021). Regarding this concept of good and safe water, Souza stated that, more than covering the standard of potability, it needs to encompass the perspective of the risk, the dangers that may be

- 1 Basic Sanitation Company of the State of São Paulo.
- 2 Portuguese Association for Environmental and Sanitary Engineering.
- 3 Brazilian Association of Sanitary and Environmental Engineering Section: São Paulo.
- 4 Data show that 71% of the Earth's surface is covered by water and, of this total, only 3% are freshwater bodies, used for human consumption. Due to its intrinsic importance to the survival of thousands of living beings on planet Earth, the UN declared the creation of World Water Day, on March 22. Within this declaration, important statements about the resource were highlighted, such as: "Water is part of the planet's heritage", "Water is the lifeblood of our planet", "Water management planning must consider solidarity and consensus of its unequal distribution on Earth", among others (NÓS..., 2021).
- 5 According to a report released by the SOS Mata Atlântica Foundation, in 2019, a study carried out in the Atlantic Forest basins showed that, of the 278 water collection points that were monitored, only 18 presented water with a quality considered good (which is equivalent to 6.5%). None of the points reached the optimal level. About 74.5% of the rivers are of regular quality, 17.6% are considered bad and 1.4% are considered bad (CARDIM; TUNES, 2019).
- 6 Diseases that can be transmitted by contaminated water include: diarrhea caused by *Escherichia coli*, also known as E. coli, this microorganism lives in harmony in the intestines of warm-blooded animals, but can mutate, becoming harmful to humans; amebiasis, disease caused by the protozoan *Entamoeba histolytica*; cholera, caused by the bacterium *Vibrio cholerae*; caused by bacteria of the genus *Leptospira*, bacterial dysentery, caused by bacteria of the genus *Shigella*; hepatitis A, whose form of contamination is associated with the ingestion of water and food contaminated with feces of infected people; schistosomiasis, known as "water belly" and caused by flatworms of the genus *Schistosomia*; among others (BRK AMBIENTAL, n.d.).
- 7 According to WHO, Water Security Plans are tools aimed at "assessing and managing health risks associated with water supply systems, from collection to the consumer, which facilitate the implementation of the principles of multiple barriers, good practices and management, inserted in the Ministry of Health ordinance on potability of water for human consumption Ordinance MS No. 2.914/2011" (MINISTÉRIO DA SAÚDE, 2012).
- 8 Recent data from the WHO and the United Nations Children's Fund (UNICEF) indicated that, between 2016 and 2020, there have been some advances in the world, with access to safe drinking water managed at home rising from 70 to 74%, sanitation services made some progress, rising from 47% to 54% and also highlighted the increase in handwashing facilities with soap and water (from 67 to 71%). However, she highlighted that, during the pandemic, three out of 10 people around the world could not wash their hands with soap and water at home (TRÉS..., 2021). In relation to Brazil, the latest survey carried out by the National Sanitation Information System (SNIS) showed that approximately 15% of the population still live without access to a water network and 45% do not have access to the sewage network (SNIS, 2020).

contained in the water that the population consumes, such as issues such as drought, contamination, lack of coverage and cost. A number of factors affects the feature. "We are talking about a population that does not have this availability of water and, therefore, will be harmed in its hygiene, in its consumption of water inside the house, being able to even search for other risk waters," she says.

For the speaker, talking about safe water is talking about the risk of waterborne diseases, the need for a methodological apparatus to accompany the population, dealing with topics such as urban and peripheral areas, in addition to socioeconomic conditions, since populations have different incomes. Currently, these discussions are directly related to the United Nations (UN) Sustainable Development Goals9 (SDGs) and the Water Safety Plan (WSP). According to Souza, when it comes to health goals, there are three major blocks: 1) epidemiological and toxicological data, which support the values found in the standard of potability; 2) the question of water quality itself, that is, the need to have potability standards. "There is no point in maintaining the standard where it is not known whether the water is within or outside the standard, where it causes risk to the consumer"; and 3) the question of the efficiency of the treatment. "What we have today in our springs is a continuous compromise of water quality, which ends up harming the efficiency of the treatment - which was designed, structured and operated for yesterday's water and not for today's water".

Regarding the risks and dangers, Souza stated that it is necessary to know them in order to choose which pathogens to combat. "For each spring, for each water supply system, there are different risks." Because of this, the engineer stressed that the implementation of the WSP is important in order to encompass the individuality of the different systems. According to her, there are several types of pathogens, but there is no need to analyze all these parameters. "It is important when we promote the issue of safe water or a more shared management

in the issue of the source and the efficiency of the treatment, so I reduce the issue of monitoring." Souza presented the carcinogenic chemical substances present in the universe that are being studied by the International Agency for Research on Cancer (IARC) in relation to a classification also used by Brazil to define what is carcinogenic or not. There is a list of substances quantified and expressed in terms of probability or appearance of a disease or illness.

The speaker cited the recent changes that came with Ordinance GM/MS No. 888, of May 4, 2021¹⁰, which amended Annex XX of the Consolidation Ordinance GM/MS No. 5, of September 28, 2017, and provided for the procedures for controlling and monitoring the quality of water for human consumption and its potability standard. "In previous ordinances, we already talked about a security plan, but this ordinance makes it clearer." According to her, in some articles it is possible to see guidelines on the importance of the health authority asking the supply system for an alternative solution or water safety plan. For Souza, the WSP can also be used to reduce monitoring analyses, as it will help to identify the contaminants existing in each source. Currently, health authorities are increasingly requesting the plan, the Public Prosecutor's Office, among others. What is really missing, according to the professional, is the expansion of the WSP within Brazilian legislation. Today, the only legislation in Brazil that covers the Water Safety Plan, which deals with this obligation, the importance of the Supply System to bring this methodology, and the elaboration of the Safety Plan, its implementation and evaluation is Ordinance No. 888 of the Ministry of Health.

For Eng. José Vieira, water is not only a technical issue, but also a public health issue. As it is a universal solvent, capable of dissolving a multitude of substances, such as salts, gases, proteins, pollutants, it presents itself as a preferred vehicle for the transmission of diseases to humans, either through the consumption of contaminated water or through poor

⁹ The 17 SDGs are: (1) No Poverty, (2) Zero Hunger, (3) Good Health and Well-being, (4) Quality Education, (5) Gender Equality, (6) Clean Water and Sanitation, (7) Affordable and Clean Energy, (8) Decent Work and Economic Growth, (9) Industry, Innovation and Infrastructure(10) Reducing Inequality, (11) Sustainable Cities and Communities, (12) Responsible Consumption and Production, (13) Climate Action, (14) Life Below Water, (15) Life On Land, (16) Peace, Justice, and Strong Institutions, (17) Partnerships for the

¹⁰ Among the characteristics presented by the new ordinance, are: increase of definitions destined to the understanding of the legislation; introduction of a standard for microcystin and saxitoxins (toxins produced by cyanobacteria harmful to health); update and expansion of elements and chemical substances to be analyzed for 14 inorganic elements, 16 organic substances, 40 pesticides and metabolites and 10 by-products of the chlorine disinfection process; introduction of turbidity pattern for membrane filtration; prediction of differentiated sampling plan for indigenous peoples and traditional communities; among others (ALVES et al., 2021).

sanitation and hygiene systems. Currently, with scientific advances, it is possible to identify a large amount of pathogenic microorganisms, chemical substances and radiological elements carried by water and their effects on human health. Sanitary engineering aimed at public health has registered significant technological advances in order to achieve high levels of health and well-being. In relation to the transmission of diseases through water, Vieira stated that substances in toxic concentrations that cause chronic diseases could be verified in a wide spectrum of effects on public health of inorganic, radiological and organic contaminants and their high level of severity for the human being. Just like "the discovery of microorganisms or, at least, the possibility of analyzing and linking these beings to the disease were essential for the development of new methodologies aimed at controlling these diseases through technical solutions for water supply and environmental sanitation".

Advances in engineering have had beneficial effects on the disease control by bringing water into homes and sewage beginning to be released outside¹¹. The disinfection of public systems and use of chlorine also grew. Subsequently, large water and sewage treatment facilities appeared. For him, changes are recent. Currently, a topic of great focus are the UN-SDGs. Among them, he highlighted Goal 6, relating to water, sanitation, and the pursuit of universal and equitable access to safe and affordable drinking water by 2030. Data published by the WHO point to the existence of a great imbalance in distribution between countries in the northern and southern hemisphere. Another worrying fact is the lack of safe drinking water and the fact that approximately 818 million children do not have access to basic hygiene services. "It's embarrassing that, in 2021, we have these difficulties in accessing drinking water".

According to Vieira, one of the main global challenges for water security is the demographic question. With the increasing population growth, the issue of inequality grows proportionally, which directly affects the supply systems. Another topic mentioned by the speaker is pollution, which brings with it

emerging biological and chemical threats, in addition to climate change, making it more difficult to manage water resources, with the depletion of water sources; lowering of water tables and decline of sources of surface water; the increase in the frequency of extreme events, droughts and floods and, therefore, an increase in the atmospheric temperature, which increase the demand for water. He also mentioned the level of available water quality, which is affected by the increase in pollutant concentrations when atmospheric conditions are drier; flash floods that affect water quality by transporting contaminants into the water environment; increased mineralization of organic nitrogen and, thus, increasing its concentration in rivers or groundwater; toxic algal blooms and cyanotoxins in ponds, lakes and reservoirs; and other aggravating events¹².

The PSA, proposed by the WHO, assumed great importance as a fundamental element to support policies for the quality control of water for human consumption and its impacts on public health. For the speaker, it also allows public health management to focus on preventing microbiological and chemical water contamination. Furthermore, it "constitutes a paradigm shift in the approach to managing water supply systems in both developed and developing countries." The WSP is a way to ensure safe water through everyone's knowledge of the water supply system, identification of where and how problems may arise, preventive placement of barriers and management systems, ensuring that all components of the system function efficiently. It is an approach to risk assessment and management from the source to the point of consumption inserted in the Public Health objectives by the WHO.

Vieira also cited a WHO survey carried out in 118 countries in 2013 on the experiences of implementing the PSA or equivalent risk management approaches¹³. Afterwards, the data was updated. After the evaluation, there was an increase in the application of the methodology in several regions around the world. According to Vieira, norms and regulations show strong political support for WSP in several countries.

On this, the professional mentioned the experience of Uruguay,

¹¹ The history of sanitation is ancient, leaving its mark on various civilizations such as Rome, with its streets with pipes that served as a public fountain; Sumerians, responsible for the construction of the irrigation system of terraces; and Egypt, which worked to control the flow of the Nile River. Over the centuries, humanity has evolved in this subject, creating sewer galleries, rudimentary supply and drainage systems. However, for a long time, it suffered from the precariousness and contamination of the water, leading to tragedies such as cholera, in the late 19th century. In Brazil, it was only in the 1940s that the marketing of sanitation services began. Together with them, several autarchies were created for monitoring. An example of this was the Special Public Health Service (SESP), now known as the National Health Foundation (FUNASA) (BARROS, 2019).

¹² UN states that, around four billion people experience severe water shortages for at least one month a year, and around 1.6 billion people – almost a quarter of the world's population – have problems accessing a clean and safe water supply. According to the organ, the scarcity of the resource is only increasing and it predicts that, by 2050, more than half of the world's population will be suffering from scarcity problems (VISTO..., 2021).

¹³ According to the publication made by WHO in 2013, and updated in 2017, WSPs are being implemented to varying degrees in 93 countries representing all regions of the world, with 30% of countries in the early adoption stage and others implementing at a national scale. In addition, 46 countries reported having policies or regulatory instruments in place that promote or require WSPs, and a further 23 countries reported that such instruments are in development (WHO/IWA, 2017).

a country with 3.5 million inhabitants, 80% concentrated in the metropolitan area of the capital Montevideo. Currently, the entities providing water services are in charge of a single company, called Obras Sanitarias del Estado - Public Health Works. It also has a regulatory body directly linked to the presidency of the republic called Unidad Reguladora de Servicios de Energia y Agua (URSEA) - Unit for Energy and Water Services. In 2012, the implementation of the WSP in the country began, with lectures and internal training sessions. The first pilot was developed in the city of Dolores. In 2014, several efforts were made in order to guide more and more people on the subject. Finally, in 2018, the URSEA worked for the approval of a law on the institutionalization of security plans nationally. According to Vieira, this law was fundamental for changes in the theme, as it included definitions such as "safe water" in its articles, in addition to promoting the development of safety plans compatible with the needs of different population groups.

Biol. Rafael Piovezan presented the case of success of WSP in the city of Santa Bárbara d'Oeste, in the interior of São Paulo. A medium-sized city, with approximately 200,000 inhabitants, the city, according to the speaker, has some characteristics that contributed to the choice of the city as a precursor to the implementation of the plan. "We have a quality technical team within the Department of Water and Sewage (DAE), an autarchy created in 1986 recognized for excellence in service provision. Another point that I consider to have been important was the fact that the city is supplied by a system of dams within the city," he reinforced. When he started his career at the Municipal Environment Department, Piovezan identified the need to work on building a sanitation plan for the region. Hiring a plan could be an alternative, but he preferred to rely on the team he already had, as it helped him to establish deadlines, goals and funding closer to the reality of what he would be able to execute.

In 2014, the professional was called to the position of superintendent director of the DAE of the region and the great challenge of that period was to face the water crisis¹⁴ hat affected the entire state of São Paulo. In Santa Bárbara d'Oeste, the event had an impact on its dams. "To a certain extent what we had in terms of information was that the dams were built a few decades ago. There was no modeling of volume utilization that would allow us to better understand their capacity in times of crisis, of water stress." The situation made the department feel the need to seek answers in large research centers. Thus, the movement of approximation with research institutes was natural

and very beneficial for the evolution of DAE and, consequently, for the city, which now has an even more qualified department committed to anticipating solutions for occasional crises. "We had this extremely important look at how the global impacts of global warming, of climate change, would affect the sanitation system, particularly the water supply".

Due to the commitment to understand how the springs in the region would respond to possible problems and the effort to improve the situation of water supply in the region, Santa Bárbara d'Oeste was chosen, in 2017, as a pilot city in the elaboration of the PSA. According to Piovezan, building a relationship with renowned research institutes in the country helped to transform the monitoring system that exists in the region. The sanitation plan also gained from this movement as all of its goals were achieved. We were able to achieve the objectives that were outlined for water treatment, expansion of networks, replacement of old networks, renovation of elevations. In six years, we have built two stations that are the biggest infrastructure works in the history of our city," he said. One of the first steps taken was to identify the existing risks, such as the proximity to the Bandeirantes Highway and the possibilities of accidents. The effort was also made to identify the quality of the region's springs, mapping their biota to find out if there was any ecological imbalance.

Currently, said Piovezan, Santa Bárbara d'Oeste has a program for reforestation and recovery of springs considered the largest recorded in the city. Throughout this work, which began in 2017, each stage of the process that integrates the water supply system underwent a reformulation, showing that the investment in sanitation brought quality and financial return. "This investment involves having more efficient networks, which have less disruption problems, and all of this will mitigate any risks that exist, even the emergence of pathogens in this system." For the speaker, the country needs the look of managers to invest in skilled labor within the sanitation system and monitoring of research centers, taking what is learned in academia to the reality of what is happening in each city. It also alerted to the need for commitment to the implementation of the WSP. "I believe that what ends up hampering the progress of sanitation and water security plans is the lack of continuity in actions, specifically when they are not built by the team of each one of the secretariats or departments that are responsible for treating water or even taking care of environmental issues".

¹⁴ In 2014, the state of São Paulo suffered a severe drought in its eight supply systems. Right at the beginning of that year, the Cantareira System was operating at 27.2% of its capacity and, in May, the level was reset to zero, forcing Sabesp to work with the so-called technical reserve (dead volume). In addition, other systems suffered from the low volume of rains. In that period, the government worked on an extensive rationing campaign, leading the population to change their habits in order to save water (CRUZ, 2014).

For all the speakers, the WSP enables an increasingly broad work when it comes to water safety. "The security plan is a health prevention plan because of drinking water, but it has a lot in common with the sanitation sector. So, there is a need for the security plan not only to look at the Ministry of Health, but also at other ministries," said Souza. For Piovezan, the water crisis triggered a new look at water security, driving new attitudes and the consolidation of integrated management to improve supply. Vieira reinforced that, for the dissemination of the PSA, institutional commitments, organizational methodologies and support mechanisms are needed. According to him, these are key factors for success. Furthermore, "a coherent and pragmatic fundamental framework is needed for monitoring a standardized WSP implementation process and prioritizing the key components and assigning responsibilities to institutional partners".

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Hélio Suleiman



Vitor Aly



Melissa Cristina Pereira Graciosa



Regiane Relva Romano

ROUNDTABLE: URBAN DRAINAGE INTEGRATED TO SMART CITIES

Moderator:

Eng. Hélio Suleiman - FABHAT¹

Speakers:

Eng. Vitor Aly - USP²
Eng. Melissa Cristina Pereira Graciosa - UFABC³
Adm. Regiane Relva Romano - Smart Cities Facens

Coordinator/Evaluator:

Eng. Luciomar Wernerk - AESabesp⁴

Smart cities⁵ is an increasingly widespread concept in several areas, but a smart city, in fact, needs proper urban drainage⁶, which brings daily benefits to the citizen. The integration of the concept into the system was the theme of the 32nd edition of the AESabesp Technical Meeting, which organized a roundtable called Urban Drainage Integrated to Smart Cities, which aimed to show how these topics should be integrated, as well as pointing out solutions for planning and acting so that urban drainage is part of a smart city. Eng. Hélio Suleiman, moderator of the roundtable, began by highlighting that, events such as the increase in rainfall, floods, climate change, speed of change in the world and the need to have more and more sustainable and resilient cities make the subject necessary to discuss. "We are part of a system in an ever-changing world. He pointed out that the theme has infinite challenges and opportunities that the world has imposed on us".

In turn, Eng. Vitor Aly, one of the speakers, tried to show that the smart cities concept is not to deal with the point of view of computerization in its fullness. Technology will be part of this concept, but it is not everything. From the point of view of the public manager, they are Planned Urban Centers with efficient processes that seek to improve the daily life and quality of life of the population in a sustainable way. Information technology can be used to improve the quality of life for those who pay taxes, but the environmental issue is also very important to ensure the future generations. For an adequate urban drainage, within what we call a "smart city", it is necessary to put an end to the lack of information or to the precarious information⁷. "In order to do something efficient, it is necessary to have as much information as possible. This is a huge problem for the public manager, as he does not have all the available elements at hand to make a decision. Making an inventory of the subsoil, mapping all the assets, is essential," said Aly.

The steps to gather this information are: asset registers, which are pavements, trees, urban drainage, poles, vertical road signs, urban furniture, bus stops, bridges, viaducts, footbridges, underpasses, risk areas, among others; creation of digital maps with the design of watersheds; creation of digital maps with the assessment of areas of historical flooding; availability of BI (Business Intelligence) with the results and modifications over time; creation of the Association for Subsoil Management

- 1 Foundation of the Alto Tietê River Basin.
- 2 University of São Paulo.
- 3 Federal University of ABC.
- 4 Sabesp Engineers Association.
- 5 The concept of smart cities, according to the European Union, refers to a system that has its infrastructure (services, information and communication) developed in a strategic way with the purpose of improving people's quality of life. Despite being considered a recent concept, the topic already moves the global market for technological solutions by US\$ 408 billion by 2020. Currently, more than half of European cities with more than 100,000 inhabitants are already working towards becoming smart cities (O QUE..., n.d.).
- 6 According to data from the National Sanitation Information System (SNIS), in 2020, in Brazil, 45.3% of the municipalities had an exclusive system for urban stormwater drainage. In addition, only 12% of the cities had a unitary system (mixed with sanitary sewage) and, even less, municipalities that had some type of treatment for rainwater (4.6%) (SNIS, 2020).
- 7 According to the survey carried out by SNIS, only 4,107 of the 5,570 cities in the country sent their data in the 2020 measurement. Of those that sent, only 1,332 had data on drainage and rainwater management services with mapping of risk areas. (RODRIGUES, 2021).

(ASM); promote governance, intervention planning, smarter, more efficient and participatory management. It is necessary to analyze what happens in the city of São Paulo from the point of view of water. According to Aly, 109 hydrographic basins in São Paulo were analyzed. "Given that, what we need to know is: what is a rain gauge, cleaning streams, conservation of galleries, derived drainage branches, registered drainage branch, manhole, wolf mouth, lion mouth etc." From there, it maps and collects occurrence information, observing natural resources, such as plant cover, contour lines, among others.

One example is the Aricanduva sub-basin, which has a history of flooding. In this location, the complete inventory becomes even more important. Public facilities in the region must be checked – not only the quantity, but also the situation they are in, whether they are operating properly – and whether they carry out predictive maintenance. In situations where the budget is small within a sub-basin or watershed, this information helps to better direct investments according to the risks within those areas, focusing on where they represent the greatest chance of flooding. "That way, I see how much I have accumulated average precipitation per date, how much accumulated precipitation I have per year, and by checking the map, I see where there is more risk of flooding to tackle these issues. The more information one has, the more active decisions can be made," he highlighted.

A very important point that Aly highlighted is the change in rain behavior. Despite the fact that the city of São Paulo has a history of rainfall over the last 100 years, it is known that the most recent rains have a different behavior, being faster and more intense⁸. This requires a change in some parameters, which will be important to know which areas are more critical and need cleaning actions and structuring measures - from a more specific cleaning for a gallery, grating etc. to a work in a gallery, among others. He stressed that the more information, the more assertive the decision-making is in the face of a risk situation.

All service providers, utilities owners or any stakeholder that has a relationship with the city's subsoil can have more dialogue, as the speaker suggested. Thus, actions at this level will be more assertive and cause less damage to citizens, not to mention the financial waste caused by rework. Aly even used the phrase "organize this mess", given that São Paulo has hundreds of stakeholders using the underground. "Our proposal is to create an association for manage the subsoil. The main goal is to strengthen the relationship between concessionaires and permissionaires and their subcontractors, with a focus on reducing damage to infrastructure, the pavement, minimizing environmental impacts, in the search for best practices, aiming at a more intelligent, efficient and participatory management," he claimed, using an example from the city – a stretch of 2.48 km from Santo Amaro, between Bandeirantes Ave. and Juscelino Kubitchek Ave., has 248 interferences, between telephony, gas, water and sewage.

Converting all this information is intended to cause: zero damage to infrastructure, training companies with training, improving logistics for monitoring announced works, communication and daily relationship between companies, as well as a planned view of the demand for works, categorization and prioritization of works with direction of supply of registration, remote guidance or field monitoring, sharing of information, solutions and technologies, and consolidation of remote technologies. 'The concept of smart cities will become a reality when we find ways to adapt public budgets to projects and, for this to happen, the mobilization of the population, government officials and the private sector is necessary," highlighted Aly.

For Eng. Melissa Cristina Pereira Graciosa, the subject is challenging and provocative. The watersheds have been greatly changed due to human action and the challenge of large cities is to promote river-city integration, which will be much more viable with the contribution of smart cities concepts. According to her, urban drainage is nothing more than making the water reach the rivers, but this is not a simple equation, given the different components that make up the city's landscape.

For the speaker, some of the challenges of modern urban drainage are: quantity control, reducing flooding and mitigating the risk; infiltration, with cities that have little permeable terrain⁹, which prevents adequate aquifer recharge and increases surface runoff; quality control, whether in drainage

⁸ Studies carried out by two meteorological stations confirmed the increase in extreme weather events in the São Paulo Metropolitan Region (RMSP). In the last two decades, rainfall intensity is above 100 millimeters/day, "There were 11 over 100 mm in the last 20 years (period 2001-2020), compared to 10 in the sum of the previous 60 years (period 1941-2000)". Furthermore, the total rainfall volume has gradually increased over the last 80 years, from 1,000 to 1,500 mm/year in the 1940s and 1950s to 1,500 to 2,000 mm/year in the last 20 years (ESCOBAR, 2020).

⁹ One of the major problems that caused soil sealing (which means the loss of its water absorption capacity) was the disorderly and unplanned urbanization of cities. Data from the European Environment Agency indicated that "between 1990 and 2006, the land use rate was approximately 1,000 km²/ year, resulting in an increase in the total urbanized area of about 9% (from 176,200 to 191,200 km²/" (OS IMPACTOS..., 2020).

as a generator of diffuse pollution or a receiver of garbage and sewage, which impacts maintenance, causing it to have the highest maintenance costs for basic sanitation; reintegration of rivers in the urban landscape, since most of them are covered in the city; solutions for the urbanization of slums, with most of the land occupied by irregular settlements, prone to flooding and landslides, among others; and resilience to extreme events, such as storms, tornadoes, hurricanes, among others, for which there is monitoring, warning, risk management, integration between decentralized and centralized measures.

Given all these situations, river-city integration will go through a few points, such as managing each watershed, which is the basic principle of sanitation. Graciosa stressed the importance of each basin committee and cited São Paulo as an example. Although São Paulo has many watersheds, many of them have territorial extension beyond the city, as well as rivers that cut through the capital of São Paulo and cross other cities. In this way, it is necessary that each committee is strong to ensure sanitation in all these locations. "All decisions and actions should be based on diagnoses. We can agree or disagree with some actions, but all of them need to be, above all, guided by a diagnosis. It has, in fact, the size of the problem and the thus developing models that are more faithful to reality that definition of what will be faced from that, planning multiobjective solutions," she highlighted.

Basically, all decisions to solve a drainage problem are linked to the Sustainable Development Goals (SDGs)10, three of which stand out: climate action, sanitation and clean water and sustainable cities. "When we talk about 'smart cities', we are not talking about the Jetsons cartoon, but the following definition, according to the European Union: "Smart cities are systems of people interacting and using energy, materials, services and finance to catalyze economic development and improve the quality of life." According to the Citien In Motion Index, from the IESE Business School in Spain, there are 10 dimensions that indicate a city's level of intelligence: governance, public administration, urban planning, technology, the environment, international connections, social cohesion, human capital and the economy.

The beginning of planning involves identifying the elements that connect urban drainage and smart cities. One of them is to think of the watershed as an urban system and, in order to better manage it we must seek a qualitative-quantitative diagnosis and create a hydrological model, which will represent processes in the watershed through mathematical

equations that describe them. Thus, it is possible to predict flows and flood levels for a given rainfall, based on the physical characteristics of the basin. With the hydrological modeling, which identifies the hydraulic deficit, it is possible to plan how this water space can be allocated, trying to re-establish, as far as possible, the hydrological cycle in this city. It is necessary to draw up risk maps, study scenarios for the recovery and hydrological sustainability of urban basins, plan the occupation of the territory with hydrological security and scale and design control systems. For this reason, it is very important to know the hydrographic basin and "its systems" in order to implement these solutions.

A smart city, from the point of view of drainage, has good hydrological monitoring, providing subsidies for the calibration of models. This monitoring is a central component within the alert systems, which supplies risk management with information, such as, for example, alerts in the event of floods. Monitoring also supports remote operation of control structures to optimize their functioning and increase efficiency. Model calibration is when model parameters are refined to adjust simulated data to observed data, based on monitored events, allow more accurate diagnoses, smarter planning and more efficient processes. To reach this point, more and more accurate monitoring is needed, which will also allow for an efficient alert in relation to floods, in which it is possible to see the levels of risk and levels of alert. With the integration of the telemetric network and the assessment center, the Operations Center has more clarity for decision making and crisis management.

An effective system also allows the population to be alerted during the event - not only via siren, but also via apps or cell phone messages - about the risks and that they receive a Contingency Plan, which indicates where people should go to avoid becoming victims of the risk. A very interesting detail is to have trained community agents to help, in addition to the support of the Civil Defense. "That this doesn't have to be put into practice in every rain, only in unusual episodes. For the rains, we need to have efficient drainage to accommodate this flood," she stated. According to Graciosa, remote operation of flood control structures means being able to intelligently operate the sluice gate system for water entry into the detention basins, operation of mobile docks, sills, spillways and others. This enables the remote operation of the system in real time, optimizing for the maximum use of the volumes and capacity of the structures, even based on the own rainfall forecast. The

¹⁰ The 17 SDGs are: 1) No Poverty, 2) Zero Hunger, 3) Good Health and Well-being, 4) Decent Work and Economic Growth, 9) Industry, Innovation and Infrastructure, 10) Reduced Inequality, 11) Sustainable Cities and Communities, 12) Responsible Consumption and Production, 13) Climate Action, 14) Life Below Water, 15) Life on Land, 16Peace and Justice Strong Institutions, 17) Partnerships to achieve the Goal (ONU BRASIL, n.d.).

objective of these actions is to smooth the flow curve and keep it within the system's capacity, without overflowing the rivers.

Therefore, a smart city is a resilient city, where processes are not stagnant, but adaptable. It has diversification of protective measures, works at different scales (micro and macro), both at source and centralized measures. The volume of floods in São Paulo is very high, so there is not only one solution, but several. For example, there is no knowledge of large cities that do not use detention basins to fight floods, but this should not be the only way to act, it is necessary to have protection sprayed throughout the basin. Restoration of the hydrological cycle also involves the maintenance and expansion of the green-blue infrastructure¹¹, increasing the terrain capable of absorbing it, which also helps to recharge the aquifer and prevent small floods, which are, on average, 98% of the occurrences. Another point is that most rivers are channeled, which raises the question of whether they cannot be depolluted and opened up to be able to absorb greater rainfall. In São Paulo, there are avenues on top of rivers and streams, which would make this change practically unfeasible, but many others were channeled through the central beds, which would make this change easier how to deal with the city that is there.

The quality of the waters is a matter of drainage. Control of diffuse pollution, regular garbage collection, integration with sanitation systems, sewage collection and treatment, local solutions that complement centralized effluent treatment, among other actions, are important for good water quality. Nature-based solutions are here to stay and should be used. "Drainage should also think about solutions for slums and slums. Today, there is no longer any thought of channeling the river and crossing an avenue, it no longer works. Most of them are located on the hills and close to rivers and streams. We need to think about protecting people, carrying out smart urbanization, assessing the geological-geotechnical, hydrological and structural risk, relocating at-risk families and promoting on-site urbanization of safe buildings," she said. "From this, we can think of the concept of smarter cities, in which we look at each point of our structure and, with small changes, make the structure there as effective as possible. We won't be able to take a city and rebuild from scratch, but we can make the changes so that the results are the best possible," completed Graciosa.

Finally, Admr. Regiane Relva Romano brought the case of

the Smart Campus Facens, which fully applies the concept of smart cities, developing projects and showing society that it is possible, in Brazil, to have more and more intelligent cities. At the beginning, the speaker showed that the world still confuses the concept of "smart city" with "digital city" and much of this is due to the North American vision, which includes "smart city" very much from a technological point of view, which focuses on the aspect of having all solutions online and on the corporate vision. The concept of smart cities in Brazil is based on the European school, which considers the interaction of economic, cultural, human, social, environmental and technological aspects, with solutions that can be on-line or off-line, with an institutional focus. Smart Campus Facens uses the Inter-American Development Bank (IDB) vision. She considers people at the center of development, incorporating information and communication technologies into urban management, using these elements as tools that stimulate the formation of efficient government, encompassing collaborative planning and citizen participation. "Smart cities favor integrated and sustainable development, becoming more innovative, competitive, attractive and resilient, improving lives," she said.

to implement. Reinserting rivers in landscapes means knowing Smart Campus Facens is a living laboratory that seeks to solve real problems, connecting the academic community, the market and society, through projects that make cities more humane, smart and sustainable. A place to learn, relearn and even unlearn, as Regiane well highlighted, so that every partner project is scalable and makes it viable for cities to become intelligent and sustainable. There are more than 20 innovation laboratories on campus and everything that is developed must serve a city that has at least nine secretariats: Environment, Energy, Health and Quality of Life, Industry and Business, Mobility and Security, Governance, Urbanization, Education and Culture, Information Technology and Communication. The campus also follows the National Plan for the Internet of Things (IoT), which has the area of health, cities, industries and rural areas to bring social development to the Brazilian society, in favor of increasing the competitiveness of the economy, strengthening production chains and promoting people's quality of life. Currently, there are more than 340 projects following these guidelines, with real-time monitoring of the campus and integral management.

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¹¹ These are infrastructures for the management of rainwater, which combine natural resources with traditional drainage systems, inserting elements into the urban landscape such as filter gardens, green cisterns, biochannels, and parks with lakes, among others. Increasingly present in several cities, the process differs from traditional drainage system which work with the objective of promoting the rapid flow of rainwater, an action that results in the increase of waterproofed areas, rectifications and canalization of water bodies (INFRAESTRUTURA..., 2019)

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Godeiro Carlos

ANA



Wladimir

Antonio Ribeiro

ROUNDTABLE: COLLECTION AS A WAY OF FINANCING SOLID WASTE MANAGEMENT SERVICES

Moderator:

Atty. José Valverde Machado Filho - CIRS1

Speakers:

Atty. Alexandre Araujo Godeiro Carlos - ANA²

Eng. Marco Seidenberg - Sabesp³

Atty. Wladimir Antonio Ribeiro - Manesco Advocacia4

Coordinator/Evaluator:

Eng. Alisson Gomes de Moraes - Sabesp

The new Legal Framework for Sanitation⁵, enacted by Law No. 14,026/2020, has brought a series of challenges to the sanitation sector. Throughout its articles, the new law implemented some novelties, but it also revived old discussions, which gained a new perspective and new attributions. An example of this was article 29, which, in its caput, discussed the need for public sanitation services to achieve what it called "financial sustainability", either through remuneration for charging services or other means such as subsidies or subvention. What caught our attention in this article is that, among the services listed in the search for financial sustainability, there is urban cleanina⁶ and the management of urban solid waste, whether in the form of fees, tariffs or other public prices. This old topic, with the new law, has become the subject of new discussions. To address the issue, the 32nd edition of the AESabesp Technical Meeting organized a roundtable called Collection as a Way of Financing Solid Waste Management Services, seeking to

discuss with different representatives of sanitation which paths the sector can follow in relation to this topic.

Atty. José Valverde Machado Filho, moderator of the roundtable, highlighted that the Solid Waste issue is currently being treated with a sense of urgency by the government of the state of São Paulo. "We had an event that precisely discussed the collection mechanisms brought by the new Sanitation Framework, including a direct reflection on the National Policy on Solid Waste (PNRS)." To talk about the subject, the first lecture was given by Atty. Alexandre Araujo Godeiro Carlos, representing the recently created Superintendence of Regulation of Services, of ANA, destined to attend to the new attributions of the agency in relation to the sanitation services. According to him, the agency already had accumulated knowledge about water, as it is about water resources, in addition to some experiences with sewage treatment. However, other topics are still demanding a little more preparation by the agency.

Carlos presented a diagnosis of the urban solid waste sector, with the data organized by the National Sanitation Information System (SNIS), which currently has a sample of 66 municipalities and a total population served with its information system of almost 83%. "I would like to highlight the attendance rates of the population: 193 million Brazilians are served with regular solid waste collection, recording an average of 93% of the population." The speaker also expressed his concern regarding the estimated final disposal on the ground, especially

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- 2 National Water and Sanitation Agency.
- 3 Basic Sanitation Company of the State of São Paulo.
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- 5 Among the changes implemented with the New Legal Framework for Sanitation are: universal access to water and sewage services by 2033; the role of ANA, which was renamed the National Agency for Water and Basic Sanitation, and which absorbed the competence to issue reference standards for public sanitation services; extinction of the so-called program contracts, executed without bidding between the city and state sanitation companies; expansion of the water and sewage network with services provided by auction-winning companies; etc. (KRONA, 2021).
- 6 Belonging to services included in sanitation, urban cleaning is essential for maintaining public health and the environment. It involves activities such as sweeping, weeding and clearing, pruning, collecting solid waste, cleaning after fairgrounds, in addition to cleaning storm drains, beaches, cemeteries and other urban places (EOS, 2020).

regarding the existence of dumps⁷ (1,114 self-declared units). More specifically on the topic of the table, Carlos presented that only 45% of the municipalities (a number that is equivalent to 1,663) declared that they had a charge for solid waste and the costs covered by the charge.

According to the speaker, after the implementation of the new Legal Framework for Sanitation, ANA divided itself into three major actions: regulatory coordination, training and technical studies. With regard to regulatory coordination, he spoke of the regulatory agenda, already developed through Resolution No. 64/2021, which went on to define the reference standards for sanitation in the periods 2021-20228. In the meantime, the agency also monitored the adoption of the standards by subnational agencies9. About training, Carlos highlighted the production of a manual for subnational regulators. Regarding technical studies, he highlighted the elaboration of these in support of the Interministerial Committee on Basic Sanitation in defining priorities for the application of Union resources and the elaboration of a planning study for each sanitation component. The speaker thought it was important to highlight what the ANA will not do: it will not replace the local regulatory agencies, directly regulate the basic sanitation service providers where there is regulation, determine the tariff or fee, carry out the economic-financial monitoring of the provision of service, will not monitor the inspection of the quality of service provision and will not define the regional blocks¹⁰.

According to him, the first rule concluded in Resolution No. 64/2021 was the one that refers to the institution of a tariff/fee for the urban solid waste segment and he stressed that this rule does not cover the charge for the provision of public cleaning service, since this service is considered to be indivisible. Within the reference standard are important concepts such as required revenue, calculation methodology, parameters, user category, document and collection. Furthermore, it deals with issues related to regionalization, social collection and accounting guidelines. He pointed out the possibility of setting

the initial value by the regulatory entity and that, in the absence of a collection instrument, defined by contract, the entity must consult the holder or the regionalized provision structure in order to institute the instrument. "From then on, there is a period of 60 days to respond and it has the legal attribution to define the system tariff, following the guidelines of the reference standard, as well as readjustment, extraordinary periodic review, default, advance, etc".

The speaker informed that the rule would start to be applied from January 2022, respecting the current contracts. In this case, cardholders, regionalized provision structures and regulatory bodies would have until December 31, 2022 to make adjustments. Regarding the billing instrument, he highlighted item 7.5 of the rule which spoke about the need for a collection mechanism in place or the presentation of an implementation schedule to be informed by the holder or structure of the regionalized provision to ANA and the respective regulatory entity by December 31, 2021. Another topic explored by the professional refers to the manual is still being prepared and which, among other things, seeks to deepen definitions. In addition, the proposal, under development, is the creation of a flowchart with strategies for the issue of collection. According to him, the basic question to ask is: are there charges? If so, ANA will guide the review and adjustment of the existing collection policy to the new parameters. If not, the institution of a collection regime and instrument is guided, then the definition of the form or forms of collection and collection execution. In the following step, the required revenue is calculated. "During these steps, we have to have an effective communication and awareness strategy so that the user knows what is happening throughout the system".

After, the proposal must have the parameters for setting the amount to be charged (eg, property category, region, income, built-up area, frequency, volume of waste generated or destined for use, recycling or others). In the next stage, the draft law must be prepared and approved, establishing and regulating

⁷ One of the initiatives to close dumps in Brazil was the launch of the Lixão Zero program in 2019 by the Ministry of the Environment (MMA). Since its inception, the action has achieved the mark of, in one year, deactivating more than 600 dumps across the country. One of the goals set with the implementation of the new Legal Framework for Sanitation is the closure of all existing dumps in Brazil by 2024. After the deactivation of the dumps, which no longer receive waste, it may be necessary to decontaminate these spaces to complete the sanitation of the area. In this context, the MMA launched the National Program for the Recovery of Contaminated Areas, one of the axes of the Urban Environmental Agenda, which has as one of its objectives the mapping and management of these locations throughout Brazil" (BRASIL..., 2021).

⁸ In force since the first half of 2021, the Resolution is intended for the second half of 2022 to work around the guidelines for defining a model for regulating drainage and urban rainwater management; development of general conditions for the provision of solid urban waste services; definition of security measures, contingency and emergency, including rationing; tariff readjustment for water and sewer; and the development of guidelines to progressively reduce and control water losses (ANA..., 2021).

⁹ They consist of regulatory agencies for sanitation services that operate at the municipal, intercity or state level. They regulate, in an isolated or joint manner, sanitation activities, such as: water supply, sewage collection and treatment, urban solid waste management, and urban rainwater drainage and management (AGÊNCIAS..., n.d.).

¹⁰ Currently, the solid waste sector is gaining strength through auctions for the implementation of new concessions. According to the Secretariat of the Investment Partnerships Program (PPI), it is estimated, for 2022, five disputes, in addition to the body being supporting 10 urban solid waste projects, 7 for consortia and 3 for isolated cities. Recently, 7 have already advanced in the structuring process and are expected to benefit 4.3 million people and also hire investments that reach R\$ 7.95 billion (PUPO, 2022).

¹¹ Indivisible services or *uti universi* are those services that will benefit society without being able to measure how much an individual has benefited in relation to another. As a result, the costing issue is jeopardized, since it is not possible to charge a fixed fee or fee, as it is not known exactly how much each user consumed. For example: street cleaning and street lighting. On the other hand, there are divisible services or *uti singuli*, where there is the possibility of calculating consumption individually, for example, consumption by residence (SERVIÇOS..., n.d.).

the essential aspects of the collection of fees and the basic guidelines of the tariff policy. Likewise, it is guided by the issuing of a decree regulating the implementation of the fee collection policy or the elaboration of administrative acts and executive regulation of the tariff regime. At the end of the creation of a collection management system, Carlos said that ANA is structuring a system to receive this information. It will be directed to the holders of the municipalities who will have to fill out an online questionnaire that will contain data on the billing instruments instituted or the implementation schedule.

The panel also featured a presentation by Engineer Marco Seidenberg, who began his speech by informing the most current data from Sabesp. Operating in the state of São Paulo, the company is present in 375 cities out of the 645 existing throughout the territory of São Paulo, which is equivalent to 70% of the urban population in the state. According to him, the company is the fourth largest sanitation company in the world in terms of the population served. From 1994 to 2021, the company went from 95% to 98% when it comes to water supply; from 68% to 94% for sewage collection; from 29% to 76% in sewage treatment and it is estimated to reach 83% in 2022. Another point highlighted by the speaker is the question of the tariff. Compared to other state sanitation companies, Sabesp has the sixth lowest tariff in the Normal Residential rating, charging an average of R\$ 25 per month. Currently, 27.6 million people are served with water supply and 24.4 million. In his presentation, Atty. Wladimir Antonio Ribeiro began by people with sewer collection. In addition, Sabesp currently has 88,000 km of water distribution networks, 60,000 km of sewage collection network, 10.1 million water connections and 8.6 million sewage connections. "In relation to the forecast of investments from 2021 to 2025, the company will invest 21 billion reais. In other words, 30% of all investments in basic sanitation in Brazil will be made by Sabesp".

Regarding the work carried out by the company on solid waste, according to Seidenberg, in 2020, before the New Legal Framework for Sanitation was approved, Sabesp signed a contract with the city of Diadema for the treatment of urban solid waste. "Diadema, currently, is a city that generates around 400 tons of urban solid waste per day and Sabesp, in this contract, is prepared to treat this waste." For this work, the company studied several technologies, such as gasification, pyrolysis and other smaller technologies to be deployed in the city. Among them,

in the case of Diadema, the speaker mentioned gasification as a promising technology for the volume of garbage existing in the city. Another action under analysis would be the use of this volume of waste, together with other municipalities to obtain the scale necessary for incineration. According to the speaker, currently, Sabesp collects the garbage collection in the water and sewage bill, which was stopped at the request of the mayor of Diadema in view of the new agreement¹².

"We see that the collection of this collection of water fee brings financial security to the waste treatment market," highlighted Seidenberg. According to him, Sabesp is entering this field not to be an operator, but to work with environmental viability, sustainability, to transform waste into energy. He also mentioned other possibilities for transforming waste into Refuse-Derived Fuel (RDF), which could be marketed to the cement industry. Currently, according to the professional, Sabesp has also made contacts with companies in search of new technologies that, for now, remain under confidentiality terms. In addition, the company is undergoing internal changes as a result of the establishment of a new business policy that focuses, in addition to water and sewage, on solid waste treatment. "Sabesp sees great potential in solid waste treatment. Today, landfills in São Paulo are reaching the end of their useful life, and it is important that we find a solution for this".

dealing with a very important topic: legal certainty¹³. According to him, there is no legal security until there is a minimum political consensus. "The world is changing and Brazil needs to change, especially in this area in which we operate, which involves managing the environment, solid waste; it's a civilizational challenge: what to do with our solid waste, our consumption pattern and living in society." Regarding charging, the speaker explained that the main question that guides the context of charging for urban solid waste services is in its base; it is an introductory question. When we talk about charging for service provision, we are talking about a fee, which is a tax category, or a tariff, which is a value in return for an activity owned or controlled by the State.

According to Ribeiro, there was a period in which there was an attempt to charge for the solid waste service, which generated a great deal of controversy. With the Federal Constitution of

¹² Signed in July 2020, the agreement between Sabesp and the city of Diadema has a 40-year term. While the city will be responsible for the collection, the company will act in all the other stages of the waste, also providing for the construction of a plant to burn the waste and its transformation into electrical energy. Within the new agreed rules, there will be a separation of the tax payment in relation to water and sewage tariffs, safeguarding the regular supply of water and sewage in case of non-payment of the new service fee (CARVALHO, 2020).

¹³ According to the Strategic Industry Map 2018-2022, developed by the National Confederation of Industry (CNI), Brazil ranks last in the legal certainty ranking in the world. "Part of this delay and the amount of legal disputes is due to the excessive number of rules issued, which makes it even more difficult to guarantee the pillars of legal certainty, such as publicity and stability, in addition to aligning with the old rules on the same subject" (SEGURANÇA..., n.d.).

1988 and, later, with the state constitutions of 1989, there was a process of legal-institutional reorganization of the country in the redemocratization environment. The country reorganized itself, and each city regained its autonomy. In this process, cities reorganized their form of remuneration and started to pay for services. So, in the early 1990s, they instituted fees and called it the public cleaning fee. These fees charged users in services known at the time as garbage collection and final disposal today, a public service of urban solid waste management. In this arrangement, a situation was created in which they were charged for two different services: public service for urban solid waste management and public cleaning. However, the latter is considered an indivisible service and ended up being mixed into a divisible service, resulting in conceptual confusion. Faced with this situation, the judiciary pointed out illegality in charging for the public cleaning service, but it also ended up encompassing the solid waste management service.

Over the years, this perception that charging for solid waste services was illegal was deconstructed and cities began to institute fees for the waste service. According to Ribeiro, a reference was the case of a rate institution in the city of Jacareí, in the state of São Paulo, in 2000. After years of discussions in the judiciary, the issue of charging or not charging was resolved in 2009, at the Supreme Federal Court (STF), through a Binding Precedent, which approved the collection by the public service of urban solid waste management. "What you cannot do is charge for public cleaning or an urban cleaning service, which is another public service considered indivisible, and cannot be charged." With the release of charging for the service, some experiences evolved in the country and brought news, as was the case of the city of Joinville, which started charging a tariff instead of a fee.

For Ribeiro, when a fee is charged, the Public Power collects the resource as public revenue and then integrates it with budget revenues, this resource only leaves the Treasury's single fund in the form of payment to a service provider, and this payment becomes a budget expense. The use of the fee therefore requires several formalities in terms of invoicing, settlement, etc. According to him, due to the most modern forms of provision in force, the provider already assumes many risks. It makes no sense to require him to take on more risk, make more investments that will be amortized over the long term, without having a guarantee that he will get paid. "In order to be able to use these new forms, especially the simple concession, which is the most recommended for the solid waste sector, it is necessary to guarantee payment to the concessionaire and the best way to do this is precisely through the use of tariffs".

With the experience of the tariff as a form of collection in relation to the solid waste service, an issue came to the fore: the solid waste service works by availability. Would there be a tariff in an availability relationship? In this regard, Ribeiro cited Precedent 545, of the STF, which says that "when the service must be provided by the public administration, this service must be remunerated by a fee. When the public service can be provided either by the public administration or by a private person contracted by the public administration, in this case, the public manager can choose to remunerate the provision of service, if divisible, by fee or tariff." The speaker also highlighted the distortion of understanding in relation to the text of the summary, as many considered the "compulsory service" as if the obligation fell on the user, who would have to obligatorily use the service. "There is no mandatory use service. The service will always be offered and you will use it or not based on your individual freedom decision".

Despite the discussions on the subject in the STF, Ribeiro stressed that these are side issues from the institution of the New Legal Framework for Sanitation, in 2021. "We are witnessing the new regulatory framework and its recognition of the possibility of using tariffs and the modeling of our most recent concessions is asking for a tariff, especially the concessions that were modeled with the support of Caixa Econômica Federal under the Partnership Structuring Fund (FEP)." According to Ribeiro, despite the uncertainties and debates on the topic of charging, he believes that the legislator solved the problem by changing the sanitation framework. Nowadays, more and more the world uses tariff. "We need to have economic and legal institutional stability, which will allow a great advance from a technological point of view, for this service to evolve and to be increasingly included in the environment of the circular economy".

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Paganini

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Fátima Marinho Organização Internacional úde Pública Vital Strategies



Soraya **Smaili** Centro de Saúde Global - Unifesp



Décio Semensatto

Rede Colaborativa de Pesquisa em Poluição da Água e Recursos Hídricos (Rede HydroPoll)

ROUNDTABLE: PUBLIC HEALTH AND ENVIRONMENTAL SANITATION

Moderator:

Eng. Wanderley Paganini - FSP/USP1

Speakers:

Dr. Fátima Marinho - Vital Strategies Pharm. Soraya Smaili - Centro de Saúde Global/Unifesp² Biol. Décio Semensatto - Rede HydroPoll³

Coordinator/Evaluator:

Journal, Ana Paula Rogers - AESabesp⁴

In recent years, Brazil has sought to close the historical gap in terms of basic sanitation, seeking to increase the coverage of water supply and sewage collection. If in some regions, such as the Southeast, the percentage of houses with this coverage is very high; there are areas, such as in the North, which still lacks a very broad investment to achieve what would be satisfactory. In general, Brazil⁵ has 84.1% water supply and 55% sewage (SNIS, 2020), far from the 99% water supply and 90% sewage that the New Regulatory Framework estimates to achieve in 2033. Improving these numbers has a direct impact on public health. For these reasons, the 32nd edition of the AESabesp Technical Meeting organized a roundtable called Public Health and Environmental Sanitation, which addressed several nuances of these topics. Eng. Wanderley Paganini, moderator of the roundtable, was emphatic in saying that "there is no fairy godmother, there must be effort and political decision so that there is investment in basic sanitation and, consequently, in health".

In her lecture, Dr. Fátima Marinho emphasized that there is no development if there is no basic sanitation, showing that

more developed countries have a very broad structure for water supply and sewage collection. Therefore, countries that invest in basic sanitation are closer to meeting two SDGs (Sustainable Development Goals), which are to ensure healthy lives and promote well-being for all, and ensure the availability and sustainable management of water and sanitation for all. Marinho expressed concern about these goals at the global level, given that water supply and sewage collection rates around the planet are low in many nations, especially in parts of Africa and Asia. "China itself, an economic power, has low levels of coverage, being much lower when it comes to sewage. There is a whole world that needs to advance in basic sanitation," she declared.

The lack of basic sanitation has a direct impact on people's health, such as hand hygiene, which, it is worth noting, is very important for disease prevention, even more so in a pandemic period. "The recommendation to wash your hands is a public health recommendation, but it needs to be permanent. I need water to wash my hands. If I have little water at home, it will certainly be used for other things, other than washing my hands," said the speaker.

The expansion of water supply and sewage collection coverage in Brazil has reduced the levels of risk attributable to loss of health in recent decades, despite the fact that the advancement of basic sanitation is necessary in several regions of the country. In the early 1990s, an estimated 2,134.7 people per 100,000 contracted diarrheal diseases due to poor sanitation and 146.8 per 100,000 had upper respiratory infections such as pneumonia. The advance of basic sanitation in the country

- 1 School of Public Health, University of São Paulo.
- 2 Federal University of São Paulo
- 3 It is a Collaborative Research Network on Water Pollution and Water Resources. It brings together different researchers and institutions to develop projects and produce knowledge through interactive thematic initiatives that contribute to the achievement and effectiveness of public policies at various levels, including the Sustainable Development
- 4 Sabesp Engineers Association.
- 5 Still far from the target set by the New Regulatory Framework, Brazil shows a huge disparity between regions when it comes to basic sanitation. Southeast, South and Midwest have more than 90% of water supply coverage, while the Northeast has 74.9% and the North, with the largest freshwater reserve in the country, reaching only 58.9%. When talking about sewage collection, the numbers are alarming, only the Southeast surpasses the mark of 80-80.5%. Midwest has 59.5%, while the South has 47.4%, Northeast 30.3% and the North with only 13.1% (SNIS, 2020).

caused these rates to decrease to 202.1/100 thousand people in relation to diarrheal diseases and 34.3/100 thousand people for infectious diseases, according to data from 2016. This also represents a drop in the mortality rate attributed to unsafe water, poor sanitation and hygiene – a rate of 82%. In 1990, 36,955 deaths were associated with diarrheal diseases and 3,556 with upper respiratory tract infections, while 26 years later this number had dropped to 4,313 for diarrheal illnesses and 3,050 for infectious diseases – these have fallen at a much slower pace.

Every improvement in sanitation has a positive impact on health and immediately – it reduces the circulation of bacteria, protozoa and viruses, right from the start. For example, Brazil reduced by 96% the number of deaths of children under five years old caused by lack of sanitation between 1990 and 2016 – it dropped from 19,953 to 799 deaths, which could have been avoided by treated water and sewage. In 2019, 505 died due to the lack of basic sanitation. In 2016, there was an outbreak of hospitalization and deaths due to acute diarrhea, especially in children, which was concentrated in the semi-arid region of the Northeast, where there is no adequate supply of water. It is noteworth the outbreak of the zika virus occurred together, after all, the stored water, often standing, helps the proliferation of the mosquito. One thing relates to the other, to the point where both outbreaks are in the same region.

Marinho highlighted that for every dollar invested in water and sanitation, it is estimated that US\$ 4.3 are saved in health costs⁶ worldwide. In other words, sanitation is profitable for the health sector, preventing hospitalization of children and even chronic diseases. For example, a child who develops acute hepatitis A into adulthood will remain a cost to the system. In 2017, BRL 98.4 million were spent on hospital admissions and outpatient care in the SUS with patients with diseases attributed to the lack of basic sanitation and access to water quality, such as acute hepatitis A, schistosomiasis, leptospirosis, watery diarrhea, toxoplasmosis, amoebiasis, dengue and respiratory diseases. It is worth mentioning that children, with their bodies still in formation, are more susceptible to diseases and problems resulting from the lack of basic sanitation and occupied a large part of these beds. "I reaffirm that Covid-19 itself is not going to be controlled with a vaccine alone. I need to focus on this problem because, without basic sanitation, it continues to spread. A prevention does not cost so much if you compare the cost of health. In the long term, this is a quite economy".

Pharm. Soraya Smaili began by pointing out that it is necessary to change public policies to have more sanitation and, consequently, more public health. The pandemic has exposed a series of situations and helped to accelerate the application of issues in society. We continue to seek answers about this pandemic, about how it came about, how to face it, how to get out of it, but many answers came and, in record time, because the whole world was mobilized for it. "Right away, we realized that we could not sit back and wait for a vaccine. There is structural tiredness in this pandemic, but we cannot stop," she declared.

According to the speaker, most scientific studies in Brazil are produced by universities (80%)⁷, which responded to the emergency position that the pandemic brought us, with several research and studies in the face of an uncertain virus, which still lacks answers. However, in the face of this effort made by universities, there has been increasing knowledge about what we are dealing with, whether in national projects or in partnership with international bodies. "These studies have shown, for example, that hydroxychloroquine does not show results in patients affected by Covid-19, and the use of corticosteroids reduces mortality." Just to have as a parameter, Brazilian universities registered more than 800 studies in the National Health Council (CONEP), which reached 34 million people.

Before the pandemic, there was a negative perception about universities that they spent a lot, education was not of quality and did not produce adequate returns to society. With Covid-19, the population has increased support for the studies and research developed by these institutions, expressing more interest in knowing about science. "Currently, 40% of Brazilians want to read scientific articles, to seek, let's say, 'science at the source', although 8% of Brazilians prefer to have the messages sent by President Jair Bolsonaro as sources".

Despite the anti-vaccine and anti-mask stance of members of the federal government, which goes against the more than proven methods for preventing and combating the spread of Covid-19, researches by SOU_CIÊNCIA⁸ shows that only 5.5% of people have not taken and do not intend to take the Covid-19 vaccine. The others have already taken or expressed a desire to be vaccinated, which, for Smaili, shows "very positive data that we must use". Approval to SUS also increased significantly in all regions and social classes, with emphasis on the 98% who

⁶ In 2020, Brazil invested R\$6.02 billion in the water system and R\$5.89 billion in infrastructure to collect sewage (SNIS, 2020). Together, we are talking about R\$ 11.91 billion in basic sanitation. Keeping the proportion estimated that Brazil has saved R\$ 51,213 billion in the public health system, as cited the speaker.

⁷ More than 90% of scientific articles published in Brazil were generated by public universities, with most of these materials focused on the health area (EVEN3, 2016).

⁸ An initiative supported by Unifesp, SOU_CIÊNCIA is a center for studies on topics on society, university and science, which aims to make these three sectors more closely correlated, whether through surveys, studies or informative content.

started to support the institution in the income bracket above five minimum wages.

Smaili also brought evidence of how poor sanitation is correlated with Covid-19 deaths. In a study carried out by the Federal University of São Paulo (Unifesp), it was identified that the 16 locations with the highest death rates due to the relationship with Covid-19 in Greater São Paulo are regions that lack adequate basic sanitation. The pandemic has made studies focused on "planetary health", in a global way. There are a number of institutions studying for unique health, in addition to data science, called Predictive Intelligence – for disease prevention and future pandemics. The speaker only regrets that, even in the face of an urgent situation, we have experienced cuts in the public budget for scientific studies.

Another point raised by Biol. Décio Semensatto is about the pollution caused by the inappropriate disposal of medicines, a subject that has not been addressed in the wide-spread media. According to him, we are consuming more and more drugs and, in the same way they save lives, they are also pollutants, and are being classified as emerging contaminants. They, according to the International Soil and Water Conservation Research, are synthetic or naturally occurring chemical substances not commonly monitored in the environment. They have the potential to enter the environment and have known or suspected adverse effects on ecosystems and/or human health. "Given the impact that these drugs can have on our water system, a demand came from the Environmental Company of the State of São Paulo (CETESB) to know which substances should be prioritized for monitoring. We have a different reality and habits from other countries, so it is important to know which components are more present," said the speaker. To illustrate this question, about knowing which substances should have their monitoring prioritized rather than following a global agenda, in Brazil, Dipyrone is one of the most consumed medications, while it is banned in Europe.

IMS⁹ Health pointed out that Brazil, between 2015 and 2020, had a 38% increase in the daily use of drugs – from 2.04 to 2.82 the *per capita* use of medicines per day. However, it is worth noting that this projection may be lower than the current reality, since these data are pre-pandemic, a sign that there is an urgent need for greater regulation in the polluting aspect of medications. Understanding which the best selling drugs are can be a factor that influences the determination of which

substances should have their impact analysis prioritized, but these must also be analyzed under the ecotoxicological aspects, physicochemical variables and the removal in water and sewage treatment systems.

On the one hand, there is the growth in the sale of pharmaceuticals¹⁰, while on the other hand there is the challenge of covering unequal sanitation. "The disparity in basic environmental sanitation between cities is worrying, even when we are talking only about the São Paulo Metropolitan Region. While São Caetano has 99.6% of the houses with coverage, Juquitiba, close to São Paulo, has only 13.9%," Semensatto highlighted. There is also the technical-scientific challenge (detection, prioritization and monitoring of emerging contaminants) and the maintenance of the quality of water and hydric resources. The challenge is to integrate these four dimensions in order to have an efficient environmental sanitation management to guarantee the population's actual health.

The work carried out by Semensatto and, with data from Close-Up International, between April 2016 and April 2017, showed that the São Paulo Metropolitan Region consumed 448,445 kilograms of dipyrone, the most used medication in this location. Metformin, with 310,067 kg, and paracetamol, with 94,881 kg, followed. Phenylephrine, chlorophenamine, losartan, sodium bicarbonate, citric acid, ibuprofen, and zinc were the most consumed drugs. As a large part of the population does not have the information on which medicines should be disposed of in pharmacies or health centers, they discard it in the garbage collection¹¹ or throw it down the drain, causing a big problem from the point of view of pollution. To resolve this issue, it is necessary to engage and involve various sectors, starting with the pharmaceutical industry, by identifying its product as a pollutant and acting in reverse logistics. Health and environmental regulatory agencies should also be part of this dialogue; monitoring and environmental enforcement agencies; Universities and Research Institutes; sanitation companies; pharmaceutical commercial sector; general population; training of health professionals; and governors and legislators.

According to Semensatto, it is essential, among other factors, to raise the awareness of users about the environmental risks of drugs, from consumption to inappropriate disposal, and of the health professionals involved, from indication to

⁹ North American company that provides information, services and technology for the health care industry.

¹⁰ In 2019, the sales of medicines in Brazil reached 85.9 billion (Statistical Yearbook of the Pharmaceutical Market, 2021), a 7.9% increase compared to 2018. There were 5.3 billion commercial packages, 5,897 products sold, with 1,935 active ingredients and associations of 224 companies (SCMED, 2021).

¹¹ About 10,300 tons of drug waste are generated by the Brazilian population (ANVISA, 2013) and 89% of people discard their medicines directly in the domestic waste (CAMPOS et al., 2017), increasing the polluting potential of these drugs, since the residue will reach a water table or a body of water.

commercialization, about environmental impacts. It is also necessary to include content about environmental aspects for health professionals; include information in the package insert on how to dispose of the medication correctly; make the pharmaceutical industry sector accountable in light of the National Solid Waste Policy (PNRS); adopt the unit-dose prescription for medicines in Brazil; fractionation of drugs according to the exact prescription; include content on this issue in school education; regulate a prioritization list of drugs in the environment; develop and apply analytical methods for the detection and monitoring of drugs, metabolites and degradation products in environmental matrices.

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ROUNDTABLE: CHALLENGES OF IRREGULAR AREAS WITH THE CHANGE OF THE LEGAL FRAMEWORK FOR SANITATION

Moderator:

Eng. João Paulo Tavares Papa - Sabesp¹

Speakers:

Arch. Elisabete França - SEHAB² Eng. Oscar Cordeiro Netto - ANA³ Sociol. Rafael Castilho - FESPSP⁴

Coordinator/Evaluator:

Eng. Eliana Kitahara - AESabesp⁵

Recent data released by the Brazilian Institute of Geography and Statistics (IBGE) showed that there are 5.127 million irregular homes6 in the country. Characterized by a profound lack of essential basic services, these areas classified as favelas, invasions, glens, lowlands, communities, villages, wildness, irregular subdivisions, huts and stilt houses suffer from a lack of infrastructure and basic sanitation. Among the topics under discussion, with the enactment of Law No. 14,026, of July 15, 2020 (New Framework for Sanitation), is the question of these subdivisions. To address the issue, the 32nd AESabesp Technical Meeting organized a roundtable called Challenges of Irregular Areas with Change in the Legal Framework for Sanitation, with the purpose of promoting a reflection on the impacts of this law in relation to irregular housing and regarding the legal, social and technical impediments to acting in these areas.

For Eng. Eliana Kitahara, coordinator of the roundtable, in the history of sanitation in Brazil, the demands of more urbanized

and economically viable areas have always been prioritized and received greater attention from the public/private power. One of the advances of the new sanitation law, which has universalization as a fundamental premise, is the opportunity to focus on the issue of irregular areas, and not just on them. It was suggested to AESabesp to provide space for debates on sanitation in rural and traditional areas, such as indigenous quilombos and riverside regions. In irregular areas, the demands have been deferred in the local and legal context. She mentions that Law No. 14.026/2020 updates the sanitation framework and brings a new way of evaluating sanitation indicators, including, in Article 49, the Objectives of the Federal Basic Sanitation Policy and, in its Item II, "prioritize plans, programs and projects aimed at implementing and expanding services and basic sanitation actions in areas occupied by low-income populations, including consolidated informal urban centers." According to Kitahara, the roundtable aims to integrate the management of sanitation in irregular areas, discuss the new sanitation framework and seek solutions to improve public health and human dignity.

In his presentation, Eng. João Paulo Tavares Papa, moderator of the roundtable, highlighted the great importance of the topic. He pointed out that, in addition to the lack of public services, other aspects characterize subnormal urban agglomerations, such as irregular land ownership. This is due to the occupation of private or public lands located, often in environmental protection areas, such as riverbanks, estuaries, slopes and hilltops. These situations of land irregularity make it difficult or even prevent public services, including basic sanitation, to

- 1 Basic Sanitation Company of the State of São Paulo.
- 2 Municipal Housing Department of São Paulo.
- 3 National Agency for Water and Basic Sanitation
- 4 Foundation School of Sociology and Politics of São Paulo.
- 5 Sabesp Engineers Association.
- 6 Data released in 2020 in a Technical Note, as a preliminary mapping, in preparation for the 2020 Population Census, postponed due to the Covid-19 pandemic. The disclosure of these data, specific to subnormal agglomerations, was carried out in advance to assist in health policies in this period (IBGE, 2020).

be offered in an adequate way. The occupation in irregular areas occurs by population with lower *per capita* income, in a disorderly and dense manner, in areas lacking infrastructure such as basic sanitation, paving, electricity, public transport and public services, such as schools, health centers, among others.

Despite the great challenge to be faced, there were advances. "In recent years, Brazilian legislation has taken important steps to promote the full and responsible development of these centers, with the approval of two laws: Law 13,465/2017, the so-called Land Regularization Law⁷; and the New Legal Framework for Sanitation, Law 14.026/2020," which established as a federal public policy for basic sanitation the execution of basic infrastructure works for sanitary sewage and drinking water supply in formal, informal and consolidated urban centers, which could be subject to Urban Land Regularization (Reurb), except for those who are in a situation of risk. For Papa, both laws are devices that, rather than encouraging, determine the implementation of actions that definitively guarantee the fundamental right to basic sanitation in irregular areas, which, in 2010, housed more than 11 million people - a number that has certainly grown considerably today.

Amid this scenario of opportunities provided by the new legislation, a character comes to play a fundamental role: ANA. According to Oscar Cordeiro Netto, in 2020, the agency celebrated its 20th anniversary and, at this moment in which it celebrated its two-decade trajectory, the agency changed its name, renamed the National Water and Sanitation Agency, and gained new attributions, being responsible for the establishment of national reference standards to regulate the provision of public sanitation services. For him, the choice of the agency was due to the work already developed in relation to water, acting in federative articulation, water governance, among other consolidated actions. In his perception, there is a great challenge ahead in view of the multiplicity of regulatory realities in the country. According to him, there are more than 72 subnational agencies and some of them with experiences that may serve as inspiration. However, there are others with a short lifespan and very little experience, which will demand a strong work of normative coordination and governance support from the agency.

The new law brought to ANA the role of coordination, regulatory harmonization, agenda setting and the development of norms. Regarding the latter, Cordeiro Netto pointed out that the entity is working under the aegis of some principles: transparency, public participation, regulatory impact assessment and regulatory results. "Another role that the law brings us is the role of mediation and arbitration. We are still discussing. This is an open question." He also highlighted the training of subnational regulators, the publication of manuals

and the performance of technical studies. These activities, according to the speaker, are already part of ANA's activities. "The agency carries out a series of technical studies such as the water supply atlas, which has been revised. We are concerned about producing important information for decision-making and regulation in general".

Cordeiro Netto pointed out that, after extensive discussion within the body in early 2021, ANA published its regulatory agenda for 2021/2022. "Since the enactment of the law, great care was taken in organizing a debate. In it, questions arose such as: what would be the most important standards in the view of the different actors in the sanitation sector, whether they are providers, granting authorities, subnational agencies themselves and society". According to the professional, one of the first commitments on the agenda was to meet the legal deadlines highlighted in the new framework, such as the production of the solid waste collection standard until July 15, 2021. Another highlighted deadline was in relation to the time for the issue of amendments to existing contracts to be defined until March 31, 2022. The creation of the agenda sought to increase the legal and regulatory security of the sector, incorporating new insights collected during the meetings with the actors, ordering in time according to legal deadlines and with the impact on the legal-regulatory framework. It also considered the potential operational capacity of the agency itself, which, today, acts beyond the limit of its possibilities.

Within the standards presented in the agenda, the speaker highlighted the norm 11 regarding the guidelines for progressive goals of universal coverage of water and sewage and that the topic of the roundtable could contribute to start discussions on the topic of irregular areas, since it intends to deal with the issue of water and sewage contracts. The professional highlighted that, given the enormous diversity of situations existing in Brazil the agency would certainly work with clippings. "These clippings consider not only the socioeconomic situation of the country's regions, but also issues related to rural and urban areas, regular and irregular, access to water, climatic issues and environmental and health criticality." The speaker emphasized what the ANA will not do: it will not replace local regulatory agencies, it will not directly regulate sanitation companies where there is no regulation, it will not determine tariffs, it will not carry out economic-financial monitoring and it will not monitor/inspect the quality of service provision. He ended his presentation by emphasizing the great challenge ahead and the need to count on those who have more experience to ensure that new perspectives can help in this journey towards the universalization of sanitation.

In his speech, Pope highlighted the importance of that moment of discussion and exchanges for the consolidation of these

⁷ On January 11, 2022, the city hall of São Paulo enacted State Law No. 17,734, which deals with urban land tenure regularization, which aims to guarantee the right to housing for families in an irregular situation. "In our Master Plan, until 2024, is the commitment to regularize 220 thousand properties in the city of São Paulo. It is a daring goal, but, at the same time, it shows us the need for regularization," reinforced the assistant municipal secretary for Housing and Urbanism, Junior Fagotti. This law also includes points such as urban land use planning and urban demarcation in general, in addition to establishing procedures and norms for Urban Land Regularization (Reurb) (SILVA, 2022).

new views on the subject. One of these rich experiences to be shared, according to the moderator, can be found in the city of São Paulo, which, for many decades, has focused on the issue of precarious settlements. He also highlighted the important role of Sabesp through initiatives such as the *Se Liga na Rede*⁸ and *Água Legal*⁹, programs, which spread throughout the metropolitan region and recently began to be implemented on the coast of São Paulo.

Arch. Elisabete França was invited to talk about the São Paulo experience. According to her, the city of São Paulo has a tradition of work, mainly in the Housing Department (SEHAB), in relation to the urbanization of favelas. This tradition dates back to the 90s, when the country, because of some international financing from the World Bank and the Inter-American Bank, bet on the search for a solution in the issue of precarious settlements. "Unfortunately, as of 2010, Brazil has kind of abandoned these favela upgrading programs and today we see these frightening rates in relation to access to basic sanitation and sewage treatment networks." According to the speaker, the city of São Paulo has always dealt with the issue of basic sanitation as one of the components of the housing issue. The first great experience to be highlighted in this sense, considered the mother of all actions developed to date in relation to the issue of irregular areas, was the Guarapiranga Program¹⁰. It was a partnership between the state government, Sabesp, the São Paulo City Hall and the World Bank, developed in the 1990s. "We have transformed a program that was initially intended to remove people from watershed areas into an initiative that, on the part of the City of São Paulo, turned into a program of urbanization of favelas with the objective of removing the sewage that was going to the Guarapiranga Reservoir"

The integrated action promoted during Guarapiranga generated results, qualifying the technical team of all the entities that participated, and the improvement served as the basis for advances in the issue of precarious settlements. In 2005, the Municipal Housing Plan was prepared, a program dedicated to understanding the problem of favelas in São Paulo. When you talk about a large deficit, you have no idea where they are.

Thus, a broad diagnosis began with the visit and mapping of all favelas and irregular subdivisions in the city. The number of dwellings was counted, including the participation of Sabesp, which helped by providing data on connections, and at that time, 1,200 favelas were reached, totaling 3 million inhabitants that, in some way, had an infrastructure deficit. Approximately 30% of the population of the city of São Paulo. In possession of this information, a system for prioritizing interventions was created, which was divided into four variables to establish priorities. According to França, the first was the lack of infrastructure, the absence of water and sewage connections; the second was the risk issue in these settlements; the third were the social vulnerability indexes; and the fourth, health indicators, mainly related to diseases transmitted by the lack of basic sanitation.

One of the questions that everyone asked at that time was how to work territorially on these priorities. Thus, the sub-basins were defined as a territory of intervention, believing that they would solve the essential problem, which was the lack of basic sanitation. This entire action was called the Integrated Action Plan (IAP). At that moment, it became clear that the main housing program for the city of São Paulo was the favelaupgrading program. In 2009, there was a breakthrough: the City Council approved that the city of São Paulo enter into an agreement with the state government to grant water and sewage services to Sabesp, signed in June 2010, assigning to Sabesp the water and sewage services of the city, as a service provider; and ARSESP, as regulatory agency. Given this favorable scenario, the Basic Sanitation Plan was prepared, closely linked to the Municipal Housing Plan, with the establishment of priorities such as the universalization of sanitation services by 2039, providing 17 billion investments by Sabesp. In that same legislation, it was established that the company should invest 13% of its annual gross revenue in the great infrastructures of the city of São Paulo. Additionally, it had to put 7.5% of its revenue into the Municipal Sanitation Fund¹¹, created during this period. This one, in turn, had the obligation to prioritize its resources (today, around 300 million to 350 million/year) for the urbanization of favelas, some drainage activities and the

⁸ Created in 2012 by Sabesp, the Pró-Conexão Program (invented name: Se Liga na Rede) was created "with the objective of connecting the sanitary installations of low-income customers to the collection networks, avoiding the disposal of sewage into the environment". Currently, the program has reached more than 104,000 people, carrying out 29,700 sanitary connections and intra-household adaptations. Contracted residents who advise on the benefits of sewage connection (SABESP, 2020) carry out awareness work.

⁹ Since 2017, through the Água Legal Program, Sabesp has been carrying out the installation of water distribution systems in communities with high social vulnerability. "Until the approval of the New Legal Framework for Sanitation, the legislation prevented services in irregularly established occupations without specific legal authorizations." With the program, more than 33,000 families (115,000 people), from 72 housing units, have already benefited from the replacement of precarious installations with quality water (idem,

¹⁰ Initiated in 1993, the Guarapiranga Program, which was financed by the World Bank (IBRD) of US\$ 262 million, aimed to preserve the quality of treated water, especially in the south and southwest of the capital. The proposal, at that time, was to extend the sewage collection and interception network, removing the favelas to areas far from the water sources (GOVERNO..., 1997). Currently, the program is called Sanitation, Environmental Protection and Recovery of Water Quality in Degraded Areas of Water Sources in the Guarapiranga and Billings Basins; or simply the Mananciais Program (PROGRAMA..., 2008).

¹¹ In 2009, Municipal Law No. 14,934 instituted the Municipal Fund for Environmental Sanitation and Infrastructure (FMSAI), together with the Housing Department (SEHAB), which aimed to support actions aimed at the development of basic sanitation in the city. "The Fund's resources come from the transfers made by Sabesp and their respective financial income, referring to 7.5% (seven and five tenths percent) of the gross revenue obtained from the operation of water supply and sanitary sewage services in the municipality of São Paulo by the aforementioned company" (FUNDO..., 2021).

creation of parks in protected areas, such as valley bottoms. It is a significant municipal fund coordinated by state and municipal entities; lessons that the city of São Paulo can share with other cities.

Based on the linked Housing Plan, integrated into the Municipal Sanitation Plan, recently revised for 2019-2020, a major program of favela upgrading was initiated. The speaker commented that there are many discussions regarding the difficulties in entering precarious areas, but she considers that there is no impediment to working in favelas. In the planning of activities, they must prepare and approve the updated projects, especially in watershed areas, with the opinion of state regulatory bodies. She also mentions that the existing regulation law in the municipality facilitates the process and takes care of the approvals of the projects.

According to França, this integrated work has generated important results in terms of advancing in relation to precarious settlements. Currently, the main favelas in the city of São Paulo have been urbanized, with services almost universalized, and these initiatives are still in full swing, the result of a lot of learning. "Today, just for you to understand, the Mananciais Program is the one that receives the most resources, it comes from the Municipal Sanitation Fund. We have around 80 precarious settlements in the urbanization phase, in agreement with CDHU (São Paulo State Housing and Urban Development Company) and Sabesp. In these urbanizations, mainly in the Billings and Guarapiranga dams, we seek to recover the banks of the dams and all those streams that reach them," respecting the recent Sabesp map to protect the springs that cannot be occupied. Many parks are being created and important resettlement work and the construction of new housing units are currently being carried out. Situation of urban poverty due to the country's economic indices, which are increasing considerably, especially in metropolitan regions where it is known that people do not have access to the formal housing market and occupy areas irregularly. There is specific legislation in special zones and in 88 settlements, with the goal of building more than 7,000 homes to house families who need to be resettled.

Its guideline is to house families close to where they lived, safeguarding the bonds built. Recent studies carried out on the numbers of urban poverty in this phase of the pandemic showed a considerable increase in precariousness in cities and metropolitan regions. "We have to urbanize precarious settlements; it is the only possible action to universalize basic sanitation in urban areas and, especially, in irregular and precarious areas. It is necessary to direct resources towards this end".

In his presentation, Sociol. Rafael Castilho initially highlighted the work developed by FESPSP, a school of humanity with almost 90 years of history formed by São Paulo business people with the mission of creating strategy, formulating and thinking about the development and modernization of the Brazilian state. "When talking about developing and creating strategies for progress in the Brazilian state, sanitation is the most symbolic aspect of the country's delays and needs. Much has been done, but through sanitation there are great elements of the formation of society, among them the immense inequality and social distortions".

Over the course of the country, the theme of modernization has always been on the agenda of policies, programs and plans (always thinking about the economic miracle, acceleration of growth, Avança Brasil, Estado Novo) but it carried the reality of the territory with it through the precariousness of sanitation. For him, the new sanitation law will only be effective when it is, in fact, able to transform and intervene in these great distortions. "Sanitation has this responsibility, but it is itself the result of these historical processes, of this difficulty in making the necessary changes. The question of the interface with housing, for example, tends to touch the wound." It is no use talking only about new businesses, participation of private companies, new business plans and a new sanitation law. There are around 6,000 irregular areas, 3 million homes, with approximately 11 million people living in precarious housing. He mentioned the population of Portugal, Belgium, Uruguay, Greece, New Zealand, Haiti, who live, relatively in size, in these precarious and wellspring regions, and this has a gigantic cost for sanitation and for the country, including social exclusion, which directly affects the prosperity of capitalism and the Brazilian internal market. The biggest cost is not having adequate housing and not having sanitation facilities. There are consequences generated from an economic and social standpoint in the country. According to Castilho, the crisis of the pandemic has made this kind of drama very clear that affects sanitation and the social aspect due to the impossibility of complying with isolation in the face of housing reality.

For the speaker, with the new law, a new opportunity arises, with new rules, but it is important to create a favorable business environment, which allows the participation of new investors, the private sector, but "it is also important that the investment meets the purpose, mainly, of taking sanitation where it does not exist, reaching where it is needed most". Regarding these areas of precarious housing, the new framework still leaves some gaps, but at the same time, it brings joint actions, especially among federative entities. Castilho believes that articulations are essential to create pacts and conditions for states and municipalities to have plans and sanitation policies that meet and provide for the necessary interventions in regions of greater calamity. He also highlights the need for new companies or a new sanitation arrangement, new players and the ability to train professionals. These need to be able to see the existing social problem in a structural way and with a view to developing

solutions that have analytical, negotiation, intervention and communication capacity with society.

The professional mentioned that FESPSP started in 2021 the fourth MBA class in environmental sanitation, where there is a first module dedicated to the formation of the Brazilian state, the relationship between public and private. These themes, according to him, prepare the sanitation professional for the reality of the country, helping him to understand not only for analysis, but also for intervention. According to him, it is a great challenge for many professionals to deal with structural issues in the country, such as sub-housing. "More than a problem, this situation should be seen as an opportunity to modernize our country, to make our economy more dynamic. We need to prepare these professionals to have the vision and sensitivity to understand the great historical difficulties".

The great challenge is to create economic viability harmoniously in new projects and incentives so that the private sector finds opportunities in new businesses without giving up the experience of professionals and the services provided by Sabesp. The speaker mentioned that successful experiences such as the company's performance in the *Córrego Limpo* Program and Depollution of the Pinheiros River can attract new investments in public sector issues in complex environments with a strategic vision. Contribute to new possibilities for the modernization of sanitation and bring an opportunity for real change that will reverberate in the social perception, public safety, stability and happiness of residents of precarious areas.

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Vanessa

Hasson Métodos de Apoio à Práticas Ambientais e Sociais (MAPAS)



PALESTRANTE

Erika Mota



PALESTRANTE:
Rosa Maria

Atique
Prefeitura Municipal
de Guariba



Dawn Fleming

Brasil Lead

ROUNDTABLE: SDG AND THE TRANSFORMATIONS ON THE PLANET

Moderator:

Atty. Vanessa Hasson - MAPAS1

Speakers:

Ms. Dawn Fleming - Waterlution² SW. Rosa Maria Atique - Prefeitura Municipal de Guariba/SP Assist. Soc. Erika Mota - Sabesp³

Coordinator/Evaluator:

Eng. Lara Dias de Jesus e Sousa - Sabesp

In 2015, the United Nations (UN) established 17 Sustainable Development Goals, known as SDGs, which make up a global agenda to lead humanity to 2030, the deadline set to achieve these goals and the 169 goals that make up the SDGs. There are several fundamental themes for human development that are addressed in five perspectives: people, planet, prosperity, partnership and peace. Aiming to bring more and more people closer to this subject, the 32nd edition of the AESabesp Technical Meeting organized a roundtable called SDG and Transformations on the Planet, bringing together specialists in various areas, who have been highlights and references in their actions, aiming at transformation and sustainable development, fulfilling processes to achieve the 17 SDGs.

Moderator of the roundtable, Atty. Vanessa Hasson stressed that all individuals can contribute to the success of the 17 SDGs and their 169 goals, which have a deadline to be achieved: 2030. For her, the most important thing is to make people and institutions aware of the importance of debating and strengthening the

subject. "In order to achieve the goals, it is necessary to give more breadth and depth to the understanding of sustainable development, which we need to achieve life in harmony with nature, as recommended by SDG 12, in item 12.8. By 2030, we must ensure that people everywhere have relevant information and awareness for sustainable development," she said. According to her, there is a need to propose a discussion on the following question: how can partnership entities and technical meetings help individuals, companies and corporations, especially environmental sanitation service companies, to contribute to the necessary planetary transformations?

First speaker at the roundtable, Ms. Dawn Fleming spoke about the performance of Team Waterlution, which has been operating in Brazil for five years, aiming at sustainable development actions in relation to one of the most precious assets of our planet and vital for humanity: the water⁴. "We have to celebrate our five years of operations in the country, in the face of the enormous challenges that lie ahead. Our current focus is on developing young water leaders, in a variety of ways and programs, with the Water Innovation Lab being the most wellknown globally. We want to bring together different sectors on the issue of water and climate," said Fleming. For her, as is the message of the organization of which she is a part, developing water solutions in a world undergoing climate change is not just urgent, it is fundamental. With the time set for 2030, she says it is necessary to have focus and direction to work, collaborate and reach this deadline.

The speaker highlighted the importance of raising a question:

¹ Founded in 2004, MAPAS is an international organization that promotes ways of living well and recognizing the Rights of Nature. Originated from community policies in Ecuador and Bolivia, the concept of Good Living is constantly being formulated and, for Mapas, it consists of multiplying and deepening knowledge about a way of life in harmony with Nature, understanding all human and non-human beings as part of it (MAPAS, 2022).

² Originally Canadian, Waterlution is an NGO with international operations focused on water issues. It offers differentiated capacity building, leadership and facilitation training to stimulate and guide innovators and aspiring entrepreneurs in the space of water and climate change (WATERLUTION, 2022).

³ Basic Sanitation Company of the State of São Paulo

⁴ According to the National Water Agency (ANA), Brazil has an alarming statistic: more than 35 million people still do not have access to treated water, with the drinking water supply system generating an average of 37%. It is also worth noting that the lack of sewage treatment compromises more than 110 thousand kilometers of Brazilian rivers that receive the waste (AGENCIA FBC. 2018).

"what do our waters' need?" The use of the pronoun "our" is necessary for regional action; after all, each place has a distinct characteristic, whether it is another Brazilian region or even another country. According to her, the answer to this question will optimize the focus to seek a water solution for a particular location. "For us, water is also the whole basis for the climate issue," highlighted Fleming, noting that the work has an impact on all the SDGs, but that three of them are more evident: SDG 6, clean water and sanitation; SDG 13, climate action; and SDG 14, life below water.

One of Waterlution's hallmarks, through the WILBrasil project, is the training of young water leaders, working collaboratively in the practice of innovation and trying to contribute to a new culture of care for the resource. Fleming points out that, year after year, the focus on this subject has increased, caused by the activities carried out. This generates a very large diversity of mentors due to the commitment they have to the cause. In these five years of projects, there were 346 participants, 165 mentors, 65 projects, 865 registered for the webinars, 3 and a half months of pre-acceleration for 3 projects, with 39 partners and R\$ 60 thousand in seed money⁶, which could be directed towards the first steps of realization.

WILBrasil has several partnerships, whether private, public and governmental agencies, which has helped in the multiplicity of views on the most diverse issues addressed by the NGO, whether in the problem or in the solution to be found. Among WIL's projects around the world, Brazil is the oldest that is, the most consolidated and avant-garde. The program seeks to prioritize and ensure gender diversity, LGBTQIA+ and ethnic-racial diversity in its programs, bringing different perspectives to the most varied issues. In addition, the participants have a path of progress within the project itself, since, in future years, they are invited to become mentors to inspire and contribute with the participants of each new edition. "This strengthens the network on the WIL experience base, always remembering that the program must respond to the challenges of the SDGs".

These are the three WIL elements: innovation projects, in which innovation tools are learned and collaborate on developing something that can be implemented and have an impact; leadership experience, developing leadership skills for

complex water scenarios, learning from experts and mentors in the area, in addition to building your network – a huge challenge in a pandemic period; and systems thinking, to know where and how to intervene in the system. All of this, with different strategies and ways to get these various elements into the program. In 2021, Waterlution created three events to bring people and people interested in the topic together. The first of these was the Inspirágua Festival, with six meetings on innovation, arts, knowledge, resilience and engagement with different themes and challenges of the water landscape in Brazil, shown on the organization's YouTube.

The second was the Collaborative Innovation Laboratory, in which 40 young people, between 18 and 35 years old, were selected to develop capacities and collaborative innovations for water challenges with five territories in Brazil. Finally, the Mão Na Massa nos Territórios (Hands on the Territories), implementing innovative solutions and prototypes in Waterlution's five action territories (Maceió/AL, Salvador/BA, Foz do Rio Doce/ES, Morro do Preventório/RJ and Tekoa Guvra Pepo/SP), activating local partners and generating a positive transformative impact, being carried out in a hybrid way. In these territories, those involved act in search of local partnerships for implementation, search for sponsorship, communication and dissemination partners, technical knowledge of the territory, local leadership, understanding of the territory's potential, and engagement with public authorities and academic institutions to increase the impact on the continuity of actions.

Educ. Rosa Maria Atique raised the point of how education⁷ can be an instrument for the 17 SDGs to have penetration in every Brazilian home. She highlighted that in the SDGs there is a vast field of work, especially in target 4.7, which defines that, by 2030, all students acquire the necessary knowledge and skills to promote sustainable development, as well as promoting sustainable lifestyles, human rights, gender equality, promoting a culture of peace and non-violence, global citizenship, and valuing cultural diversity and the contribution of culture to sustainable development. Education in sustainable development shows that all lives are our biological relatives.

Change, in terms of education, will take place in the face of millions of small acts. The question that must be answered is

⁵ Brazil has the largest reserve of fresh water in the world, which represents approximately 13.7% of the world's reserves, with emphasis on the Amazon River, the largest in terms of volume of water on the planet, and the Guarani Aquifer, which is the largest underground freshwater reserve in the world. Around the world, fresh water is available from glaciers and ice caps (68.9%); groundwater (29.9%); rivers and lakes (0.3%); and other places, such as swamps and soil moisture (0.9%) (TODA MATÉRIA, 2022).

⁶ Financing tools at a stage where the entrepreneur is still looking for resources for business development. "There is a well-founded planning step, with research steps, including, that deliver a business 'proposal'" (TORRES, 2022).

⁷ Despite being important and recognized for the reduction of social inequality, the Federal Government has attitudes contrary to the vitality of education for citizens. Between 2014 and 2018, the Ministry of Education's budget was reduced by 6%, while in 2019 it maintained the same level as the previous year. For 2020, there was a R\$ 12 billion cut in the MEC, returning to the level of 2011 (SINDRERE, 2021).

not about what is wrong, but about what is right. "In order to find the answers to these questions, we must provide situations in which young people can be protagonists in discovering these solutions. History changes when people's consciousness changes – and that transformation will come through education. The students will be the ones who can take the changes to their homes and families, through a public policy consistent with sustainable development," she said. The speaker went on to say that the story told by humans needs to change in line with new scientific evidence. The new phase of the pandemic proves that education, life and nature need to be interconnected so that humanity does not walk towards chaos and that culture needs to change, because people need to understand that we are connected beings and that the other's pain also affects us.

Education needs to be a priority to bring sustainable development to every home. This can be done in different ways, with educational activities or playful games, for example. In a fun way, it is possible to educate as many people as possible in favor of sustainable acts. Education is a primary path to awareness and several actions have been taken worldwide, such as the British Royal Foundation, led by Prince William, which has taken a stand in favor of education to make people aware of this new way of thinking. The Prefecture of Guariba, of which Rosa is a member, is a partner of the institution and hopes that the direction of this educational program can involve more localities, whether through museums, schools, NGOs and other interested bodies. "Albert Einstein already said that we needed a new way of thinking and I believe that this will be achieved through education, which is broad and effective. I not only toys are donated, but also food, hygiene products and We need to embrace this cause to find the path that humanity needs," she concluded.

Finally, SW Erika Mota talked about how volunteering can help us reach the 17 SDGs. Leader of Sabesp's Volunteering Program, which has been operating since 2009, the speaker showed the actions that have been taken by the company, which has a seat on the Brazilian Corporate Volunteer Council (CBVE). For Erika, the SDGs come from a voluntary practice by society so that we can achieve these objectives and the goals that permeate them. In all volunteer actions⁸, the 17 objectives are followed. Quite a challenge arose during the period of the pandemic, when solidarity was even more necessary. According to Mota, Sabesp came under pressure to get involved in several other voluntary actions, and the search for a wider network to meet this demand was the solution. The Volunteering Program carried out a series of conversations and partnerships, starting with Telefônica, a private group that has the largest number

of volunteers on the planet - 17 thousand. Sabesp also held talks with other groups, such as Bradesco, Camargo Corrêa, Intersemente, among others. A forum was held to further achieve these goals.

According to the speaker, currently, it is necessary for companies that aim at volunteering to invest more in this theme to promote more actions, but also to show society the impact that the actions taken have. "Show the actions, where they are carried out, how many people are involved, how many hours are invested, among others," she pointed out. In addition to reinforcing the commitment to some of the most necessary causes, this type of action, in addition to being good for the company's image, can generate the famous "snowball" effect, as it serves as an incentive for more people to act with volunteering.

To promote these issues, Sabesp launched the 20/21 Challenge, with the company's main volunteer campaigns. The first of these was the mobilization of the boards, with management getting involved and motivating volunteers to take part in some actions. In the second, a campaign was carried out to donate parts for the winter, such as blankets, warm clothes, among other items, in which there were more than 250 thousand items donated throughout the state of São Paulo. The third of the actions was the Rio Pinheiros Campaign, which aims to raise environmental awareness, in which a group of volunteers works with young people who live in risk areas near streams. There are also campaigns focused on Children's Day, when other items for the neediest, in addition to Solidarity Christmas, which involve actions in entities supported by Sabesp.

Sabesp's Volunteering Program holds several meetings and internally prepares its employees for volunteering, preparing them for some topics, reinforcing the need for some causes, but also to, indirectly, provide the well-being of employees. "Volunteering helps in the quality of life of each one. There is a publication by the United Nations Educational, Scientific and Cultural Organization (UNESCO) which shows that it is proven that when we do an activity of this type, our body releases a series of neurotransmitters, which help our immunity," she declared. Finally, Sabesp carries out work with young people, which also serves to identify promising characters to act and change the reality of a series of environmental issues. "I want to bring a reflection of our performance, which can serve as a mirror for various people and companies".

⁸ In 2016, in the latest survey by the Brazilian Institute of Geography and Statistics (IBGE) on the subject, there were 237 thousand NGOs in the country and about 7.2 million volunteers. Despite the considerable number of participants in this type of voluntary action, the percentage figures are still small: only 4.3% of the population is engaged in some social cause (WORLD PACKERS, 2022).

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César Mendes Ecolab Química



Paula Marcia Sapia Furukawa



Ricardo Assumpção

ROUNDTABLE: WHY IS ESG IN EVIDENCE IN BRAZILIAN SANITATION?

Moderator:

Eng. César Mendes - Ecolab Química

Speakers:

Eng. Paula Marcia Sapia Furukawa - Sabesp¹ Eng. Ricardo Assumpção - Grape ESG²

Coordinator/Evaluator:

Eng. Reynaldo E. Young Ribeiro - AESabesp³

In recent years, ESG has become more and more common in the Brazilian corporate environment⁴. However, what does this term mean? Coined for the first time in 2004, in a publication of the Global Compact (an arm of the United Nations - UN) in partnership with the World Bank, called Who Cares Wins, the term aimed at mobilizing, at the time, 50 presidents of major financial institutions on the need to integrate three major currents within companies: environmental, social and governance. From then on, the term began to be spread, also reaching sanitation. To talk about the subject, a roundtable called Why is ESG in Evidence in Brazilian Sanitation was organized at the 32nd edition of the AESabesp Technical Meeting, a space destined to understand the impacts of this concept in Brazilian companies and entities, as well as the perspectives for the future in this environment.

According to Eng. César Mendes, moderator of the roundtable, this is a very important topic, since building a sustainable environment that guarantees a better quality of life for everyone depends on the ability of companies to develop and implement good social, environmental and governance practices. For Eng. Ricardo Assumpção, there is still a certain estrangement from people regarding the topic. Despite this, the scenario is changing. "In the year 2020, we talked a lot about ESG and it was very important for people who didn't know to start to become familiar with the subject. In the same way, it was good for companies to be able to organize themselves and show how much they have already advanced in the topic of good practices," said the speaker. In his presentation, he highlighted the great importance of planet Earth as the main source of resources available to humanity and the responsibility that must be taken in relation to this consumption. "The water we consume is the same as it was during the dinosaur period, however, we are currently consuming it much faster than the planet can replace it".

In relation to natural resources in general, Assumpção pointed out that humanity is exceeding its limit⁵ and that affects future generations. He also quoted a speech by Larry Fink, CEO of the world largest accept manager BlackRock, on the topic: "climate

¹ Basic Sanitation Company of the State of São Paulo.

² Grape ESG is a company that develops sustainable strategies and businesses. In its activities, the company works with the development of personalized sustainable strategies, research and development, ESG Training, sustainable investment and communication plans that aim to create value and positive impact in the short, medium and long term.

³ Sabesp Engineers Association.

⁴ Data from Valor Econômico magazine indicate that, in Brazil, the search interest for the term ESG has tripled in the last 12 months (from February 2021 to February 2022). In comparison to the previous environment, there was a 150% increase in searches. In addition, Brazil was the Latin American country that researched the most on ESG and one of the 25 countries in the world that searched for the topic (BERTÃO, 2022).

⁵ According to the Global Footprint Network (GFN), humanity currently uses the resources of 1.7 planets, which is equivalent to more than 74% of the Earth's capacity for renewal. This calculation was made by dividing the amount of ecological resources that can be regenerated by the planet (biocapacity) by the amount of natural resources needed to guarantee the pattern of world consumption (humanity's ecological footprint) (DIA..., 2021).

risk⁶ is financial risk", as it affects the ability of companies to create value. Over the years, issues such as climate change and the excessive use of human resources began to put pressure on companies. "The market began to see that companies that did not have good behavior in the environmental and social area were creating an enormous financial risk up front," explaining that, in the early days of capitalism, what mattered to the companies was to make a profit, despite anything. Later, in the 1980s, in order to make a profit it was necessary to assess the risk, the greater the risk, the greater the profit. Currently, the market is heading towards an era where profit is no longer enough. It is necessary to calculate the risk, but mainly the impact that the company has on individuals and organizations impacted by the company's actions (stakeholders). According to Assumpção, society is going through a period of transformation of capitalism, with emphasis on sustainable development. Concepts such as "impact capitalism", "conscious capitalism" and "ESG" are the new responsible ways in which the market began to conduct business.

How can you measure the sustainability of a company? According to the speaker, that is where ESG comes in, which is the balance between the environment, social and governance. Society has talked about sustainability for many years, but the big change is that sustainability has become a powerful strategic tool. If previously sustainability was managed by an isolated area of the environment and compliance, today, companies have made it transversal, with the company as a whole oriented towards creating a positive impact. "ESG are these criteria that the market uses to measure how sustainable a company is," explains the professional, reinforcing that the bigger the company, the greater its responsibility. ESG is global, not being connected to one company or another, one sector or another, being, therefore, configured as a collective effort. For him, the coronavirus pandemic put a spotlight on human frailties, on how society is susceptible to these risks and highlighted essential sectors such as sanitation, due to their intrinsic relationship between the environmental, social and their responsibility and impact on public health.

One of the major pressures on companies today is attracting

investment. "As the capital market understands that climate risk is financial risk, it demands better ESG postures from companies. Responsible companies, with this part, have a better reputation and are likely to perform better in the long term," he pointed out. In addition, there is the issue of competitiveness. According to him, humanity is going through the biggest generational transfer of all time, highlighting the presence of millennials, who have purposes aligned with sustainability both professionally and in terms of consumption." By 2026, they will be 70% of consumers and will take their place in companies and within the accept managers, companies that lend money to the market. Given this, the professional reinforces the importance of businesses aligning with the ESG.

In addition to attracting capital and competitiveness, companies are currently also under pressure to be innovative and more ecoefficient, due to climate change. They need to have a reputation and an increasingly strong production chain to serve a mass of connected consumers⁸ and they also need to have the courage to invest, as the results will come in the long term.

For Assumpção, sanitation companies have a very big responsibility to promote a transversality of ESG within the companies, with actions that lead to social equity in all areas. "Sustainability must be integrated into the strategy. When we integrate it, it becomes an innovation catalyst. By targeting sustainability, we are right in innovation, as we will force the company to seek new ways of doing things and this generates financial results, both in the medium and long term." According to him, Sabesp currently promotes positive environmental and social impact. However, the speaker raises a question: what is being done is enough? For him, no, and the market will charge sanitation companies more and more because of the circular economy, after all, the sector can advance and contribute a lot to the energy issue. "The sector has the opportunity to go beyond sanitation, becoming an important producer of renewable energy".

In her presentation, Eng. Paula Marcia Sapia Furukawa spoke briefly about the ESG concept that involves good environmental, social and corporate governance practices; presence of non-

⁶ Climate risk is divided into transition risks and physical risks, the first referring to transition scenarios with a combination of economic, legal and/or technological factors within a predefined period. "The construction of transition scenarios aims to evaluate the impacts of the route (or transition) to a low carbon economy in an organization. These scenarios assume a variety of assumptions to assess, for example, different timeframes for implementing policies, adopting technologies and changing the energy matrix." In relation to physical risks, they arise from changes in the frequency and intensity of climatic events and are classified as acute and chronic. "Acute risks are triggered by extreme weather events like cyclones and floods. On the other hand, chronic risks are related to consequences that will come in the long term, such as the progressive increase in the level of the oceans and a gradual change in the precipitation regime" (RISCO..., 2021).

⁷ The GfK Consumer Life 2021 study showed that millennials (born from 1980 to 2000) are highly connected to the consumption of green products. In the same way, this generation expects companies to assume greater responsibility in relation to sustainability, provide educational support on the subject and the development of sustainable products and/or services more suited to Brazilians' income (MILLENIALS..., 2022).

⁸ According to the annual Digital 2021 report, prepared by We Are Social in partnership with Hootsuite, 75% of the Brazilian population (160 million people) have access to the internet and spend around 10 hours and 8 minutes connected daily. Such numbers place Brazil in second place in the world ranking (MEDEIROS, 2021).

financial risks; legal, economic and reputational impacts for an organization, which affect the ability to attract investment and competitiveness of companies; as well as favoring innovation and new business opportunities. In addition, the professional linked ESG with the Sustainable Development Goals (SDGs), whereas "environmental" corresponds to SDGs 6 (clean water and sanitation), 7 (affordable and clean energy), 12 (responsible consumption and production), 13 (climate action), 14 (life below water) and 15 (life on land); the "social" to SDGs 1 (no poverty), 2 (zero hunger), 3 (good health and wellbeing), 4 (quality education), 5 (gender equality) and 8 (decent work and economic growth); and "governance" referring to SDGs 9 (industry, innovation and infrastructure), 10 (reducing inequalities), 11 (sustainable cities and communities), 16 (peace, justice and strong institutions) and 17 (partnerships for the goals).

Regarding ESG in sanitation, the speaker highlighted, in relation to the environment, the universalization of services; culture change, striving for environmental compliance and sustainable practices; and the improvement of process efficiency and new business opportunities. In terms of social issues, she cited the need, within the sanitation sector, to implement diversity and actions aimed at minimizing waste generation in administrative inclusion, also investing in supplier management and customer service. With regard to governance in sanitation, she cited the integration of ESG in business strategies and processes. "ESG is part of the core of our business, having total adherence to the sanitation sector. So, for example, when Sabesp talks about its mission, it deals with quality of life, the environment, acting in a sustainable, competitive, innovative way, focusing on the customer. Many of the ESG principles are ingrained in the nature of the services that Sabesp performs," explained Furukawa about the main bases that guide the company's performance.

Since 2007, Sabesp has adopted the Global Reporting Initiative (GRI) guidelines⁹, with the annual publication of its sustainability reports. In addition, in March 2021, it created the Sustainability Commission, subordinated to the company's presidency and with representatives from all the boards, which aims to improve the integration of ESG practices in business and strategic business processes. Furukawa stressed that, as in several companies in the sanitation sector, at Sabesp, the relationship between the company, the environment and the social is present in all corporate actions In the case of the São Paulo company, this relationship is present in already

consolidated programs such as Onda Limpa Program, Córrego Limpo, Loss Management, Water Supply, Se Liga na Rede, Água Legal and many others. "Environmental management is included in the business strategy through the actions of the Superintendence of Environmental Management, which aims to introduce corporate guidelines related to the topic in the company as a whole, focusing on managing environmental requirements and demands, environmental mobilization and development, environmental performance management and institutional articulation," she said. Created in 2007, the superintendence brought a series of programs aimed at ensuring the applicability of this cross-cutting environment, highlighting topics such as environmental compliance and cultural change.

In relation to this change in culture, Sabesp carries out several actions, such as the Corporate Environmental Training and Development Plan, which has already had more than 21 thousand training opportunities; the Corporate Environmental Education Program - PEA Sabesp, with the training of multipliers, in addition to raising awareness and mobilizing internal and external audiences (partnerships with educational networks, etc.); the Sabesp 3Rs Corporate Program, with activities; through the work of institutional representation of the Water Resources and Environment Systems, with 160 representatives participating in the Technical Chambers of the National Water Resources Council, basin committees and environmental forums; among others.

Sabesp also develops the Corporate Program for Progressive Implementation of the Environmental Management System - EMS and ISO 14001 Certification in water and sewage treatment plants. "We started the program with the idea of implementing ISO 14001 in all installations. Over time, we have matured our processes and found other, more agile ways to introduce this issue into the routine of the operation. So, we created our own management model, which we called EMS, but that maintains all the basic principles of 14001." The company has a goal of implementing this system in all facilities by 2024. Another initiative mentioned by the speaker is the Sustainable STSs Corporate Program, which aims to implement sewage treatment stations that interact with the environment and seek to minimize the consumption of natural resources and energy through the beneficial use of their byproducts. The Corporate Program for the Management of Greenhouse Gases was also created, which develops actions such as estimates and

⁹ The GRI guidelines refer to a framework that guides the preparation of reports on the organizations' economic, environmental and social performance. This tool helps companies to present a systemic view, helps to establish reference standards (benchmarking), as well as to evaluate sustainability performance and is an instrument of participation of interested parties (stakeholders) (GRI, 2002).

continuous monitoring of emissions, mitigation of Greenhouse Gas¹⁰ (GHG) emissions in business activities, adaptive resilience to the effects of climate change and extreme events, and capacity building and awareness-raising activities on climate change. In addition, Sabesp voluntarily adhered to the São Paulo Environmental Agreement¹¹, in August 2020, and is working on drawing up an environmental and climate agenda.

Furukawa mentioned various actions to mitigate GHG emissions in business activities, such as: search for a renewable energy source, replacement of an open burner with a closed one, capture and use of biogas, solar panels, forest restoration, implementation of riparian vegetation, reuse of wastewater from STSs, sludge drying system, cleaning of stabilization ponds, implementation of aeration systems etc. Sabesp also develops the Distributed Generation Program - Photovoltaic Energy, with the forecast of implantation of photovoltaic plants in areas remaining from the company itself. This project will account for 4.5% of the company's consumption. The first plant was inaugurated in February 2021, at the Orindiúva STS. In addition, there are other projects for self-generation of photovoltaic energy, an example of which is the partnership carried out for energy generation at Mogi Mirim STS (in operation). For 2022, the start of operation of the floating photovoltaic plants at Taiacupeba WTS is scheduled. "In addition to these initiatives, a very large investment was also made in research, technological development and innovation projects, such as the use of biomethane as vehicular fuel, which has already been under development at the Franca STS since 2018," she reinforced.

The speaker also mentioned the work on the social axis, with appreciation, care, training and opportunities for Sabesp employees, such as: Sabesp Business University, Young Apprentices and Interns Program, training programs, quality of life, stimulus to innovation and entrepreneurship, diversity and inclusion, health and safety at work, among others. The company also develops volunteer actions encouraging the engagement of employees in the Winter Solidarity Campaign, blood donation and the involvement of society in the Novo Rio Pinheiros project. In relation to suppliers, the company values partnerships that respect labor, tax and environmental laws; uses contractual instruments that demand compliance with legislation for ESG aspects; encourages the hiring of local suppliers; qualifies suppliers and products that are

environmentally and socially responsible, combat forced labor and the use of child labor; and also encourages partners to be committed to ethics and compliance. With regard to customers, Sabesp communicates its values through digital channels, implementing service with adaptability and providing an ombudsman.

On the topic of governance, the professional highlighted that the company conducts management guided by efficiency, integrity and transparency. Since 2007, Sabesp has been a signatory to the UN Global Compact; participates in the Business Pact for Integrity and against Corruption, of the Ethos Institute; and the United Nations Anti-Corruption Working Group. In its internal processes, Furukawa highlighted the existence of an ethics, audit and corporate risk management committee, an integrity program aligned with best practices and national and international requirements, and works with transparency in financial statements. Furthermore, as a publicly traded company, it is listed in the New Market category of B3 and issues American Depositary Receipts on the New York Stock Exchange, having to follow a series of special corporate governance requirements. It also makes up the BB ESG portfolio of Banco do Brasil, which brings together companies aligned with ESG principles.

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¹⁰ Data from the Greenhouse Gas Emissions Estimate System (SEEG) indicated that Brazilian greenhouse gas emissions increased by 9.6% in 2019. "The country released into the atmosphere 2.17 billion gross tons of carbon dioxide equivalent (tCO,e), against 1.98 billion in 2018" (ANÁLISE..., 2020).

¹¹ With more than 1,600 volunteers - among companies, associations and municipalities in the state of São Paulo - the São Paulo Environmental Agreement was launched in 2019 by the government of São Paulo, through the Secretariats for Infrastructure and Environment, International Relations and the Environmental Company of the State of São Paulo (CETESB). The initiative has the objective that the productive sector must voluntarily make a commitment to reduce GHG emissions, in order to keep global warming below 1.50 C over the next 10 years. The management will be renewed automatically until 2030 and guarantees the recognition of its signatories as members of the community of leaders in climate change and of government technical support (ACORDO..., n.d.).

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aneamento e Ambiente



Paulo **Ferreira**





PALESTRANTE:

Olivia Pompeu de Mendonça Coelho





Neuri **Freitas**

Companhia de Água e Esgoto do Ceará (Cagece) e Associação Brasileira das Empre Estaduais de Saneamento (AESBE)



Ana

Freitas Instituto de Infectologia Emilio Ribas

ROUNDTABLE: SANITATION IN THE FIGHT AGAINST PANDEMICS

Moderator:

Eng. Paulo Ferreira - Institute of Engineering

Speakers:

Eng. Olivia Pompeu de Mendonça Coelho - Sabesp¹ Neuri Freitas - Cagece² AESBE³ Dr. Ana Freitas Ribeiro - Emílio Ribas Infectious Disease Institute

Coordinator/Evaluator:

Eng. Abiatar Castro de Oliveira - Sabesp

Humanity was taken by surprise with Covid-19, a disease that, due to its peculiarities and power of transmission, mobilized society to the point of completely changing its *modus operandi*. At that moment, nations needed to pay greater attention, not only to safety and to care in order to reduce contamination, but also to observe their own reality and the structural faults that became more visible and harmful to people's health. In Brazil, one of the segments that drew everyone's attention was sanitation, exposed by its unequal reality. Consciously thinking about and acting on sanitation, understanding its socioenvironmental role has become one of the great banners raised by the sector. To talk about this subject, at the 32nd edition of the AESabesp Technical Meeting, a roundtable called Sanitation in the Fight against Pandemics was organized, in order to show the history, challenges and how basic sanitation has gone through this pandemic period.

Eng. Abiatar Oliveira, coordinator of the panel, opened the meeting by emphasizing that discussing environmental

sanitation is important to preserve and improve people's living conditions and the environment. "Sanitation prevents disease and promotes health. It improves the population's quality of life and even people's productivity⁴, positively affecting education and economic activities. Access to treated water, collection and treatment of sewage, provides a better quality of life for people by acting directly in the reduction of hospitalizations due to waterborne diseases," he declared. In the first lecture of the table, Eng. Olivia Pompeu de Mendonca Coelho brought a story about how basic sanitation is, in a way, intertwined with pandemics. First, she introduced the concept of "pandemic" which, according to the World Health Organization (WHO), is the worldwide spread of a new disease and is used when an epidemic (outbreak affecting a region) spreads across different continents with sustained person-to-person transmission. In the history of humanity, epidemics and pandemics start to occur when human and animal interactions increase. These interactions are the big drivers for pandemics - something that goes back to the beginnings of agriculture, agronomy, and interactions between civilizations. "From these moments of interaction, man comes into contact with infectious agents," said Coelho.

To date, all pandemics have a point of similarity between them, having human actions as their cause. In all of them, there are population agglomerations, contact with wild animals, climatic changes and effects, contamination of waters and seas, in addition to the deficiency in the sanitary structure. The speaker pointed out that epidemics always follow the same script. The first phase is denial, in which people go about their normal lives, believing that the illness is far from them. The second

¹ Basic Sanitation Company of the State of São Paulo.

² Water and Sewage Company of the State of Ceará.

³ Brazilian Association of State Sanitation Companies.

⁴ A study promoted by the Trata Brasil Institute in partnership with the Brazilian Business Council for Sustainable Development (CEBDS) showed that the country's per capita income would increase by 6% if all Brazilians had basic services, in addition to reducing around 11% of worker absences, as this is the percentage of absences due to problems caused by lack of sanitation. Access to the sewage network increases worker productivity by 13.3% and results in a salary gain of 3.8% due to reduced absences (GERON; RICCI,

phase is the one in which the disease approaches, but many think they will not have the strength to do more. The third is when the disease kills, but they believe that the health system will handle it.

Throughout history, there have been pandemics that have killed millions of people – at times when the population was far from what it is today. Since the Ancient Age⁵, going through the Middle Ages⁶, Modern Age⁷ and the current Contemporary Age⁸, humanity has faced pandemics such as the Black Death, Italian Silver, Yellow Fever, Spanish Flu, HIV, among others, as well as Covid-19. "The main pandemics in history were related, in some way, to sanitation - or the lack of structure of it," pointed out the speaker. The first cities appeared in the Ancient Age, therefore, from that period onwards the first agglomerations appeared. They began to appear around rivers and irrigation and canalization techniques began to be developed because of the need for water use. The city-state Esnuna, currently in Iraq, which comprised Babylon more than 3,700 years ago, had sewer systems, for example. At the same time, Harappa had a system where baths were allowed to be taken in individual areas, similar to a toilet.

In this period, there were also records of sanitation with dikes, wells, reservoirs, collectors, urban drainage, aqueducts, fountains and public baths, among others. However, the Middle Ages brought a setback, mainly due to the disorderly growth of cities, with close coexistence between men and animals. Furthermore, baths, condemned by the church at the time, were rare throughout the year, among other situations of lack of hygiene. In this context, the Black Death⁹ appeared — which occurs in two moments: in 541 and, later, in a more devastating way, in 1343. "At the time, there was no correlation between epidemics and sanitation or any other scientific evidence. All overwhelming mortality at the time was attributed to the will of God, and today, it is known that fleas and rats were agents for the spread of the disease," said Coelho.

During the Modern Age, from 1453 to 1789, the world began to worry about public health and, as a result, sanitation underwent developments such as the construction of drainage channels and the distribution of water channeled through cast iron pipes, as it was in Paris in the late 15th century. The centrifugal pump, the toilet, and the flow rate measurement were invented. It is worth noting that, in 1620, the first basic sanitation work in

Brazil began, with the construction of the Rio Carioca aqueduct to supply Rio de Janeiro – the famous Lapa Arches, which were delivered to the population over 100 years later, in 1723.

At the end of the 18th century, the Industrial Revolution caused cities to grow even more and conditions were appalling, with garbage, debris and excrement on the streets, making sanitation systems necessary to meet population demand. In a period close to that, the smallpox pandemic occurred, considered the most lethal in history, with more than 55 million deaths and an estimate that 90% of the people of the American continent, at the time, died of the disease. The historical record of the virus in Brazil shows that smallpox arrived in 1826, with more than 2,000 deaths in its first notification. "In this same record, available in the Federal Senate archive, in addition to venting the disregard for non-vaccination and non-adoption of preventive measures, the clerk relates the spread of diseases to the lack of a basic sanitation structure, such as the neglect that existed around the cisterns at the time, which were 'filth deposits that communicate through infiltrations or through the holes that rats make'," she declared.

Finally, in the contemporary age, basic sanitation has advanced with steam pumps, the recognition of epidemics as being related to open sewers, more investments in research, laws to combat water pollution when open pits are replaced by pipes, in addition to urban space planning. However, these are gradual advances. From the 1800s onwards, yellow fever reached the world and the city of Santos was an example that the implementation of a basic sanitation system was a response to the pandemic. The city had a very precarious structure, in which rainwater mixed with sewage, creating a favorable environment for mosquitoes to proliferate. The situation was so dramatic that the city came to be known because of the yellow fever outbreaks, but also from typhoid, malaria, smallpox, among others, which caused half of the city's population to have died from these types of diseases between 1890 and 1904, which gave the nickname Cursed Port to the Port of Santos.

It was in 1881 that the State Health Service and the Sanitation Commission were created to operate in Santos. The construction of canals and the creation of docks in the Port of Santos were defined. In 1907, Saturnino de Brito started a pioneering project to separate these waters. In 1912, the sewage and rainwater system in Santos started to operate, serving a population of

⁵ According to historians, this period covers the years from 3500 BC to 476. It begins with the first form of writing, held in Sumer, until the end of the Roman Empire (SILVA, n.d. – a).

⁶ Historical period between the 5th century and the 15th century, which took place between the end of the Roman Empire and the capture of Constantinople by the Turks, in 1453 (REZERRA n.d. – b)

⁷ A moment in history that, chronologically, began with the conquest of Constantinople and ended with the Storming of the Bastille in 1789 (SILVA, n.d. - c).

⁸ A period that, after the French Revolution, continues to the present day (BEZERRA, n.d. - d).

⁹ It is believed that the disease originated in China and spread to Europe through a conflict that took place in Caffa, a Genoese colony located in Crimea. It is estimated that between 75 and 200 million people died from the disease at the time (O QUE..., n.d.).

44,500 inhabitants, with 66 km of networks, 12 km of outfalls, ten pumping stations, a thermal power plant and a suspension bridge, reaching the nearby cities of São Vicente and Praia Grande, fighting the epidemic. "As well as the Covid-19 pandemic, as the lack of basic sanitation makes it difficult to control it. The regions with the highest supply of piped drinking water and greater sewage collection are places with lower rates of infection and deaths from the coronavirus," he concluded.

Bringing a focus on the present moment, Acct. Neuri Freitas started his lecture by highlighting five points regarding the importance of access to sanitation in the context of the pandemic: guaranteeing essential basic services¹⁰, ensuring the necessary hygiene, promoting health, providing quality of life and care for the environment. "We need to guarantee the population access to these basic services. Before talking about any progress, whatever the area, we have to first ensure the basics," he said. A challenge for sanitation companies during this period is to provide quality service, keep a team operating the system and keep these people away from contracting Covid-19 so that, for example, sewage could have the best treatment possible. After all, research shows that the disease was also in the sewage. How to mitigate all this and minimize virus damage? "The first step was not to be infected and to treat Covid-19 differently from the rest of the country. Much has been said about the new Sanitation Legal Framework, in which three big waves that occurred until that period – largely due we bring several new ideas to the sector. We also went after this in this face of the pandemic. We tried, at all costs, that every operation technician had priority vaccination so that supply and collection would not stop," he said.

Even in the face of the federal government, which did not place the basic sanitation service as essential in the pandemic, public basic sanitation has been increasingly strong to guarantee services for the population, especially the most vulnerable. The exemption from bills and social tariffs was then discussed, in addition to the operational effort and high default¹¹ so that services (or lack thereof) would not have a negative impact and further increase the numbers of contamination and death from the disease. Covid-19 took humanity by surprise. Not only was the sanitation sector not prepared for a pandemic, but also the entire world was not, even in the face of other epidemics and pandemics that we have suffered over the centuries. Now, some lessons remain and are already beginning to be applied. Currently, the sanitation sector is very dependent on work force and needs to improve the automation of companies, without relying only on people in the field, putting more intelligence and new technologies in favor of the sector. "We should even ask ourselves if all people need to be inside the company. Can't

collaborators be in other environments, working remotely? We saw that in most companies it is possible. Using more technology in our favor can be a way of reducing our costs and presenting a lower tariff," said the speaker.

The fact is that the world, after the pandemic, has an even greater demand on the efficiency of companies and services. In order to speed up the path towards universalization, the speaker indicated that there is room for private initiative and mixed economy companies, and the sum of these efforts, including the public power, can be a good alternative to reach the 2033 goals, as long as the commitment is, in fact, to universal water supply and sewage collection in the country. "Thinking also about cross-subsidy, in addition to maintaining and expanding investments in the sector, without thinking only about resources from the Union or the states, looking at other forms of financing. In this format, we can have a development agenda and the recovery of the country's economy, with many works and a lot of employment," he highlighted.

Finally, Dr. Ana Freitas brought the opinion of a health professional in the face of the Covid-19 pandemic, which, until March 2020, had cases concentrated in China, but that spread at a great speed, given the transmission facilitated by air. The speaker showed the cases until September 2021, showing the to the variants of the virus, which are Alpha, Beta, Gamma and Delta. Ana pointed out that, throughout 2020, only social distancing had an impact on the decrease or reduction in the number of cases, which changed from 2021 onwards with vaccination coverage. She pointed out that the variant becomes worrying from the moment when transmissibility is increased and the capabilities of antibodies reduced, increasing the risk of reinfection and decreasing people's immunity, in addition to having an impact on diagnosis. An example is having a negative result in the exam, but, in fact, being a false negative, after all the exam itself cannot detect the change of the virus. "All viruses change in constant ways, but not all of them are important, because they do not always cause these changes. When they cause it, they become worrisome," she declared.

In Brazil, until September 2021, the following picture was 21,034,610 cases, with 588,597 deaths, reaching 2.8% of lethality, most of them elderly and with comorbidities. As was to be expected, the largest number of cases came from more populated areas such as the Southeast region. However, the Central-West and South regions have a higher incidence, which, according to the speaker, may be the result of a greater number of tests. In terms of mortality, the Central-West leads

¹⁰ According to the Trata Brasil Institute, at the beginning of the pandemic, about 35 million people did not have access to safe drinking water and 100 million did not have access to sewage collection. This is the number of people who, according to the organization, do not have the hygiene conditions recommended by health bodies (EOS CONSULTORES,

¹¹ The main basic sanitation companies in the country did not cut off the supply of the service to the most vulnerable population, when they defaulted (GERON; RICCI, 2020).

in percentage terms, ahead of the Southeast. "Brazil has a very good history of hospital surveillance. However, we have an underreporting of cases in the country, after all, the asymptomatic and the pre-symptomatic will only be on this list when they look for a hospital," she commented.

Ana Freitas pointed out that the vaccine option was very quick in the face of Covid-19 and that the adhesion numbers were satisfactory, with 47.14% of the population taking the second dose or a single dose in September 2021, with emphasis on São Paulo, which reached 60.73% in the period. However, she stressed the much-talked about herd immunity. As vaccines prevent serious cases, this does not prevent a person from having a mild or moderate infection, as well as transmitting the virus to others. "Vaccines have not yet been tested against the infection. Herd immunity has to be treated with caution as it should lessen transmission, not just lessen severity," she pointed out. SARS-COV-2 is a virus that is very sensitive to environmental conditions, dying much easier than others do, such as Hepatitis A and Poliomyelitis, so it is not detected in drinking water supplies. Conventional methods of water treatment such as filtration and disinfection should destroy SARS-COV-2. The speaker even suggests keeping storage safe at home. Regularly cleaning and covering water tanks are measures to prevent the presence of the virus.

The doctor also showed that the higher the temperature, the lower the condition of survival of the SARS-COV-2, as well as it resists little to the products used for cleaning and sanitizing. For example, the virus does not withstand more than five minutes of bleach and 70% alcohol applications, while it resists a little more to the soap solution, however, this does not mean that it has conditions of transmission. "Even on surfaces (such as paper, wood, clothing, glass, metals, plastic and masks) on which the virus is, it ends up having a reduction in viral load and may not be able to transmit".

Despite being an enveloped and sensitive virus to environmental conditions, studies show that it is possible for it to be excreted in feces in high concentrations and to survive in the sewer, with the presence of the virus in these locations being proportional to the number of fatal cases in the range of 105 and 106.5 copies per liter. "Recent studies have identified the virus in toilets through aerosols, so it's possible to get Covid-19 after you enter a toilet after a person who has previously excreted feces with the virus," she said. The evolution of SARS-COV-2 in sewage has evidenced the validity of epidemiology based on the evaluation of sewage samples to know the impact of control measures and estimate the infected load, including presymptomatic, asymptomatic, symptomatic and undiagnosed cases.

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ABESP



Carlos Shauff



PALESTRANTE:
Patricia
Iglecias
Cetesb



José Geraldo Portugal



Claudio H. Ternieden

Water Environment Federation (WEF)

ROUNDTABLE: CIRCULAR ECONOMY AND A MORE SUSTAINABLE FUTURE

Moderator:

CS Carlos Schauff - IPEG1

Speakers:

Bel. Claudio H. Ternieden - WEF² Public. Adm. José Geraldo Portugal - Sabesp³ Atty. Patricia Iglesias - CETESB⁴

Coordinator:

Eng. Nilton Moraes - Sabesp

Evaluator:

Eng. Nélson César Menetti - AESabesp⁵

Created in 1989 by British economists and environmentalists David W. Pearce and R. Kerry Turner, the concept of circular economy was born with the aim of transforming the relationship between man and the environment. From a mere garbage dump and resource extraction site, nature, from the point of view of the circular economy, would be treated in a way that preserves its own cyclical dynamics. Over the years and the greater adherence of the concept of sustainability⁶ to the precepts of society, the circular economy gained space in

various segments, including sanitation. To talk more about the topic, at the 32nd edition of the AESabesp Technical Meeting, a roundtable called Circular Economy and a more Sustainable Future was presented, which aimed to show how the circular economy encourages waste reduction, reuse, recovery, recycling and reuse, aiming at the creation of new products and environmental gain.

In her opening speech, Atty. Patricia Iglesias highlighted that the circular economy is already internalized in the daily life of society, but stressed the need to take some steps in relation to the theme, inserting it in the scope of public policies. In her presentation, Iglesias described the work developed by CETESB on this subject. "The company has been working with several focuses that involve this more sustainable future, moving from a more linear economy view (planning, product placement and delivery to the consumer) to a more circular economy that takes into account the entire product cycle." Currently, the company works with the concept of circular economy from different fronts: reverse logistics, composting, application of vinasse and energy use of waste. In relation to reverse logistics⁷, the professional pointed out that the state of São Paulo has been working on the subject for a long time, even before the National Policy on Solid Waste of 2010, through a state policy

- 1 São Paulo Institute of Management Excellence.
- 2 Water Environment Federation.
- 3 Basic Sanitation Company of the State of São Paulo.
- 4 Environmental Company of the State of São Paulo.
- 5 Sabesp Engineers Association.
- 6 According to the CEO of the Ideia Sustentável consultancy, Ricardo Voltolini, the new coronavirus pandemic has accelerated the need to include sustainability in the dynamics of companies. Even before Covid-19, the world market was already mobilized around the theme, with the publication of a manifesto that proposed a new beginning (business as usual) in 2019 by 181 large companies in the United States and corroborated by 230 European investors later. Likewise, in 2020, the World Economic Forum in Davos, Switzerland, focused heavily on the topic of sustainability; and, in the same year, Laurence D. Fink, CEO of BlackRock, released an open letter confirming the need for the theme as a strategy in companies (NUNES, 2020). "When we find that companies and boards are not producing effective sustainability disclosures or putting in place frameworks to manage these issues, we will hold board members accountable," added Fink (FINK, 2020).
- 7 Data from the Ministry of the Environment (MMA) indicate that, in 2020, Brazil reached the mark of 97.4% of recycled aluminum cans, with more than 30 billion cans collected. Over the years, other important figures were recorded, such as: 45,500 tons of crop protection packaging collected; 155 tons of batteries collected and disposed of in an appropriate manner; and approximately 490 million liters of used or contaminated lubricating oils were recycled (FRANÇA, 2021).

implemented in 2006⁸. Regarding the characteristics of reverse logistics, he explained that it represents the return of products/packaging to the business sector independently from the public service of urban cleaning and solid waste management.

Among the benefits that reverse logistics provides are: offering post-consumer waste return channels to the industry; the reduction of the volume destined to the landfills, promoting the increase of the useful life of these disposal sites; and increased use of recycled material, replacing virgin resources. According to Iglesias, this tool is in the Sustainable Development Goals (SDGs), more specifically in SDG 12 - Sustainable Consumption and Production, which has as its goals the substantial reduction of waste generation by 2030, through prevention, reduction, recycling and reuse; and encouraging companies - mainly large and transnational ones - to adopt sustainable practices, as well as the integration of sustainability information into their reporting cycles. "Reverse logistics in the state of São Paulo has been working since 2015, the year in which Resolution No. 45 was published by the Environment Department, in which reverse logistics and environmental licensing were linked. It was a forerunner norm in our country," she pointed out. Based on that device, companies had to adapt. In the beginning, there were questionings in court, but the Court of Justice recognized the rightness of the decision. Because of this resolution, currently, in the state of São Paulo, licenses are not renewed or granted to the industry without companies committing to reverse logistics. This practice has already been copied in other Brazilian states.

According to Iglesias, there are several terms of commitments currently in force. Each one of them takes into account the need for reverse logistics and encourages the establishment of goals and their achievement over the years. Until now, these terms are present in the areas of pesticide packaging, used car lubricating oil filters, edible oil, portable batteries and batteries, waste lead acid batteries, used plastic packaging of lubricants, empty packaging of professional disinfectants, among others. As of 2021, all these sectors - no matter the size of the company - will have the requirement of reverse logistics in their licensing. Through the work carried out by CETESB, the number of companies included in reverse logistics plans went from less than 2,000 in 2019 to more than 4,300 in the first half of 2021, with 171 logistics plans being received. For the next few

years, the speaker said that the company is developing SIGOR Logística Reversa, which will be a platform with applications that will monitor all those involved in the environmentally appropriate destination. The system's objective is to speed up and improve the exchange of information, develop a traceability environment, and will analyze plans and annual reports.

The second topic that CETESB works on is composting⁹ urban waste. There are still only a few composting plants in operation in the state. Such a scenario results, according to Iglesias, from the lack of selective collection or failure to separate the source, resulting in low quality of the raw material; difficulties in operation and maintenance; and placing the compost on the market. "More than 50% of the waste generated in the state and in the country is organic waste that could have a more appropriate destination." At the moment, the company has some reference actions, such as the São José do Rio Preto Composting Plant, which separates waste from regular public collection, receiving 22% of raw organics, 8% of recyclables and 70% of tailings. "They manage to properly separate waste, greatly reducing what goes to landfills." Iglesias highlighted the challenges in relation to this practice, such as: raising public awareness in the separation of waste for the development of quality composts; the production of composts that meet the minimum requirements established by the Ministry of Agriculture, Livestock and Food Supply (MAPA); and the inclusion of these materials in the mineral fertilizer market¹⁰.

The third topic dealt with by the company is the destination of vinasse. There was a great demand in the sugar-energy sector in relation to the vinasse¹¹, issue, since it was considered a problem in the sector. In 2006, Technical Standard P4231 was published, regulating the application of the crop, through the establishment of technical standards and recognition of the agronomic value of the by-product in agricultural soil. "We had a technical discussion aimed at improving this standard and an analysis to implement monitoring standards. With this, the amount of vinasse was reduced to one sixth of the original volume, eliminating problems." Iglesias highlighted the need to follow the technological evolution, since each one of them will have to mean a rapid evolution in licensing.

In relation to the energy use of waste, the speaker highlighted

⁸ Law No. 12,300, of March 16, 2006, which institutes the State Policy on Solid Waste and defines principles and guidelines, postulating in its Article No. 1: "this law institutes the State Policy on Solid Waste and defines principles and guidelines, objectives, instruments for the integrated and shared management of solid waste, with a view to preventing and controlling pollution, protecting and restoring the quality of the environment, and promoting public health, ensuring the adequate use of environmental resources in the state of São Paulo" (SÃO PAULO, 2006).

⁹ Data published by the Brazilian Association of Public Cleaning and Special Waste Companies (Abrelpe) showed that, in 2019, Brazil produced almost 37 million tons of organic waste and only 1% of this total was discarded and reused (APENAS..., 2019).

¹⁰ The National Plan on Solid Waste (Planares) was approved in 2022. In addition to closing the more than 2,400 existing dumps in the country, with 100% of health waste being destined for incineration or autoclave, the plan also foresees recovering 20% of the dry recyclables and 13.5% of the organic fraction, thus working to ensure that all cities have selective collection of organics, composting or anaerobic digestion (degradation of matter by microorganisms) (GAMA, 2022).

¹¹ Generated by the production of ethanol, in the distillation of alcohol, the vinasse is a residue used as a fertilizer. When released in nature, it causes soil and water bodies pollution. Furthermore, it also impacts biodiversity, threatening the lives of animals and attracting insects. Its use generates imbalance to the environment. Study published on the Scielo platform by the authors Mellissa A. S. da Silva, Nori P. Griebeler and Lino C. Borges, entitled Use of Vinasse and Impacts on Soil and Groundwater Properties, pointed out that vinasse is approximately 100 times more polluting than domestic sewage, due to its high rate of organic matter (CABALLERO, 2022).

the work of using Refuse-Derived Fuel (RDF) from the reuse of materials from landfills¹². "We have the difficulty of depleting the useful life of the landfills. The use of RDF allows us to reduce the emission of greenhouse gases, which, many times, will occur in the traditional process of eliminating methane in the landfill". Within this theme, CETESB published two resolutions (SIMA No. 47/2020 and No. 84/2021), which define the minimum characteristics of solid waste that can be used in the preparation of RDF and Fuel Derived from Hazardous Solid Waste (CDRP).

In his presentation, Public Adm. José Geraldo Portugal explained the economic-financial aspects of the circular economy, conceptualizing that the theme aims to reduce environmental impacts through a new form of production and consumption, promoting a 'separation' between economic growth and primary resource use. The central idea is the creation of a sustainable production cycle by transforming waste into new raw materials, replacing the linear model of continuous extraction of natural resources. The circular economy has nature itself as a reference, where everything can be reused, giving the planet time for its recovery. According to the speaker, the impact of the circular economy can be analyzed at three levels: macro (city, country and planet), meso (economic sectors) and micro (organizations). In relation to business models at the meso level, he highlighted the conventional practice, which has as its fundamental principle the continuous optimization of results; the benefit exclusively aimed at the buyer/supplier; transactions in the B2B or B2C markets¹³, with money as a goods or services; and, when talking about success indicators, cost-benefit analysis is always associated with solving current problems.

Regarding the circular economy, Portugal highlighted some differences, such as: fundamental principles focused on the integration of financial, environmental and social impacts; a more integrated supply chain, with companies networked with others in a collaborative and co-creation relationship; the presence of new markets, where consumers interact with consumers (C2C) and economic agents act as producers and consumers (and not just money, but goods and services can be exchanged for energy, waste, time, etc.); access to the service becomes more important than the ownership of a product that provides the service; in terms of success indicators, in the circular model, the analysis incorporates financial and non-financial values for stakeholders and society in general, focusing on the solution of future problems. Portugal also highlighted that the impact of the new generations (millennials) aimed at a more sustainable life, triggered a qualitative growth in demand in which "access" became the new form of "ownership". Currently, the opportunities for transforming products into services emerge from the connection between

goods, which are the result of greater availability of information and interaction with the customer (smart goods). "There is also an intimacy with the customer, a direct, recurrent and personalized relationship. When the service is relevant, billing takes place. When it is irrelevant, the customer is lost. There is a very sensitive thermostat in business from this much closer relationship," he explains.

According to the professional, the circular economy guarantees the level of revenue, with significant cost savings, but in this model there are greater initial investment and capital needs, since it will be necessary to retain ownership of the product. Regarding the costs in the circular model, he highlighted savings in inputs, raw materials and waste disposal (landfills), reduction of technological costs (scales, recycling and repair), reduction of unpriced costs (negative externalities) and credits, highlighting the transformation of the market to the benefit of companies that adhere to the circular economy and ESG. "When activities are moved from new products each week to recycling and repair activities, investments are lower. So, there is an economy in technological costs due to the fact that the scales and resources required to make the investments are made in the size of smaller companies," he reinforced. In addition to the existing economy based on the application of the circular economy, he dealt with risk mitigation, with impacts in the reputational sphere, risks associated with climate change, depletion of natural resources, market losses, low investor attractiveness (equity), credit risk and access to markets. Between 2018 and 2019, 60% of the investments made in the medium of exchange; property as central to the consumption of European Union and 40% in the United States were related to the environmental theme.

Portugal related the circular economy to ESG management standards, the first being the necessary path for the application of the second and which is connected through the environmental dimension represented by the "E" of the acronym. Furthermore, both presuppose a high degree of integration between the dimensions and a long-term planning for their implementation. According to him, the principles of the circular economy are embedded in companies' ESG assessments. An example of this is the Environmental Sustainability Index, published by the official Brazilian stock exchange, B3, which presents questions related to practices oriented towards eco-efficiency or cleaner production, such as reducing the use of materials, use of recycled materials, energy efficiency processes and others. "The circular economy is at the heart of the sustainability index of the Brazilian stock exchange and through this assessment, you may or may not be on the list of companies with a high reputation for following these metrics", he reinforces. The circular economy is within the ESG assessments that currently all companies pass, because investors hire these services. In his speech, the moderator of the roundtable, the CS Carlos Schauff, highlighted that it is interesting, because, currently, investors

¹² According to Abrelpe's 2021 Sector Panorama, most urban solid waste in 2020 was destined for landfills, with 46 million tons being sent to these locations (ABRELPE, 2021).

¹³ Contraction for Business to Business, B2B refers to negotiations between companies, such as when one company purchases inputs from another. Business to Consumer (B2C) is about transactions between companies and consumers via the internet (GUIMARÃES, 2018).

are more concerned about the topic than the consumers, reinforcing that this is society's challenge: to make this change of key, because the excessive practice of consumption by humanity cannot continue.

Lwy. Claudio H. Ternieden explained the performance of the WEF, which is a non-profit technical-educational organization with more than 34 thousand individual members and 75 affiliates in 35 countries. The WEF is guided by four objectives: to connect professionals dedicated to the topic of water, to enrich the experience of these professionals, to provide a platform for industry innovation and to increase awareness of the impact and value of water. According to the speaker, currently, the world is focused on the implementation of the 2030 Agenda for Sustainable Development, in which the 17 Sustainable Development Goals (SDGs) were adopted. In particular, talking about SDG 6, which refers to sanitation. "The circular economy has gained strength, especially in the water sector, whose idea is to reduce the waste produced, creating valuable products from the additional waste streams," he said.

According to him, Water facilities can directly contribute to a circular economy by producing clean water, nutrients, renewable energy and other valuable biological materials from wastewater. And the WEF aims to create a public appeal to the topic through the ReNEW Water Project in order to accelerate the recovery of resources for the development of a circular economy. "The ReNEW project seeks to carry out a call to action to encourage utilities to seek resource recovery as a way to improve operations, manage risk and increase sustainability." The organization also seeks to catalyze the recovery of highvalue wastewater products, helping utilities develop cases aimed at resource recovery with alignment and integration with the industry. Ongoing work involves the periodic development of progress and impact reports to determine the results and goals to be achieved, as well as to report on the value impact created by these utilities.

According to the speaker, for almost a decade, the WEF has promoted resource recovery. The entity's 2011 renewable energy position statement postulates that wastewater treatment plants are not waste disposal facilities, but water resource recovery facilities that produce clean water, recover nutrients (such as phosphorus and nitrogen) and have the potential to reduce the world's dependence on fossil fuels¹⁴ through the production and use of renewable energy. "These facilities can recover a lot of resources for the development of valuable biobased wastewater products," he pointed out. As an example, he mentioned some indices regarding the recovery of water,

energy, nitrogen, phosphorus and others.

In the next stages of the project, new data will be collected and expanded to the Canadian water facilities as well. The WEF is considering targets for concessionaires to increase resource recovery. According to him, fresh water is a valuable and necessary resource for all living beings and, therefore, must be managed with care. Installations can produce water of different qualities suitable for a variety of uses, such as indirect and direct potable reuse, land subsidy, groundwater replenishment, irrigation, habitat for aquatic life, among others. With regard to other non-potable uses, he spoke of the cooling tower for boiler feed.

He also mentioned that phosphorus is a renewable resource in limited quantity needed for life. Facilities in the United States can recover phosphorus producing a range of valuable products in a more sustainable way compared to mining phosphate. Phosphorus recovery options include recovering struvite¹⁵ and other phosphate minerals for fertilizer production while reducing the formation of struvite in pipes. "Phosphorus can also be extracted from incinerator ashes and used as fertilizer." The speaker also mentioned carbon, which can be used in many ways, such as biogas production, biofuels (such as compressed natural gas) and biological oil. "The role of the WEF in the United States is to set these goals and connect with numbers to see what is being done to make progress." He highlighted the importance of the entity's work together with governments, the private sector, society and other professionals in the water area.

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¹⁴ According to the Intergovernmental Panel on Climate Change (IPCC) report, published in 2022, there is an urgency to reduce fossil fuels. "The research made terrestrial measurements of concentrations of pollutants that derive from the burning of fossil fuels: nitrogen dioxide (NO2), a common urban pollutant, and fine particulate matter, with particles with diameters of $10 \ \mu m$ (PM10) or $2.5 \ \mu m$ (PM2.5) or less. The particulate matter reaches the blood stream and causes cardiovascular, cerebrovascular (stroke) and respiratory impacts. Nitrogen dioxide is associated with respiratory diseases, particularly asthma" (GAMA, 2022-a).

¹⁵ Formed by the reaction of magnesium, ammonium and phosphate, producing a crystalline solid (MgNH4PO4.6H2O). From this formation, crystals appear normally seen in incrustations that are difficult to remove in tubes, pumps, heat exchangers and centrifuges. For the formation of struvite, there must be three key factors: the presence of magnesium phosphate and ammonia in a 1: 1: 1 molar ratio, pH greater than 7.5 (optimal range, 7.5 and 9) and temperature between 10-40°C. Its control can occur by interrupting the proportions of phosphate, ammonium and magnesium, as well as tending to have results in the harvesting or management process, promoting the formation of struvite crystals in a controlled manner. "Struvite can be an unwanted, expensive and difficult to control product in an AD process, but it can also be managed, controlled and leveraged to produce a commercially viable product" (PROBLEMAS..., 2021).

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Irene Claudette Marta
Carniatto Hahn
Unioeste Fundação Florestal

PANEL: RURAL SUSTAINABILITY UNIOESTE AND ATLANTIC FOREST CONNECTION PROJECT CASES

Speakers:

Biol. Irene Carniatto - Unioeste¹ Eng. Claudette Marta Hahn - Florestal Foundation²

Coordinator:

Biol. Maria Fernanda Romanelli - SIMA³

Evaluator:

Eng. Sonia Nogueira - AESabesp⁴

Brazil is renowned worldwide for its agribusiness⁵, especially for its harvests that break records every year. They are reasons for celebration regarding the economy, but not everything is rosy when it comes to the environmental issue. With profit in mind or due to the lack of knowledge by rural producers, options that do not follow good sustainable practices end up being adopted. For those reasons, the 32nd AESabesp Technical Meeting organized the Rural Sustainability – Unioeste and Atlantic Forest Project Cases panel. According to the Biologist Maria Fernanda Romanelli, this panel would present "different cases of implementation of actions toward sustainable development, conservation of natural resources – including water –, water security, biodiversity and environment conservation, and also social environmental actions carried out in micro watersheds, improving its population's quality of life."

At the beginning of Biologist Irene Carniatto's lecture, she presented the case led by Unioeste, an university located in the city of Cascavel, in the Western region of the state of Paraná. "When we talk of environment, we talk of life. All that happens

in the environment is a reflection of our actions. I start the presentations with the smile of my grandchildren because it is looking at them that I think about what planet we will leave for them, which will be our legacy. Environmental education, climate emergency, citizenship, sustainable, SDG... What are we doing as we face all that?" she questioned. Currently, the humankind has been going beyond all Earth's limits6, using its resources faster than the plant can absorb impacts and regenerate. Some alarming aspects on that issue have been seen lately, such as: an increase in atmospheric CO² concentration, which is one of the gases responsible for global warming; biodiversity loss; nitrogen pollution due to the excessive use of fertilizers; fresh water shortage; impacts on the phosphorus cycle affecting rocks, giving rise to leaching and consequently to the contamination of superficial waters; acidification of the oceans; expansion of the ozone hole; aerosol pollution; chemical pollution; among others. According to this speaker, this crisis is social environmental, since nothing in nature can be preserved separately; it must be carried out jointly.

"Education is necessary but it must be comprehensive so that it be not only environmental but also for the environment, in the environment and on the environment. All of this must give rise to a new way of seeing, living, facing, being and engaging with the world, with living and non-living beings," Irene pointed out, stressing that views on global issues must change. We are experiencing this environmental crisis due to our mechanistic, reductionistic, short-sighted, accumulative, greedy, economic view of this process, toward infinite growth and unlimited production. However, it must be highlight that

¹ Western Paraná State University.

² Foundation for the Conservation and Forestry Production of the State of São Paulo. It is intended for the conservation, management and expansion of production forests and state Conservation Units.

³ Secretariat of Infrastructure and Environment of the State of São Paulo

⁴ Sabesp's Engineers Association.

⁵ According to an estimate, agribusiness accounts for 25% of the Brazilian GDP and its potential exportations. An estimate by the UN for Food and Agriculture predicts that Brazil may become the greatest producer of food on Earth in 2025 (ASPPIBRA, 2022).

⁶ According to the NGO Global Footprint Netwoork, in a year, we consume the resources that Earth can produce in seven months. That is, for five months, we consume over supply (UOL, 2020).

our planet is finite and limited. So it is unfeasible to think this way. Otherwise, we will come to an end. It is necessary to substitute quantitative paradigms for qualitative ones, since "progress" in the late 150 years has taken us to a situation in which our planet cannot absorb human production.

That speaker exemplified: "As Leonardo Boff well said, 'What is sustainable is society, not development.' If society and education are sustainable, all that is within the planet, including development, will be sustainable, and this must be our quest." She presented a research conducted at the Paraná 3 Watershed, a watershed that spreads through the municipality of Cascavel, stressing that there is no life without water. The program Cultivando Água Boa was created in order to serve that region, conducting 21 programs, with 63 actions, 2,146 partners to serve an area of 8,000 km², with more than 1 million people, over 29 municipalities, recovering 70 micro watersheds. "All those actions featured Binational Itaipu, which devised, organized and coordinated them, as the university provided the education and execution of each step of the project," she said. An integrated management of the micro watersheds was conducted with the purpose of reducing the amount of sediments at the Itaipu reservoir, seeking to keep water within acceptable parameters for energy generation and other purposes. It has also been developed in partnership with research and extension institutions and with municipal governments since 1989, but with an actual financial participation since 1995, as municipal governments shared the costs.

for the dissemination of conservationist technologies, such as road adaptation, soil conservation, community water supply systems, rural sanitation, high-quality direct planting, alternative cultures, organic agriculture, among other measures, all permeated by a strong education for the benefit of the environment. Adapting roads, for example, caused sediments not to go directly to rivers and streams, and it also caused rain water to spread through the contour lines of agricultural terrains, preventing water from eroding the ground. About 1,250 roads were adapted by the program. It managed to recover the local riparian forest, through information and education for owners of lands nearby the reservoir. Currently, the vegetation strip protects over 98% of the Itaipu reservoir, and the landowners are aware of the importance of the vegetation, which also surrounds and increases the value of their lands. "This engendered a huge change, since water began to run again through where it could not anymore," the biologist asserted. Moreover, there arose the Santa Maria Biodiversity Corridor, a link between the reservoir's riparian forests and other protected areas, with almost 200,000 hectares.

Regarding Rural Sanitation, in this region, community water supply systems were created, preventing tractors loaded with agrochemicals from going to rivers and streams to collect water. That made it impossible to contaminate this precious liquid with that waste. 520 units were established in 16 municipalities with water supply systems. Other actions were:

package recycling, especially for agrochemicals' packages; the establishment of biodigesters for swine and cattle manure; epidemiological surveillance, as a support for the research of the incidence of vectors and campaigns to fight transmitters of environmental diseases such as malaria, dengue, vellow fever and others; high-quality direct planting, without burning and along the contour lines of the soil; alternative crops, creating alternative, ecologically correct financial solutions, adding value to rural lands; organic agriculture, with almost 900 agricultural workers making and organic production or transition toward it. "All of this is possible only with a lot of environmental education, with more than 135,000 impacted people and 18,400 protagonists per year, developing managers in each municipality," she asserted.

This speaker pointed out that the program divides education in four pillars: environmental education; corporate environmental education, by which engineers and collaborators at Itaipu should know which is their role and the importance of their achievements; educommunication; and environmental education in places such as the Ecomuseum and the Museo Itaipu – Tierra Guarani. They have support to take environmental managers to take part in the main environmental events and forums, such as the participation in the World Water Forum, held in Brasília, in 2018, to act at Rio+20, and also to take part in the yearly event Cultivando Água, in which results were presented and every one learned with each other. Finally, all knowledge must not remain private, according with the speaker. All data and actions of the program are shared with According to Carniatto, some subprograms were devised International Climate Resilience Research Network (RIPERC), compose of 13 countries (United Kingdom, Paraguay, Argentina, Guatemala, Chile, Mexico, Spain, Italy, Angola, Cuba, Bolivia, Ghana and Brazil).

> The Engineer Claudette Marta Hahn, leading the project, brought some elements to present the case. The reported that the program uses US\$ 31 million from the Global Environment Fund, and US\$ 17 million are employed in the state of São Paulo. Besides, co-funding resources are provided by the Government of São Paulo. It is also developed by the Ministry of Science and Technology, and it involves the governments of Minas Gerais and Rio de Janeiro, and the Foundation for Scientific and Technological Enterprises (Finatec) as the financial executor of the project. In São Paulo, SIMA and the Florestal Foundation act as co-participants. "The goal of the project is to foster ecosystemic climate and biodiversity services, consequently related to water resources and the Southern Atlantic Forest Corridor, at the Paraíba do Sul River Watershed, working with several tools such as: Payment for Environmental Services (PSA), support to certification and sustainable value chains, and management improvement for Conservation Units (CUs)," she explained.

The project is founded on three components: 1) Strengthen the institutional capacity for management and monitoring of carbon stocks and biodiversity; 2) Increase the carbon stocks at the Watersheds of the Paraíba do Sul River, in the state of São Paulo; and 3) Increase the CUs' efficiency and financial sustainability along the Serra do Mar Corridor, focusing on the increase of biodiversity and the promotion of economic sustainable activities in their Buffer Zones. In this action, the target audience are the agricultural workers of that region that work in São Paulo, Minas Gerais and Rio de Janeiro, and it is composed of: 72% male and 28% female; 2% up to 30 years old, 33% from 31 to 50 years, 42% from 51 to 70 years and 23% over 70 years; 1% have no school degree, 16% have an elementary school degree, 31% have a high school degree and 52% have an university degree; only 28% had Technical Assistance and Rural Extension (ATER) before the project, while 70% did not have it and 2% did not know how to answer; 51% of the real estate have up to 1 fiscal module, while 34% have from 1 to 4 fiscal modules, and 15% have more than 4 modules.

According to Hahn, a short-term PSA strategy causes changes on the use of soil for toward more sustainable practices. "Producers begin to look at real estate as a whole, not only areas in need for adaptation, and they get support for adaptation of the whole property," she pointed out. The program offers incentives for the conservation of the native vegetation, the restoration of Permanent Preservation Areas (PPAs) and the improvement of productive systems such as: recovery and management of degraded pastures, Silvopastoral System (SSP)7, agroecological or organic farming, agroforestry systems and native multifunctional forests for exploration. Another point to be highlighted is the adoption of conservationist practices, such as soil conservation, composting, sanitation, native or non-native stingless bee farming, rain water reuse, among others.

She showed that the program offers support to the Technical Certification (CERT), making it easier to achieve labels offered to different goods and markets, increasing the added value on a product and opening doors to other markets. Among them, there are: forest labels, such as Forest Stewardship Council (FSC) and the Brazilian Certification Program (CERFLOR); sustainability labels, such as Rainforest Alliance; organic labels, with Certification by Third-Party Audits, such as Participatory Guarantee System (SPG), Social Control Organism (OCS); agroecological labels, such as the Agroecological Transition Protocol, established by SIMA, besides other structures as civil society organizations.

Hahn also showed that there is an incentive to support Sustainable Value Chains (SVCs), in which productive chains of species from the Atlantic Forest such as fruit and native bees develop, and to Agroforestry Systems and multifunctional native forests for exploration of wood and others. "All of this, without causing pressure on the Atlantic Forest, which is already

important to us, and reducing the pressure on the remainder," the speaker said. Besides all that work, they act on the recovery and management of degraded pastures, Silvopastoral Systems and agroecological or organic farming in each land that the program supports. The adoption of good sustainable practices is applied to show producers that all of this will increase their benefits, that their activities will be integrated and that their production will have more added values, thus bringing higher financial returns. So the program will act so that access to the market expands.

By June, 2021, the program, on its Component 2, already had 642 PSA agreements signed by producers, amounting to about 13.4 thousand hectares under agreements and 35 thousand linear meters of fence established to protect water springs and water courses. So the sum of R\$ 8,565,794.94 was directly paid to producers under manifold PSA agreements. On Component 3, there were 157 CERT agreements, with 67 already certified goods, in 1,589 hectares; 197 SVC agreements, 1,720 hectares; and 253 PSA agreements, with 7,549 conserved hectares. With 613 agreements in that module, the producers directly received R\$ 6,894,360.27. "It must be highlighted that this causes and impact on the municipality itself. Those producers hire services, acquire inputs, make purchases, for example, and there is also a huge team of extensions in those places. Those are people that go live there, rent a place, have a routine in that city, and move the local economy forward," she asserted.

Hahn highlighted that an advantage of having a project that acts with international resources is that it opens the possibility of testing different things which may become public policies if they succeed. So a series of innovations became feasible, such as: the selection of environmental services providers through a reverse auction, in which services for the lowest price with the best environmental response were selected; guidelines related to the human-wildlife coexistence, the relation between rural producers, their crop and livestock considered as an important point for the coexistence with the wildlife, with no conflict; payments for environmental services related to productive activities, not considering only the area of conservation or restoration but also productive activities that may also generate more environmental services; a partnership with private companies in order to foster the planting of macaúba in consortium with pasture activities; an incentive to the economic exploration of native species, with income generation for the producer; georeferenced monitoring systems for this and for future PSA projects; action in Conservation Units' Buffer Zones, seeing beyond the CU and moving toward what is on the surrounding, making the management of the CU easier; management efficiency assessment of CUs through the Management Tracking Tool (METT⁸); Certification of native

⁷ It is the intentional combination of trees, pasture and cattle in the same area at the same time. They are managed in an integrated way in order to increase the productivity per area unit, with interactions in every senses and in different magnitudes (EMBRAPA, 2004).

⁸ Tool for management efficiency assessment in Conservation Units (WWF, n.d.).

forests for the conservation of the Atlantic Forest; Agroecological Certification, that some municipalities already integrated to their public policies, providing a special payment to those who have this certification; establishment of Municipal Monitoring Services (SIM) for animal products and incentive to the municipalities that carry out that service, seeking to enter new markets; and participation in the Food Acquisition Program (PAA) and in the Brazilian School Feeding Program (PNAE) in the small municipalities.

Finally, the speaker highlighted the work of people in the front line, since none of this would be possible without them: a work that spreads through collective efforts by rural producers, environmental education, workshops offered for such producers which are filmed and made available for those that do not belong to that family of producers, raising awareness for the procedures within their field of action, dissemination of information, community involvement, among other kinds of actions.

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Kan

Wakabayashi



Pablo

Fernandez ns no Brasil



Marcel

Kater

PANEL:

NEW TECHNOLOGIES PUT TO THE SERVICE OF **SANITATION**

Moderator:

Eng. Kan Wakabayashi - Consultant

Speakers:

Eng. Marcel Kater - Kater Cursos Eng. Pablo Garcia Fernández - Siemens Brazil

Coordinators:

Journal. Ana Paula Rogers - AESabesp¹ Eng. Olavo Alberto Prates Sachs - Sabesp²

Evaluator:

Journal. Ana Paula Rogers - AESabesp

As in many other sectors of society, the employment of new technologies in the sector of sanitation has been promoting meaningful advances. Issues such as cost reduction, optimization of processes and initiatives that benefit the environment are currently on the radar of new technologies. Through the employment of such modern tools, it is possible to ensure that resources reach users of sanitation services with higher quality, for example. Moreover, technology contributes for the identification of damages and threats through quantifying and monitoring programs, among other advantages. In order to address this theme, the panel New Technologies Put to the Service of Sanitation was organized for the 32nd AESabesp Technical Meeting, with the purpose of discussing new technologies that enable sanitation services

to be properly quantified and monitored. This panel addressed how technologies have been contributing for advances on services and their complex systems, and how those tools have been absorbed by the sanitation sector in Brazil and their results.

The Engineer Pablo Garcia Fernández began his lecture talking about the challenges that the sanitation sector faces in Brazil and abroad. According to him, nowadays one of the main concerns in companies that work in this field is guaranteeing the supply of high-quality services. Likewise, an ongoing effort is made to make processes more efficient and to meet all existing regulations. According to the speaker, the answer to that is in new technologies and their potential to answer questions such as fragmentation³. In a highly scattered sector, whose assets are spread throughout all Brazilian regions, how is it possible to help sanitation companies to be more transparent and make a better management of their assets? For professionals, there are technologies for that purpose. "With the arrival of new technologies, there is also a matter of internal barriers, mindset change, so that they are adopted as soon as possible within companies," he stressed.

Fernández asserted that digitalization⁴ is one of the current technological tools that help sanitation companies to make their operations increasingly more efficient. He mentioned as an example that there is a platform called Siemens Water (SIWA) and that within it many software solutions (applications) were

¹ Sabesp' Engineers Association.

² Sanitation Company of the State of São Paulo

Currently, automation in Brazil is unequal. After all, we cannot talk of applying those new technologies in a scenario in which basic infrastructure must be expanded in Brazil. "There are regions whose sanitation is outdated in 30 years, where there is almost no automation, and others that apply new systems in 100% of their construction," Jeyson Berland, director of Infinium Automação Industrial, asserted, in an interview to Revista TAE (RUBIM, 2021).

According to Sergio Jacobson, CEO of the Smart Infrastructure sector at Siemens, digitalizing water and sewage systems enables profits through all the life cycle of the installations, "such as reduction of project length of up to 20% and of commissioning of up to 15%, reduction of maintenance costs of up to 10%. This integration engenders benefits not only on the execution but also on the operation and maintenance of all the water and sewage system" (JACOBSEN, 2021).

created. They are cloud-based, with the purpose of acting through all the network, on the withdrawal, on the water transportation network, on lift stations, on the water distribution network, on the sewage collection network and on sewage treatment stations. Those solutions use technologies such as Artificial Intelligence (AI), that are helpful for the identification of the best way of operating pumps in lift stations, for example, in order to ensure a continuous provision, crossing data from reservoirs, treatment stations and even from energy bills⁵ (so that those bombs do not work during peak hours, causing the operation to be more efficient and reducing costs). Another solution resulting from digitalization are solutions that act on the identification of leaks and ruptures, that may be helpful to control transportation and water distribution networks. He highlighted that all possibilities of digitalization may only be applied through the proper sensing of the network. Likewise, there are solutions for sewage networks.

Another point mentioned by the speaker, and which is crucial for sanitation, is the reduction of water loss. According to him, in this topic, Artificial Intelligence may be used, giving important results for the fight against water loss. "AI, for example, will help operators to understand the network's behavior so that they identify through sensing where a rupture occurred and also make an analysis that predicts possible problems that may cause such a damage," he explained. A new technology also related to losses is the 5G network. According

to him all the data processing and speed capacity of this new network has a huge potential to contribute with sanitation, even regarding automation technologies already employed in this sector. "Automation standardization is something we work a lot with clients of this sector, through the application of telecontrol solutions, Internet of Things (IoT), so that all equipment is connected and operators may work with increasingly higher efficiency at managing all their assets," he remarked.

According to Fernández, the current hot topic is the energy bill issue. Companies are increasingly seeking solutions the enable a more efficient operation regarding energy consumption, with technological possibilities that go from operation of pumps in lift stations to the employment of new energy sources. "The sanitation sector has been searching for solutions for making it self-sufficient energy-wise. Nowadays, there are solar solutions8, and many companies are actually conducting research for the application of solar panels on watersheds," he stated. Moreover, many companies are seeking solutions through the use of solid waste generated by sewage treatment. Sludge, for example, has a high calorific value that may generate biogas to move turbines. The speaker also said that the junction between the virtual environment and the real environment (with the creation of what he called a digital twin) is increasingly closer⁹. In this scenario, companies will be able to foresee and study problems in the virtual environment, preparing their teams for faster resolutions. Another benefit pointed out by him is the creation

⁵ Data from a Diagnosis by the Brazilian Sanitation Information System (SNIS), from 2018, point out that the costs for the electric power spent in water withdrawal and pumping often amount to half the total costs for the service, and sometimes it amounts to 75%. In smaller communities, its lower efficiency and consequently higher cost is due to some factors such as the need to reach isolated communities, service management conducted by agents who sometimes do not have the necessary knowledge for the optimization of technical and economic factors, among other things. "According to the same diagnosis by SNIS from 2018, 75 out of 114 municipalities in Rio Grande do Sul with water services managed by municipal public managements present null macro-measurement indices, that is, they do not have hydrometers to measure and determine water production" (FINK, 2020).

⁶ Data from the Trata Brasil Institute pointed out that in 2019, water loss amounted to 40% of drinking water. It could supply water for 63 million people. According to that research, Brazil is highly inefficient to distribute drinking water to its cities. "Almost 40% (39.2%) of all withdrawn drinking water do not officially reach residences in Brazil, which amounts to 7.5 Olympic swimming pools of treated water wasted every day or seven times the volume of the Cantareira System – the largest group of reservoirs to supply the State of São Paulo" (TRATA BRASIL, 2020).

⁷ The 5G technology, the fifth generation of mobile internet, enables the interconnection of equipment and devices, enabling the development of the so-called Internet of Things (IoT). "A device with 5G will enable a faster processing of downloads and uploads, a faster transfer of data per second and an economy of up to 90% in the power consumption of a device" (TECNOLOGIA..., n.d.).

⁸ Engineers from the Stanford University in the United States developed a new kind of solar panel that can produce energy during the night. Many panels already function at night but they do not produce energy. Instead, they only use what has already been stored. According to them, when the panels are not producing energy, they release heat to the atmosphere. This process causes the panels' temperature to stay lower than the air temperature, thus generating electric power. With the help of a thermoelectric, currents resulting from the temperature difference between the panel and the environment are produce. The generated energy still do not compare to what is produced during the day but research are still being conducted in order to optimize that process (ASSEF, 2022).

⁹ Real-time virtual representations of goals, processes and systems, working as link between the physical and digital domains. These virtual clones from physical operations can help organizations with many processes, such as the predictive maintenance and the creation of an insight environment for decisions on capital purchases. "They can also help organizations to simulate scenarios that would be too lengthy or expensive to be tested with physical assets, create far-reaching business plans, identify new inventions and improve processes." Currently, there are twins for different fields of application: component twins/parts twins, which represent physical, mechanical and/or electrical characteristics of a component or part; asset twins, with two components working together; system or unit twins reflect the interaction between assets and compose a system or unit; and process twins, relate to the verification of how systems work, their processes (OLAVSRUD, 2022).

of training platforms, reflecting 100% of the real world upon the virtual, making capacitation faster and more efficient.

The Engineer Marcel Kater, in his initial speech, presented new technologies used in civil engineering on the BIM process¹⁰, such as drones, scanners, cameras, AI and ultrasound. Regarding drones, he presented the facilities offered by such technologies for monitoring; for embedded technologies such as cameras, sensors, laser scanners, etc.; for modelling; and simultaneously to integrate them with BIM's best practices. In civil construction, drones are very useful to monitor construction, to generate models and to measure fissures. It is possible for example to pass a drone on a work of art, to film and identify a fissure, to amplify through AI and measure the width of the fissures," he explained. He also mentioned the use of drones to map pathologies in a façade. Moreover, technology can help to detect infiltration, mortar and ceramic detachment, and other problems through thermal cameras; it can also identify gas leaks in a chemical plant; and monitor the behavior JACOBSEN, Sergio. Água e a necessidade em adotar of crops, whether they're devastated or growing.

This speaker also talked about the potential of laser scanners, which can generate about two million points per second and be used, among other things, to develop the so-called digital twins. Regarding ultrasound, Kater says it is a tool of the utmost importance for civil construction, as it is used to check steel bars on concrete, oxidation, diameter and spacing. According to him, the combination of ultrasound and AI is really useful. Another equipment that is used is the georadar, which reaches about 10 meters deep, helping to identify a location and ensure the safety of gas, water or sewage pipes in excavations; AI cameras that identify faces and temperature. "The equipment reaches a precision from 50% to 60% with a mask." Kater related BIM to the technologies that were presented and remarked that drones, scanners, cameras and ultrasounds are not properly integrated with BIM, and two different types of files are generated (e.g. LAS, STEP, RCP, TIFF and JPG). According to him, it is necessary to take those data to a BIM Platform so that a BIM file (IFC extension) may be generated from it. In an environment to be analyzed, it is possible to use the ultrasound, determining the position of the armor; scan the

structural elements; and capture the cloud of points along with the ultrasound information, generating a detailed model of the structure, turning it into an editable file on the BIM Platform.

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¹⁰ The BIM Process is a modelling technology associated with a set of processes intended for production, communication and analysis of building models. "The use of the BIM Process will enable us to act throughout all the building chain, covering all the life cycle of a building, from the project to the planning, execution and facilities; due to rich visuals with much more accurate information generated from an intelligent 3D modelling. All that information will generate an unique data bank composed of the 3D model, with properties that will define its components, materials and specific characteristics" (PROCESSO..., 2020).





Nercy Donini Bonato



Adriano Cortez dos Santos



Dirlene Palma
Gomes

Sabes

PANEL: ENGINEERING AS A TOOL OF SOCIAL TRANSFORMATION FOR UNIVERSALIZATION

Moderator:

Eng. Nercy Donini Bonato - Sabesp¹

Speakers:

Eng. Adriano Cortez dos Santos - Sabesp Eng. Dirlene Palma Gomes - Sabesp

Coordinator:

Eng. Abiatar Oliveira - Sabesp

Evaluator:

Eng. Nélson César Menetti - AESabesp²

The New Legal Framework for Sanitation³ posed a big challenge for basic sanitation companies in Brazil. Its goal is providing 99% of the Brazilian population with access to drinking water by 2033, and enable 90% to have access to sewage treatment. This is a big challenge for engineers, provided that millions of people live in irregular occupations located in urban areas which demand sewage treatment, requiring engineering solutions that go beyond the traditional ones. At 32nd AESabesp Technical Meeting, the panel Engineering as a Tool of Social Transformation for Universalization was organized in order to address this issue, with the purpose of discussing some cases and solutions for such a sensitive issue for a great part of the population. The panel moderator, Engineer Nercy Donini Bonato, stressed in her presentation that engineering cannot be stuck with paradigms so that universalization is reached in Brazil. She also pointed out that engineering must engineer solutions, warning about the need for a different point of view so that the New Legal Framework for Sanitation's goals are achieved.

The Engineer Adriano Cortez dos Santos presented in his speech a brief history of the Pinheiros river and how urbanization emerged around it. This river, just like others that cut across the landscape of São Paulo, began to be integrated with the city from the 1900s to the 1930s, much due to the Italian and Japanese immigration. In 1943, energy production became a priority and the river course was reversed due to the Traição Plant, built three years before. Throughout that period, the Pinheiros river underwent a straightening process, ceasing to be sinuous. From 1950 to 1970, besides the end of the straightening process, the focus on the surroundings of the river was mobility. The former branches of the river were plotted, and the waterfronts and the railway were inaugurated. From 1970 to 1980, there was a meaningful increase in the industrial activities of São Paulo. Consequently, there was an intense migration toward São Paulo of people in search of opportunities, which also increased the irregular occupations - including around the river. From 1989 on, the Constitution of São Paulo forbid the reversion of the river, except in case of floods. In 2019, the program Novo Rio Pinheiros⁴ began, with the purpose of depolluting the river by 2022.

Data from the Brazilian Institute of Geography and Statistics (IBGE) show that there was a boom in the number of people living in irregularly occupied areas in São Paulo. In 1980, 335,344 people lived in those areas. However, these numbers more than doubled in the following years. In 1991, there were 711,032 people and in 1996, this number leaped to 747,322. This amounted to something between 4% and 7% of the population of São Paulo. "These are places that do not have infrastructures, since precarious constructions were made, with many people living in contact with sewage, for example," the speaker stated.

¹ Sanitation Company of the State of São Paulo.

² Sabesp's Engineers Association.

³ With the purpose of achieving universalization, the New Legal Framework for Sanitation intends to structure an environment of legal security, competitiveness and sustainability in order to attract private investments for the universalization and qualification of sanitation services. Resources of up to R\$ 700 billion from the public and private sectors are estimated for achieving these goals in 2033 (NOVO..., 2020).

⁴ By May 16 2022, this program had already connected 593,807 residences to the sewage network, and by March 22 2022, it had already collected 68,525.39 tons of garbage.

Some of the challenges for sanitation universalization in our current reality lie in cities' fringes, in places far from urbanization and important for the ecosystem, with available natural resources. Occupations whose valley bottom is occupied are very common in those parts, and they make it difficult to establish an ideal sewage system there. In those places, bodies of water contain a lot of garbage and rubble, and there are estates over such bodies of water, which are often not even visible. "How can we sanitize those hardly accessible areas? The answer to this question is worth R\$ 1 million," the engineer said, before presenting some necessary steps for the universalization of those areas. It is necessary to have a diagnosis for the selected area to: remove all known discharges. proposing actions so that the sewage does not reach streams or tunnels; perform scans to identify unknown discharges such as a spillway in order to understand if there is any sewage leak; identification and solution of critical sections, view all places where there are complaints about recurring obstruction; and identification of points of household connections, that is, the internal hydraulic part of a estate.

PI-34, the watershed on Pinheiro river's right bank, was chosen to present this case. The mass balance of the sanitary sewage system was groundbreakingly created. This is a flow chart that will show the condition of each existing water and sewage connection in this watershed. There are currently 59,655 active water economies that generate about 296.44 liters of sewage per second. 50,093 economies out of these, producing 255.90 L/s are collected (amounting to 84%); and 9,562 economies out of these, that produce 40.71 L/s (16%), are not collected. Among those that are not collected, there three groups of economies: Potential, those that do not have network infrastructure; Feasible, those that may be connected to the network at the same time; and Unfeasible, those whose houses are usually below the street level, which does not enable a conventional connection. Regarding PI-34, within the Potential category, there are 3,033 economies (32%), which generate 14.2 L/s. In the Feasible group, there are 44 economies (0.5%), that produce 0.15 L/s; while 6,485 economies (67.5%), that produce 26.36 L/s, are part of the Unfeasible group.

Within the Potential and the Unfeasible groups, there also two other subgroups: Recoverable, which shows which estates are more likely to be reconnected to the network; and Challenge, within which there are obstacles to be overcome. For both groups (Potential and Unfeasible), the Recoverable group rate amounts respectively to 84% and 15%. Regarding statistics of collected sewage, 75% of these are treated in ideal conditions, while 25% are among the ones that are not treated. Those are also analyzed in order to find out whether it is necessary to make an interconnection, as it is seen in 91% of these cases, or a structuring work, ideal for other 9%. The goal is to

direct 15,868 economies for treatment, in face of the 21,868 residences with no collection nor treatment, so that sanitation is universalized in this example.

How is sanitation universalization possible in this area? Hiring for performance, whose payment will be linked to goals, according to the purpose of directing economies for treatment and reducing the Biochemical Oxygen Demand (BOD). Conventional hiring pays a single price with the purpose of having works executed, not directing sewage for treatment. "Resorting to this kind of hiring is groundbreaking, since the goal of the hired party becomes the same goal of hiring party," explained Santos. The first thing to think about the performance agreement is the concept of total solution, including in the agreement all necessary actions to direct sewage for treatment. From the sewage generation up to its treatment, Sabesp will conduct an action so that this becomes feasible. For these agreements, some particularities may be seen: a strong social environmental action, from the adhesion of the connections up to workshops that will be conducted; establishment of common connections and household connections; and employment of alternative solutions, such as networks on valley bottoms and on river sides.

At Sabesp, there exists BOD's Ruler to measure the quality of the stream water. Within that measure, Class 1 with up to 3 mg/L, in which the natural condition is considered, that enables people's primary contact and greenery watering; Class 2, with up to 5 mg/L, considered to be in good conditions and, although it is not recommended for primary contact, neither for greenery watering, enables the existence of fish, animals' thirst-quenching and may receive a conventional water treatment; Class 3 with up to 10 mg/L, when it shows good conditions, a good aesthetic aspect, enables the existence of fish, does not emit odors and may receive a conventional water treatment. At the end of the Sewage Treatment Station (ETE) in the Metropolitan Region of São Paulo (RMSP), with up to 30 mg/L, it shows still good aesthetic conditions but with restrictions to the existence of fish, emits odors in certain times of the year - dry summers, mostly - and has its water treated with a high consumption of chemical products; and maximum legal Limit at ETE's end, 60 mg/L, means it is polluted, without any aquatic life, emitting bad odors. During the BOD measuring by Sabesp, if there is any anomaly in the streams, that are daily evaluated, the sewage team is called to verify if there is no sewage leak moving toward the stream.

A performance agreement has a few steps: The 1st phase is the Establishment of a Minimum Scope, with the starting date of the work performance and the payment only if 30% of the goal of the economies sent for treatment is reach, as a kind of an advance payment; the 2nd phase if the Performance

Check, when the minimum scope must be fully performed and the goal of the economies sent for treatment must be achieved, and the variable payment must be paid in accordance with the performance and the BOD; and the 3rd phase is the Fixed Payment, which depends on the average performance during the previous phase. "A performance agreement helps with the pace of the results for universalization, employment of alternative solutions, increase in customer satisfaction, income generation for local populations by hiring local dwellers, quality of life for the population and the ecosystems, decrease of waterborne diseases, good aspect for stream waters and return of aquatic life," Santos concluded.

The Engineer Dirlene Palma Gomes, in her turn, brought a case from the Southern Business Unit, that is also located in a vulnerable area. She contextualized her lecture and reminded that a good part of the population that migrated to São Paulo in the 1970s and in the 1980s in search of opportunities sought distant lands in the city, much due to the fact that they were cheaper. However, they were far away from the infrastructure of São Paulo then, and the constructions made by those new dwellers were poorly built, as Santos mentioned. "Throughout time, this issue worsened even more and the population density sewage system, through a participative, inclusive management became even higher in those areas. This is the portrait of many cities in Brazil⁵," she remarked.

According to Gomes, a sanitary sewage project must overcome a few points: irregular, narrow streets; the occupation of valley bottoms, a place where collectors must be established; the declivity of the terrain for the transportation of effluents, which must be sent for treatment; and the deadline defined by the New Legal Framework for Sanitation. The deficit in São Paulo and other big cities lies in irregular areas. A different view for that question is necessary, as classic engineering solutions do not adapt to this environment. It is unthinkable to remove those dwellings from the places they are right now," she spoke.

According to the speaker, the PDCL⁶ model (Plan, Do, Check and Learning) for universalization in five steps in order to achieve the goals: diagnosis, performance, communication, action and learning. The diagnosis, that must be thorough, features field survey, data bank analysis, and adaptation of projects and construction planning. In the performance case, it ensures a fast pace and adherence to the goal, as had already been explained by Santos too. "Communication is a complex

step. It is not about what you say but how people understand. So the message must be properly conveyed," Gomes stressed. In this topic, there are some steps such as: choosing the target audience, identifying who are the actors within that area, including subprefecture, health agents, community leaders, the population, etc.; establishing a common goal for all those participants; electing which communication tools will be employed for each audience, which has its own specific characteristics, so that thus feedback may be received, which ensures that the message is being properly delivered.

"The main agents are Sabesp and the Consortium but there are many other characters that interact with each other. It is not a pyramidal communication but a network one. So we need to identify each agent within this community. This communication part is essential so that there is transparency and adherence by those people at performing services and trusting what has been announced, she concluded. A social environmental team, a tool provided in the performance agreement, is used so that communication is efficient. It is formed in a multidisciplinary way, also including people from the community responsible for planning and developing actions for the universalization of the conducted by the population and stakeholders.

The speaker pointed out that it is necessary to pay much attention to the stakeholders' demands. Health agents want to reduce waterborne diseases, while the subprefecture wants to improve the access to infrastructure, and the community leaders want improvements for the neighborhood and citizenship. "Holding meetings with those stakeholders in order to talk about the project is important. As all those agents are mobilized, we can go to people's houses to talk, answering every question and establishing a channel of accountability and trust." Social media and WhatsApp are important tools for communication with those people and also for feedback from monitoring those participants in real time.

The action begins after these three first steps but it is based on what was defined in the diagnosis, which shows the tactical plan for action – from how to transport materials to how what was excavated must be extracted out of the community. For example, even before network settling works in the bottom of the valley began, a team cleaned all the stream bank so that the water course were not strangled. Later, another team settled

⁵ Currently, the Brazilian population that live in favelas amounts to about 109 million (CHADE, 2020), while the total Brazilian population amounts to 206,081,432 people (RIBEIRO, n.d.).

⁶ The method used to feed the system/project with new learning, aiming at continuous improvement. The previous experience is always used for new planning, based on the acquired knowledge. Continuous learning is PDCL's main goal. So the previous experience is always used as a basis for new planning, which engenders organizational growth through the knowledge that was produces, stores and applied again (PROVALORE, n.d.).

the networks, each on each bank side, following the declivity of the place and able to collect all estate. "Thus, each estate has its individual connection, later, to ensure operationality and provide its maintenance. All the effort to raise awareness for the network use was also conducted so that the connection was individual," the speaker said. In each part, there is an adaptation to the local reality. There are squares where houses were built above the streams and the sewage went directly to them. So the works had to prevent the sewage from going directly to that stream. At the end of the works, the network is wrapped in concrete in order to ensure its operationality for many years. "The care for detail is everywhere in the project. We must pay attention to all details. They make every difference," she said.

Being able to enter the estates is important for a greater efficiency on actions for universalization in those areas. So it is necessary to separate rain water effluents. This low-income population has no financial viability for that kind of work and this separation makes all difference for the network sizing on the stream banks. "As each connection matters, we have often had to urbanize alleys again to be able to conduct the work. While constructions were standardized in the community, on the surroundings, the traditional works continued."

Learning is the ultimate step for the performance but it is continuous. In the presented case, the speaker showed that more monitoring and control were necessary. Operations must be conducted every day, basically solving situations on the same day. As there may be unusual issues, other technicians may be called every week. Each 15 days, a new meeting is 12 11 11 11 11 11 held to address what happened throughout that period, and it is also integrated with other similar actions in other regions. Every month, a new provision of accounts is made both locally and for the top management of the company. Simultaneously, the evaluation of results is monitored, with an analysis of indicators, the percentage of finished works and the BOD monitoring of the stream. A feedback is submitted at each cycle of these, incorporating and sharing improvements. Through this kind of action, the result shows that performance agreements generally surpass the goal of houses with sewage connections and that the BOD decreases throughout the conduction of the works. In many locations, such as in the one from this case, the result of 99.99% of collected sewage was achieved.

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MODERADOR: **Aurélio Fiorindo** Filho



Alexandre





la Politécnica da USP

Liedi Legi **Bariani Bernucci**

PANEL: INTERFERENCE FROM **CONCESSIONAIRES ON** MUNICIPAL PAVEMENTS

Moderator:

Eng. Aurélio Fiorindo Filho - Sabesp¹

Speakers:

Philos. Alexandre Modonezi - SMSUB² Eng. Liedi Legi Bariani Bernucci - EPUSP³

Coordinator/Evaluator:

Eng. Luciomar Santos Werneck - AESabesp⁴

Care for urban roads is essential to ensure the durability of pavements⁵. The streets and avenues of big Brazilian cities, with high-quality services and materials, will be able to ensure not only safety for the community but also the implementation of efficient, long-lived public services. Currently, there are many interferences on the urban pavements that deserve attention and also transformation in the conduction and posture of its agents. In order to address this theme, at 32nd AESabesp Technical Meeting, the panel Interference From Concessionaires On Municipal Pavements was organized with the purpose of raising awareness about the impacts resulting from the activities conducted by concessionaires on the urban environment and on the population in general, and discussing alternatives for the treatment of pavements and kinds of control.

The Philosopher Alexandre Modonezi started his lecture telling that when he got to the Municipal Secretariat of the District

City Halls of São Paulo, then led by the secretary Bruno Covas, he faced an analog secretariat, with the challenge of implementing modern tools for the city management. In face of that, the secretariat underwent a reformulation, installing new technologies such as the Janitorship Management System (SGZ)⁶, which after all became the greatest in the world. A pavement system was also created in the city for street monitoring, defining which is the need of every road. Along with that, circuit boxes were installed on car axes – Uber drivers and taxi cabs that move through the city – and the equipment enabled the verification of the tarmac situation through the pavement deformation. "Nowadays, more than 90% of the city is mapped. This information is updated every month. Cars move around every day. 108 vehicles send this information to us every day," he asserted. By using data coming from cars, it is also possible to monitor the durability of the city pavement and also contribute when it gets to choosing the best kind of material to be used to resurface roads.

Based on those data, a new need emerged: managing the work of concessionaires in the city. According to the speaker, São Paulo has 17,000 km and 196,280,000 square meters of pavement. In order to monitor the impact caused by companies, the Urban Infrastructure Management System (GeoInfra) was created through the Decree no. 59,108. This system controls concessionaires' services in the city, automating all the process (which makes it easier for those companies) but

¹ Basic Sanitation Company of the State of São Paulo.

² Municipal Secretariat of the District City Halls of São Paulo.

³ Polytechnic School of the University of São Paulo

⁴ Sabesp' Engineers Association.

⁵ Currently, Brazil presents some unfavorable points when it comes to pavement durability. According to a research conducted by the National Transport Confederation (CNT), Brazil applies few resources on the construction, monitoring and maintenance of its highways. Likewise, in Brazil, there is a lack of planning for highway maintenance, as its Pavement Management System if outdated. Moreover, the highway sector itself is overloaded for the lack of an integrated multimodal policy, capable of ensuring equilibrium for the transport matrix of Brazil (POR OUE.... 2021)

⁶ Through the SGZ, the actions of 32 district city halls in the city of São Paulo could be now monitored, enabling the access to demands in real time. With this work, about 1,500 requests that come through SP 156 are answered every day (SMSUB..., 2021).

also ensuring the monitoring of the work conducted by them. Throughout 1 year and 8 months since the system began to function, it was possible to survey some important data. More than 41,000 ditches were opened in the city in different ways, sometimes continuous ditches and sometimes only for repair. 83% of the works and services registered by GeoInfra were motivated by Sabesp. Sorting by kind of service, 35,761 (90%) were conducted as emergencies, 2,876 with the purpose of expansion/implantation, 1,406 were motivated by household connections, 589 for preventive maintenance, 314 for corrective maintenance and 75 referring to other services.

With that information, Modonezi related that he felt the need for a monitoring work. So through bidding, three technological control and monitoring companies were hired to follow carefully what was happening to city repairs. Through that work, it was possible to identify which problems were there. So 16.142 technical visitations were conducted. 11,159 occurrences of noncompliance were identified and 69% of the visited works did not comply with the law. "From that moment on, we established a stronger relationship with the concessionaires, seeking for a technical solution and showing that we could discuss with suppliers and with the companies, since we had all the information and technical reports," Modonezi explains. Consequently, a cultural change began, both on the part of the city hall regarding monitoring and a greater control of the city pavement and on the part of the concessionaires, which began to conduct new actions in their services and along with their suppliers.

It is worth highlighting that 1 year and 8 months after the implementation of GeoInfra and 1 year and 2 months after the technological control, the services that were being conducted improved. According to the speaker, since the moment that these pavements began to be properly controlled and managed, it was possible to reach some meaningful numbers. So recomposition works performed by the concessionaires in accordance with the law in force saved about R\$ 66.2 million, comprehending an area of about 552,000 square meters and

3,420 roads. Through a cooperation term with Sabesp, about R\$ 79.2 million were saved, 660,000 square meters were resurfaced and 117 roads benefitted from it. In total, through this work of control and monitoring, R\$ 145.4 million were saved for the city hall. According to Modonezi, there are currently many roads undergoing new interventions, so that a higher-quality resurfacing may be done. In many cases, companies such as Sabesp and Comgás⁷ are changing agreements and suppliers, ensuring that the final work achieve the expected quality level. Another action highlighted by Modonezi is the compatibilization of works, that regulate the schedule of works in the city.

"I think that the city of São Paulo made a lot of progress, with conditions to make decisions. And most importantly: Public policies are medium-term. Through this work, we leave bases for future decision-making for the city," he concluded. The panel's moderator, Engineer Aurélio Fiorindo, Filho, in his explanation, congratulated the work conducted by the city hall of São Paulo, stressing that it is a great victory, especially for São Paulo, where there are many roads, which makes this work much more complex. "When we see the actual amount of roads in the city of São Paulo, we realize how complex it is to manage this, and we can only manage something we control and know. So I congratulate you for that," he remarked.

The Engineer Liedi Legi Bariani Bernucci in her presentation presented a diagnosis for the average frequency of services and pavement substitution in the Metropolitan Region of São Paulo (RMSP) regarding the work conducted by Sabesp, between 2019 and 2020. According to her evaluation, the numbers are expressive and correspond to the lecture made by Modonezi. Regarding repairs of leaks, the speaker pointed out that in 2019, 333,936 repairs were performed, and in 2020, this number increased to 348,965. Regarding water and sewage connections, in 2019, an amount of 156,049 connections was registered, and in 2020, 176,154 connections were made. Among the main complaints from users registered by Sabesp itself, there is one about the workmanship quality and the low durability of the

⁷ In 2021, a meeting between Sabesp, the City Hall of São Paulo and Comgás was held for aligning actions that would prioritize the use of materials produced in the Ecological Center of Pavement Recycling. Besides the use of sustainable materials, the partnership also worked for the implementation of a work schedule. "The compatibilization of our works with the use of integrated platforms will engender promptness and it will not let happen what is the big complaint in the city today, which is rework. The City Hall carries out a work, and Sabesp goes there and demolishes it. Or Sabesp carries out a work, and the City Hall goes there and demolishes the pavement again. This integration of systems with technology will improve the efficiency of all and it will lower costs both for the municipality and for Sabesp," the municipal secretary of the District City Halls, Alexandre Modonezi, said (SABESP..., 2021).

pavement substitution, with sinking, irregularities and opening of holes8. According to the speaker, actually, the city of São Paulo has a huge network to be monitored and managed. "Due to the traffic, trucks, excessive loads and pavements that were often built in the 1960s and in the 1970s, there are many roads that have been deteriorating and that are really difficult to be managed, and for us to have enough resources to keep them in excellent or good conditions," she explained.

In face of this scenario, Bernucci highlighted that as quality decreases with time, it is necessary to perform restoration, which can be highly diverse. According to her, this maintenance work depends a lot on the quality of the services and materials used to achieve a good workmanship level. Depending on the material, durability may be achieved or not in these solutions. In certain cases, the pavements are already deteriorated, which poses a certain complexity for the work. For the opening of ditches, for example, some pavements are already cracked and it interferes with the performance of the service and the workmanship later. There are also works that create certain to industry, innovation and infrastructure, with goals for the slopes, which causes a few problems. "For example, when there is a speed bump on a road and there is a lot of truck traffic there, there especially occurs defects on the pavements near that slope. The defects end up developing much faster." Therefore, a good workmanship is crucial to prevent problems in ditches due to those slopes. She also mentioned problems caused by and sustainable; the SDG no 12 - Responsible Consumption materials that are already saturated, damaging the soil. This makes it difficult to recover a pavement. In her opinion, reusing materials taken from the place is not recommendable. So she advocates recycling materials.

She also warned about executive matters. Very light equipment is usually used for the recovery and compaction of materials in ditches, and it makes the densification of materials troublesome. According to her, it is necessary to choose noble materials to compose those ditches, in order to ensure that the whole is resistant and that there is no sinking. Regarding that, she stressed the importance of using recyclable aggregates, of using materials in a smart way. "Currently, the standard applied in São Paulo already uses milled materials and other technologies considered to be "new" for the recomposition of pavements, for ditch filling. The standard created in São Paulo was already devised having the use of those materials in mind," she explained. She pointed out that the city was a pioneer in Brazil regarding the creation of a standard for recycling construction and demolition aggregates. Later, the Brazilian Association of Technical Standards (ABNT) made its standard based on the regulation of São Paulo. She also mentioned that currently there is a material being used a lot, which is foamed bitumen⁹. "You mix heated bitumen and water. When you add the liquid, it causes it to expand and produces a foam. This material has many uses and it is a high-quality environmentally correct solution."

Bernucci stressed that when it comes to pavement reposition, it is also about sustainability. According to her, all this work along with the pavements, with the implementation of standards that recommend the use of recycled materials, is aligned with some of the 17 Sustainable Development Goals (SDGs) by the United Nations (UN), through the SDG no. 9, which refers construction of more resilient infrastructures, the promotion of an inclusive industrialization and of innovation by the year of 2030. Besides, reposition actions already regard the SDG no. 11 - Sustainable Cities and Communities, which has the purpose of making cities and human settlements inclusive, safe, resilient and Production, intended to ensure sustainable production and consumption standards; the SDG no. 13 – Action Against the Global Climate Change, with the purpose of taking urgent measures to fight climate change and its impacts; and finally the SDG no. 6 – Drinking Water and Sanitation, which has the purpose of ensuring the availability and management of water and sanitation for every one. "The world is in our hands and we have something to do because if we do not, the younger generations will seriously suffer the consequences. We have to do our part," she concluded

⁸ Among the may defects on roads, we may mention; fissures, caused by bad bitumen dosage or excessive compaction; transversal cracks, that may be long or short, causing irregularities and weakening the pavement coating; longitudinal cracks, caused by bad execution of a longitudinal joint for the separation of two traffic lanes, among other factors; plastic settlement, a permanent deformation that causes the pavement surface to sink along with a side volumetric compensation (sublevation); slide, that corresponds to the coating displacement regarding the underlying layer of the pavement, causing half-moon-shaped clefts; wear, which causes superficial roughness on the coating; among others (CONHECA..., 2018).

⁹ For the reposition of ditches after services are finished, Sabesp began to use residues from tarmac, curbs, gutters and concrete, which were recycled and turned in a higherquality material through the Ecological Center of Pavement Recycling (CERP). It is called Foamed Civil Construction Residue (Foamed RCC) and Milled Material Basis with Foamed Bitumen (Foamed RAP) (SABESP..., 2021).

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AESABESP COMPENDIUM 2021





Angélica Campos Institut für Virologie (Berlim)



Jorge Enoch Furquim Werneck Lima

Agência Reguladora de Águas, Energia e Saneamento Básico do Distrito Federal (ADASA)

PANEL: ENVIRONMENTAL DEVASTATION'S IMPACTS ON EARTH

Speakers:

Biol. Angélica Campos - Institut für Viralogie Eng. Jorge Enoch Furquim Werneck Lima - ADASA¹

Coordinator:

Eng. Uladyr Ormindo Nayme - ASEC-CETESB²

Evaluator:

Eng. Sonia Nogueira - AESabesp³

Society has been using Earth's resources excessively every year, surpassing its capacity. The Overshoot Day4, when society has consumed all Earth's resources that enable it to live sustainably for a year, occurs increasingly earlier. In 1980, this day was December 30, while in 1990 it was October 19. Its last register was in 2020, when it occurred in August 22. Estimations are not hopeful for 2022. To have an idea of it, the Overshoot Day in Germany was May 4 (BRANDLIN, 2022). At 32nd AESabesp Technical Meeting, the panel Environmental Devastation's Impacts on Earth was organized in order to address the negative aspects of human interaction with nature, and human and environmental health. The Engineer Uladyr Ormind Nayme, the coordinator of the panel, began his lecture with a resonant speech: "If we follow this way, future is in jeopardy. Those will be dark days for every one, with new diseases and pandemics," he asserted.

The Biologist Angélica Campos began her lecture explaining the concept of One Health – or single global health – which must collaborative, multisectoral and which transcends disciplines. It addresses the local, the regional, the national and the global,

seeking to improve the health of people and of everything connected in this planet, such as animals, plants, forests and others. This concepts seeks to prevent, intervene or rehabilitate critical health points, be it human, animal or environmental health. Throughout the centuries, men and animals have interacted on Earth, be them domestic species or not. This connection attention, since there are zoonoses, infectious diseases proceeding from animals that are transmitted to human beings. These may be bacterial, viral or parasitic, and may be transmitted directly or through food, water or the environment. About 60% of diseases that infect human beings are zoonotic. Among these, 75% of them are considered to be emerging diseases, including Ebola, HIV and influenza, besides the most recent one, Covid-19 - the Sars-Cov-2 virus. It is worth highlighting that each year five new diseases arise, and three of them have an animal origin. A scary piece of information about this all is that 80% of these pathogenic zoonotic agents have a bioterrorist potential.

Climate change can interfere with the spread of diseases. The speaker showed an image that exemplified this issue through the zika virus. Places where climate change was intense, the presence of the mosquito that transmits that disease increased. Those changes also contribute to alter the ecology of places where animals that host diseases live, and this can affect biodiversity and many zoonotic agents. All of this affects ecology as a whole, causing unbalance on Earth, as wild animals search other places to live and possibly gets closer to humans, for example.

The speaker reminded that the coronavirus has a zoonotic origin

¹ Regulatory Agency for Water, Energy and Sanitation of the Federal District.

² Engineers Association of the Environmental Company of the State of São Paulo.

³ Sabesp's Engineers Association.

⁴ The Overshoot Day was a way to show society the date when natural resources available every year are totally consumed. It is calculated by the Global Footprint Network and this index considers how much is consumed, the efficiency of product manufacture, the population size and even to what extent nature can recover (RRANDI II N. 2022)

but that it can be naturally transmitted to human beings. There was no direct human action for the virus to spread. It would be naturally transmitted. When you invade an environment where a virus freely circulate, where animals live, we are more likely to be infected, and that happened in the case of Covid-19," she asserted. Emerging diseases are infections that are new or that had had low indices for some time which emerge or reappear with great speed in a certain moment. This concept was used for the first time in 1995 by Dr. Morse S. Factors, from the Columbia University, in the Untied States. Campos showed an image with an overview of new emerging diseases, with infections that began to circulate again, and the deliberately emerging ones, that are cases of bioterrorism, such as the use of anthrax⁵.

Throughout time, humankind, even before the definition of this concept, lived along with emerging infectious diseases. The first of them was Influenza H1N1, around 1918, which caused the death of 50 million people. After it, the world faced the Western Nile Fever, the Bird Flu, Ebola, the Hong Kong Flu, the Russian Flu, HIV, the Asian Flu, the Swine Flu, the Hendra virus, the Nipah virus, among so many other high diversity of mammals; biodiversity loss; high density of diseases and viruses. The point is that the number of emerging infectious diseases has been increasing a lot in the past years, which is something related to the increase of environmental degradation. This has become a threat to public health and to the global economy. After all, the most recent scientific survey pointed out that 25% of deaths on Earth result from this kind of disease. It is worth highlighting that 13% of human pathogens are emerging, 75% of the emerging infectious diseases have a zoonotic origin – out of these, 70% are wild – and within this disease classification, almost 40% are RNA viruses.

Research in this area is very advanced, to the extent that researchers and the World Health Organization (WHO) reached a consensus in 2018 that there was a big possibility that an unknown agent with an epidemic or pandemic potential were unchained. In 2019, this "X disease", as it was treated until then, arose: It was Covid-19. R06 is how much an agent can spread causing diseases. Sars-Cov-2 has its R0 at 2.5, which represents that the virus will cease to have its peak after about two thirds of the population is vaccinated. Among these emerging diseases, measles is the one that most spreads, and its R0 has already been over 14. "Before the vaccine, the number of measles cases was extremely high, as it spread too easily," she said. The speaker explained that for an emerging disease to occur, there must be: an agent, be it a virus, a bacteria or other parasite; a host which accepts that agent; and the environmental component, where the host and the agent live together. Diseases arise with the support of these three pillars.

According to Campos, a pandemics occurs when a disease is spread worldwide, breaking all kinds of barrier, no matter how serious it is. An endemics occurs when there is an explosion of cases in a specific spot. The outbreak of emerging viruses is a consequence of the relation between some situations: evolutionary viral factors, such as the mutation rate or aspects of replication; an increase in the direct or indirect contact with wild reservoirs, which occurs very fast nowadays with the increase of agriculture and cattle raising, urbanization, deforestation, habitat alterations, human invasion in intact forest areas, consumption and selling of wild animals and others; populations near forest areas. "Microbes or microorganisms are part of the wildlife diversity and they can be found in many hosts," the speaker said.

Currently, the main activities that cause environmental degradation are: mining, energy sources, agriculture, waste generation, deforestation and fires. We need to worry about how to manage those issues. For example, thermoelectric plants. We need energy but some things need to be reviewed. In Germany, there are four out of the five most polluting thermoelectric plants in Europe, she stated. The speaker showed that the deforestation of 1 km² of an Amazon rainforest⁷ may amount to 27 new malaria cases, and 24 trees per second are cut off there. "We need this green protection belt. We need to think how we can have a better relationship with the environment and what we can do to keep our planet for the future generations."

Campos explained the spillover concept, which is known as overflow. It occurs when a host jumps from one to another.

⁵ Anthrax is a common disease on cattle, camels, sheep and other animals, caused by the Bacillus anthracis. Its infection on humans occurs only when they are exposed to contaminated animals, have contact with them or through the consumption of contaminated meat or meat products. Its three clinical forms are: cutaneous, pulmonary or gastrointestinal (VIGILÂNCIA..., n.d.). After the attack against the Twin Towers and the Pentagon in 2001, in the United States, bioterrorism emerged. It used biological agents as weapons. About five contaminated letters containing Bacillus anthracis spores were sent to the city of Treton, New Jersey, for specific targets – politicians, TV channels and newsrooms. At least nine people died in these attacks, and their authorship is unknown until today (FERNANDES, n.d.).

⁶ R0 is defined as the average number of secondary cases of infection resulting from the first case, when the virus is introduced in a population that was never exposed to the disease (JN, 2020).

⁷ Brazilian researchers found out that the transformation of a forest territory in an agricultural area favors the occurrence of diseases, not only malaria but also leishmaniasis and dengue. For example, malaria is concentrated in places where there are many forests but agro-extractivist culture is dominant, while dengue occurs in places with a low forest concentration (SOARES, 2021).

This makes a disease from a pathogenic agent have a high prevalence, and it keeps the virus in nature in a constant way. "There must be an exposure by the new host, an infection, a spread and an adaptation. Then we have an overflow, the spillover." There also exists the spillback, when the disease goes back to nature, to the hosts that "took" it to humans, and this is already happening with the Sars-Cov-2. "The decline of ecosystemic services in the world, such as water, food and clean air supply are constantly linked to environmental degradation. The risk to people's health increases as human beings destroy the environment fast and get close to species hosting pathogens. It is worth mentioning that viruses are everywhere and that there is no medicine for viral diseases, only vaccines," the speaker explained. It is worth stressing that bats have no fault. Just like other wild animals, they keep the virus in nature, exclusively in the wild. So it is necessary to review strategies for forest invasion. If all insects disappeared from Earth, in 50 years, there would be no life on Earth, although it would keep existing.

The Engineer Jorge Enoch Furquim Werneck Lima, in his initial speech, justified the title change in his lecture, which In face of this scenario, Lima questioned what must be done addressed disasters on Earth. For this theme, instead of addressing the increase in the use and occupation of soil, its changes and coverage, besides mentioning carbon and the amount of disasters, he preferred to present a more optimistic view to the audience, "so that we think what to do in face of society's demands, the demands that we have and the natural resources." He pointed out that the humankind has five big challenges based on its own demand, such as: energy, water, food, the environment and poverty. The three first points require even more attention, according to the speaker, as they provide alarming data. By 2030, the demand for food and energy will be 50% higher and the demand for water, about 30%. "When we look at these themes, we see that all of them will demand even more from the environment, and that they are triggers for climate change, for example."

Currently, society already experiences huge problems about its environment. Five points with clear signs of degradation must be highlighted: climate, with many extreme events, such as really strong rains, cyclones, typhoons, extreme droughts, among others; pollution contaminating the air, the water and the soil; drinking water, be it in quantity or quality; biodiversity, with habitat losses; and residues, such as the lack of basic sanitation in many places. "This is a not very pleasant case but when sanitation came to the Federal District, it came strong, with a tertiary water treatment system, but our small river down here cannot dilute the effluent in our treatment stations. So we ended up degrading the environment. But it is us (society) that cause that. If before I said that it was intended to meet our demand, we produce waste⁸ and residues – and we are talking lots of it."

The speaker considers it impossible for us to meet all those demands without affecting the environment but he thinks that we must find out how to minimize the negative impacts that come back when we go beyond the acceptable limits. For Lima, it is important to speak about the territorial management in Brazil. According to him, the scenario of use and occupation of lands in Brazil is organized this way: 38.7% of rural properties, composed of native vegetation in rural properties (11%), crops and planted forests (8%) and pasture (19.7%"; 61% of native vegetation, composed of native vegetation in conservation units (17%), indigenous lands (13%) and unclaimed lands, land reliefs and inland waters (20%); and 11.3% referring to cities, macrologistics, energy infrastructure and mining.

in already open areas and what if society demanded more areas. He presented a research of his own authorship for the Brazilian Agricultural Research Corporation (Embrapa), where he developed a spatially explicit mapping model, easy for all to understand, for any ecosystemic system. This method contributes for this mapping in order to find out and know how to keep occupying space in function of what the environment offers to us, and also the "tolerable" impacts and limits, preventing consequences for society. It is called MapES and it has an approach purpose capable of structuring, synthesizing and organizing the knowledge produced throughout almost 60 years of research – that was conducted in the Cerrado but which may be applied to any place – in a simple way, relating natural characteristics and land use with ecosystemic systems.

MapES is a model based on knowledge, which is important and essential, especially in a time when any discussion on the environment has been embedded with "beliefs or other information", as the speaker said. "As a scientist, I find it bad. Much wrong information has been spread and such issues have even made me agree to give a lecture in order to explain certain points," he asserted. The model is composed of cells, which may have any size, as it makes it possible to work with several scales, considering the information and the area where it will be applied.

⁸ Data presented in the 2020 Panorama of Solid Waste in Brazil, developed by the Brazilian Association of Public Cleaning and Special Waste Companies (Abrelpe), pointed out that each Brazilian is responsible for the production of an average of 378.2 kg of waste every year, which amounts to more than 1 kg every day (PIRES; OLIVEIRA, 2021).

The first step is mapping the soil occupation in the region, identifying urbanization, native forests, agriculture, among others. Based on that, you can seek knowledge to see the existing relations between the soil use and the provision of ecosystemic services or other information. The speaker even used the example of mapping the happiness levels of the population next to a planted forest and next to a corn crop, for example. Environmental services are also compared, whether they are best "provided" nowadays than in the past. Due to that, the current map of ecosystemic services is compared to the past one. So it is impossible to say if there were or if there are environmental impacts among the services. It is possible to evaluate many issues, such as erosion control, water supply, water quality, soil quality, food production, energy production, biodiversity preservation, among others. Using several literatures and many different disciplines, all those factors are evaluated based on technical criteria.

With all the information on the region, studying how the original local vegetation was and how it is currently, it is possible to evaluate what would happen if changes were made in that area, measuring the impact if all the area was urbanized or had some kind of crop, for example. Any new activity may have its impact evaluated even before it occurs. The potential uses for MapES are: comparison of areas concerning the generation of ecosystemic services (natural and with anthropic use); evaluation of impacts derived from anthropic actions (current and future scenarios), providing guidance to how necessary it is to alter an area in order to verify the impacts on it; how much that area may still be modified without a noticeable impact; and it enables to verify the trade-offs⁹ between ecosystemic services and know how necessary it is to produce food without water shortages.

This model has a totally explicit approach, enabling questioning and discussing what was considered for the production of results; the user has total control over the whole process, including over the chosen ecosystemic service, over the typology of soil use, reduction factors and uncertainty/impact limits. As it is spatially discretized in cells (cell base), it may be applied to any area or scale, be it a lot, a farm, a basin, a region, a state, a biome, a country, among others. It may be easily constructed and it enables to evaluate scenarios in which any person with knowledge on geoprocessing may apply it with any tool, and the results can be easily communicated.

Finally, regarding the system's limitations and risks, the knowledge of the person who is drawing or altering a table

is inherently subjective; as the system may be easily applied, it will be applied by people without a proper knowledge for such; working with different ecosystemic services requires knowledge from different areas; a solid scientific basis for drawing a table, as the themes addressed and uncertainties inherent to hydrological and environmental studies are permeated by beliefs and ideologies. The analysis of processes is conducted while tables are drawn but its results are only a "picture" of a given moment and place; the values there must be relativized for each ecosystemic service. "Preservation alone is not possible. Development alone will not work. We discussed a little what we want for the Cerrado and for the Amazon. The decision-making way is always political. Our population is not well informed on matters regarding the environment and water resources. We need to find an intermediate way," he concluded.

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⁹ An economic concept that means choosing an option over another. An example of this term may be found on matters such as present consumption vs future consumption, in which one decides not to use a certain sum of money, in order to invest this resource in the future (REIS, 2018).

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BIENTAL NO ORMAÇÃO



Mirna
Argueta

AIDIS



Alberto Palombo

Palombo

Red Interamericana de
Recursos Hídricos (RIRH)



Carl-Axel P. Soderberg

Comisión sobre Agua del Colegio de Ingenieros y Agrimensores de Puerto Rico

PANEL: SANITATION IN LATIN AMERICA - ADVANCES AND CHALLENGES

Moderator:

Chem. Mirna Noemy Argueta - AIDIS1

Speakers:

Eng. Alberto Palombo - RIRH² Eng. Carl-Axel P. Soderberg - EPUSP³

Coordinator:

Mgr. Célia Castelló - AIDIS

Evaluator:

Journal. Ana Paula Vieira Rogers - AESabesp⁴

Latin America is currently one of the regions in the world that most need a transformation when it comes to access to safe water and sanitation. About one quarter of its residents do not have access to tap water and more than half its population is not connected to a sewage system. Besides, even the share (26%) that has some kind of sanitation suffers with treatment plants, most of them with low quality (ÁGUA..., 2020). In order to better address this theme, at 32nd AESabesp Technical Meeting, the panel Sanitation in Latin America – Advances and Challenges was organized. Its purpose was to discuss challenges for the advancement of water security and reduction of people's vulnerability to risks of extreme phenomena (such as shortages and floods), as well as to promote social and economic development in Latin America.

For starting the theme, the Chemist Mirna Noemy Argueta, moderator of the table, showed the situation of sanitation in Latin America. According to her, 15.5 million people in this

region defecate on the open air. In order to change this scenario, the Unites Nations' (UN) Sustainable Development Goals, through their goals, seek to ensure that residues are safely taken to their final destination. "We have seen that sanitation has an impact on health and in the reduction of death for water contamination. If sanitation is safely managed, it helps us to prevent a great amount of diseases." There are currently 71 million people in Latin America that do not have proper sanitation. However, the speaker said that society is about to reach 100% of the sanitation goal. In 2016, the World Health Organization (WHO) developed the tool "Sanitation Safety Planning: Manual for Safe Use and Disposal of Wastewater, Greywater and Excreta." In 2019, this organization published a document entitled "Climate, Sanitation and Health." Both materials resulted in the creation of safety plans⁵ for sanitation in line with climate change.

Engineer Carl-Axel P. Soderberg said in his lecture that one of the impacts resulting from climate change is the rain standards, when it rains less (such as in Central America and in the Caribbean Antilles) or more (as it happens in Colombia). In cases of low amount of rain, water bodies' assimilative capacity lowers, which end up requiring an advanced treatment of the water used in order not to exceed the water quality standards for the receiving water body. According to him, in Puerto Rico, it was identified that 11 treatment stations will have to achieve a Biochemical Oxygen Demand (BOD) and a TSS (Total Suspended Solids) of 10. Another impact mentioned by him is about rain frequency and intensity. When it rains heavily, for example, a harmful effect occurs in treatment stations called inflow or infiltration, causing operational problems,

¹ Inter-American Association of Sanitary and Environmental Engineering

² Inter-American Water Resources Network (Venezuela).

³ Polytechnic School of the University of São Paulo.

⁴ Sabesp's Engineers Association.-

⁵ The Sanitation Safety Plan (SSP) refers to an approach intended for the implementation of risk evaluation and management regarding the chain of basic sanitation services – collection, transport, treatment and disposal. The plan has the purpose of developing local monitoring actions, coordinating stakeholders and based on what must be classified as health risks (LOPES, 2020).

causing the contamination to reach water bodies and areas surrounding the coast. The speaker also mentioned that one of the impacts of climate change is the increase of frequency and intensity of droughts⁶, as it reduces the water flow used for the sewage system. Such a scenario engenders effects such as the accumulation of solids on sanitary pipes, the increase of the BOD and suspended solids at the entrance of the treatment stations, and the increase in the concentration of dissolved solids at the entrance of the treatment station located in areas near the coast

Soderberg mentioned that the sea level rise engenders irreversible effects, with the destruction of sanitary infrastructures located in the surroundings of the coast. In the case of Puerto Rico, for example, the sea level will probably destroy 70% o the capacity to treat waste war, according to forecasts. This scenario enables a rise in the concentration of total dissolved solids in the waste water that comes to treatment stations due to the rise in salt water intrusion in aquifers. It also overloads the sanitary infrastructure in big and mediumsized cities due to the displacement of people that live in areas affected by the sea level rise. According to the UN, more than 30 million people in Latin America and in the Caribbean have already had to leave their place of origin due to that problem. Still regarding the effects of sea level rise, the speaker highlighted that on areas in the surroundings of the coasts, there has been an increase in cases of overflowing sanitary valves due to sea water infiltration and inflow. It also damaged septic sanitation amid the so-called "new normal" and considers systems due to rise in the groundwater.

Regarding the rise in temperature, he related that there has been an increase in deaths on coral reefs due to the whitening phenomenon⁷. The rise in sea water acidity levels and the increase of sediments in coast waters also contributed for the death of corals. Coral reefs cushion 90% of tide energy, protecting sanitary infrastructures that would be unprotected without the reefs. He also mentioned the rise in the frequency and intensity of hurricanes, tropical storms and polar vortices, which cause the destruction of the sanitary infrastructure or the interruption of pumping and treatment station services due to the lack of energy, caused by floods, landslides and waves. Data from the Intergovernmental Panel on Climate Change (IPCC) predict that in 2030, 81 million people in Latin America in the Caribbean will suffer with water shortages due to climate change. And in 2050, this number is likely to increase, as 140 million people may be affected by water shortages in this continent. Consequently, this situations is likely to cause an increase in migration toward medium-sized and big cities, a scenario which will affect the sanitary infrastructure capacity in those regions, he said.

According to Soderberg, the work currently developed by engineering may help to appease this scenario of difficulties expected for the future. He mentioned the possibility, under the responsibility of sanitary engineers, of building advanced treatment plants in countries where a decrease in rainfall may occur and therefore a decrease in the flow of rivers and streams. This professional shall also reallocate vulnerable sanitary infrastructures to the sea level rise and interventions in order to ensure the increase of capacity of sanitary systems in mediumsized and big cities. The speaker also mentioned the need to reduce infiltrations and inflows in the sanitary system, in order to reduce the effects of heavy rains upon waste water treatment

The Engineer Alberto Palombo, in his lecture, address that Latin America's big challenges are global. "Although we are here addressing the advances and challenges in Latin America, I believe that the true challenge is opening the lock to digital transformation for water and sanitation companies." The first topic explored by him was the concept of smart water, also called digital water or 4.0 water, which installs sensors throughout the supply network for data collection, converting them into information relevant for the system. Those data are processed by artificial intelligence systems and manipulated data network, comparing them to reference parameters and huge volumes of information (Big Data). In face of this

⁶ A study published by the São Paulo Research Foundation (FAPESP) pointed out that if greenhouse gas (GG) emissions keep as they are, the temperature in South America in rise in 4°C by the end of the century, thus producing extreme climate changes - droughts, floods and wildfires. "South America and particularly Brazil already display signs of climate change, including the increase of superficial temperature, changes of rainfall patterns, melting of glaciers on the Andes, and rise in number and in the intensity of climate extremes. These variations in climate characteristics precede what may come in the next decades if the unprecedented rise in greenhouse gas emissions continue," Lincoln Muniz Alves, researcher from the National Space Research Institute (Inpe) and co-author of this study related (ALISSON, 2021).

⁷ Whitening, a result from the expulsion or loss of pigment in seaweeds that live in mutualistic association with corals, is one of the big ecologic problems caused by the rise in water temperature due to the global warming or to the worsening of the greenhouse effect. Coral reefs, with their great biodiversity and a shelter, reproduction and feeding place for several marine species, shelter one out of four species (65%) and about 30% of the coral reefs on Earth are currently damaged due to anthropic actions (AZEVEDO, n.d.).

analysis, monitoring and managements plans are devised in order to prevent losses and leaks8, offering then a sustainable high-quality service for a cheap cost for users.

Palombo addressed the concept of intelligence itself. Regarding that, he mentioned the cognitive psychologist Howard Gardner, which explored the dimensions of intelligence, dividing it in the individual (better relationship of the "me" and all its surrounding), the collective (better relationship of the "us" together, and all that matter to us) and the organizational (better relationship of the "us organized" – institution, company – with a client, a stakeholder or a user) spheres. He also mentioned the need to spread the dimensions of intelligence in the geographic sense. After all, a network of water and sewage or drainage must also be the object of a holistic and integrated management which enables us to know where each drop of water comes from, where it is and where it goes to, how it is counted and finally how it is used by users, treated to return back to nature and continue the hydrological cycle9.

In order to talk about the digital transformation experienced nowadays, the speaker talked a little about the evolution of smart technologies. Data science began in the 1960s, at the National Aeronautics and Space Administration (NASA), in the United States, through its space program. In the 1990s, objectoriented programming began. Rules and algorithms were reused according to the intensity of cycles within a process. In the 2000s, these rules and algorithms "statistically learned" World Wide Web (www) network entered into operation, what is nowadays known as the Internet of Things (IoT) was created. with objects connected to sensors in a broad and remote way, processing many entries according to the kind of sensor. Since 2020, Social IoT emerged, with objects analyzed through sensors, which could be "customized" according to a social profile. "We are currently working on how to connect not only sensors to things but also to people", Palombo explained.

For the speaker, society is living a digital revolution which has the goal of improving people's lives. "Imagine that in a near future, we will be able to have a dimension of needs for water per sector, per building and we will also be able to know how the profile of water consumed in a hospital and its sewage treatment work, which is very different from a residential building," he remarked. According to him, it is currently possible to integrate large systems which in a recent past had rudimentary interfaces considerably fast and with high trustability levels. So today it is possible to ensure the interoperability of smart systems of mobility, governance, environment, water, personal life, and all of them may be done individually or collectively thanks to digital transformation. Palombo reminded that all those systems are developed and analyzed by smart people to give meaning to connections and to offer valuable services for clients and users.

Still regarding the concept of connectivity, not so much from the digital point of view but much closer to sanitation, water management is closely linked to the concept of Water, Energy and Food, which is considered one of the foundations for the management of water resources as well as for energy and food production. In this process, water is necessary to generate energy, energy is necessary to transport water, both are essential for producing food, and the food waste may be used to produce energy. "When those managements are liable to governance marks that consider inter-relations with other resources, we are giving each of them more comprehensive goals for each resource subject to multiple uses and to users' need access. These are the so called securities: water security, food security and energy security."

According to Palombo, people currently control everything and began to give results based on sets of conditions. As the that comes and goes out of their bank accounts on their smartphones, through technologies such as 5G, cloud, Big Data, IoT and Artificial Intelligence (AI). In the past 10 years, the socalled digital spillover put solutions on the hands of consumers. According to him, in the next decade, digital transformation will be the competitive factor that will upgrade companies that make their products and services digital; and this also includes governments. In this scenario, users and citizens are prone to shape a new digital society, a "new normal." The disposition of these new business models, represented by concepts such as market place, delivery and internet banking, came like an avalanche during the Covid-19 pandemics, speeding digital transformation up. According to him, this scenario is likely to remain the same after the end of the pandemics, as companies'

⁸ A study developed by the Trata Brasil Institute pointed out that 40 liters out each 100 liters of drinking water produced in Brazil are wasted. In 2020, a loss of over 40% was registered. It would have been sufficient to supply 66 million Brazilians in a year. "These losses include physical losses, which are the leaks that we see on streets, and commercial losses, that involve measuring errors, on clients' bills, and/or even the absence of hydrometer measuring, and also the part the we call water supply frauds, which are illegal connections that also turn into commercial losses for the system," Pedro Scazufca, Trata Brasil Institute's partner researcher, remarked (BRASIL...

⁹ Hydrological cycle refers to the water cycle, a global phenomenon of circulation of that resource between Earth's surface and the atmosphere. This process is linked to the different physical states between the oceans, the ice caps, superficial waters, subterranean waters and the atmosphere, which are triggered by the sun energy, which raises the temperature of surface water toward the atmosphere (evaporation). Gravity causes the condensed water to fall (rainfall) and circulate through water lines toward rivers (surface drainage) or to infiltrated in soils and rocks (subterranean drainage) (CARVALHO; SILVA, 2006).

investments on digitalization currently surpass investments¹⁰ on physical infrastructure.

In face of this acceleration, the speaker stressed a highly relevant issue: Can governments rise to this challenge? According to him, public policies that enable an organized adoption of digital transformation must be made. And institutional frameworks and regulations for updating laws that prioritize entrepreneurship and innovation, promote a thriving technology sector, invest on new competitive resources, develop an active digital strategy, build a bridge over digital divisions and provide digital infrastructures. Despite this effort for transformation, currently in Brazil and in Latin American, many companies are still tied to the pre-Covid-19 scenario.

According to the speaker, Brazilian companies from several sectors were consulted in 2019 about the theme of digital transformation and the grades that were obtained were quite worrying. The segments that had a higher score (telecommunications and technology, wholesale and financial services) were far ahead those that were below (advanced industries, base industries, transportation and infrastructure industries and consumption goods industries). In this research, public companies of water, energy and public cleaning still did not find a strong reason to conduct a favorable approach toward digital transformation. He also mentioned the existing relation between digital transformation and the 17 Sustainable Development Goals (SDGs). According to him, the evolution of digital economy is closely associated with the main state-of-the-art technologies that impact all the SDGs.

Among these challenges, Palombo pointed out the need for implementation of smart water systems, with government officers willing to work in an coordinate way and highly qualified analysts. Sensors on hydrometers must be monitored, under an infrastructure of integration constantly updated to accommodate interactivity. According to the speaker, it is necessary to acknowledge that society is already living transformation times and not only future trends. Currently, the humankind already suffers with climate change and resource shortages, with social and demographic changes, accelerated urbanization and the need for environmental protection. According to him, it is possible to use synergies on a systemic approach, which is one of the great benefits offered by digital transformation.

He present some examples of smart water management systems already in development. He mentioned that most water and sewage systems already established in the United States and in Canada are not entirely optimized, and it involves a hybrid situation of high-accuracy measurement of components in the SCADA (Supervisory Control & Data Acquisition) typology, which is optimized in the field through the integration of georeferenced systems. From sewage pumping stations to pipe sensors, the structure is managed from a control room where there is also a protocol of preventive maintenance based on standards and statistics from the manufactures of the system components. In Europe, there are sensors directly connected to the Smart Grid and SCADA. This is a very useful system for cities where modernity and history are interwoven, enabling preventive work in newer areas in the city, rehabilitation of older structures and in older neighborhoods. Finally, the speaker stressed that much is possible with the digital transformation: "It is only a matter of opening that lock and enabling our organizations to surf the digital wave and thus offer a better service for our citizens and guarantee clean, safe water for every one," he concluded.

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¹⁰ A research conducted in partnership with Hitachi, which showed what investment expectations IT Brazilian companies had in 2021. 140 out of 260 researched companies – with a profile of over 2,000 employees – claimed investments over R\$ 4 million in their IT areas (half of them were on technological solutions and other half were on infrastructure) PESQUISA..., 2021).

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Mônica Lopes Ferreira

Instituto Butantan

PANEL: EVALUATION OF RISKS TO HUMAN HEALTH IN FACE OF ENVIRONMENTAL CONTAMINATION

Speakers:

Biol. Mônica Lopes Ferreira - Butantan Institute Dr. Telma Nery - ISEE¹

Coordinator/Evaluator:

Eng. Sonia Nogueira - AESabesp²

Life is valuable. Each living being is linked to the environment, contributing and/or enjoy the riches of natural resources. Unfortunately, the position taken by the human species in these relations is a predatory one, degrading not only the habitat of other beings but also making its own dwelling a dangerous place for itself. Environmental contamination – mostly caused by man – is currently responsible for countless diseases which occur more often and with higher impacts in low-income realities. Regarding that, the role of risk evaluations is crucial to understand the real existing scenario and to create actions in order to change this. In order to address this theme, at 32nd AESabesp Technical Meeting, the panel Evaluation of Risks to Human Health in face of Environmental Contamination was organized with the purpose of discussing the importance of the evaluation of risks to human health related to environmental contamination, based on the situation in Latin America and exemplifying it with methods used in Brazil.

Dr. Telma Nery, at the beginning of her lecture, pointed out the existing risks to human health, stressing water, air and soil contamination; accidents; air pollution; and the degradation of natural resources. The professional made a few reflections in her introduction to an evaluation of such risks. First, she mentioned a matter addressed by the missionary Monk Coen Roshi (a lecture held in the first day of the event) on the issue of the ancient. "She said something very important: Let's try to write history with ancient parameters but through a new perspective." Nery also recued a speech by Hippocrates (considered to be the father of medicine): "The way we get sick is related to the environments where we live, to the air, to the water and to places." She also mentioned the father of toxicology, Paracelsus, quoting his famous reflection that says that the distance from poison to medicine is a matter of dose.

According to the professional, society lives a chemical world, where chemical products are already part of people's daily lives, and this scientific politics' interface is essential for people to understand what may be considered as a risk or not. Unlike the time of Hippocrates and Paracelsus, new factors such as the stage of life, age, nutrition, existing or non-existing disease and other factors and the exposure to other chemical products may contribute for the process of sickening and must be considered within an evaluation of chemical exposure and adverse effects to health, especially when it comes to vulnerability. "And which consequences for the environment and especially for human health there would be in this chemical world," the speaker questioned. In the Americas, 13% of deaths are ascribed to environmental risks, amounting to 847,000 deaths per year; 320,000 deaths are related to air pollution; 1.55 million to chemical exposure; and more than 80 million people use a domestic polluting fuel.

According to Nery, its is essential not only to be aware of this scenario but also, from a technical point of view, know how to evaluate the risks of this exposure to human health. One of the most well-known and used methods, especially recommended by the World Health Organization (WHO, is present in the Public

- 1 International Society for Environmental Epidemiology.
- 2 Sabesp's Engineers Association.

Health Assessment Guidance Manual by the Agency for Toxic Substances and Disease Registry (ATSDR)³, a process in which these scenarios must be considered: those referring to the past, the current situation, and the future regarding this population exposed to chemical substances. It is also necessary to develop recommendations for the recovery and protection of human health. This risk evaluation presents a few steps for its execution, such as: survey and evaluation of the local information; community's concerns; selection of the contaminants at issue; transportation mechanisms; identification and evaluation of the exposure routes, whether it is through inhalation or by direct skin exposure; determination of implications for public health; and of conclusions and recommendations. "This evaluation is essential for us to quantify and evaluate which are the impacts on human health. ATSDR has already been adopted for many years in Latin America. It began to be applied in Mexico, and in Brazil, the Ministry of Health already used it very accurately. and it has already conducted several evaluations."

According to the speaker, the estimation of the exposure dose is made through equations, considering factors such as concentration, exposure, insertion in the human body, exposure factor and body weight, "A child and an adult, for example, have different dose specifications." In order to know the chemical substances, Nery stress sources as estimates based on epidemiological data, on bibliographical references (as Prüs-Üstün et al.) and she mentioned the data bank from the Unified Health System (SUS) in Brazil, DATASUS – in which it is possible to identify which factors are likely to determine clinical pictures of illness, hospitalization and death in a region. Regarding human health per disease group, she pointed out that 35% of ischemic heart disease cases (the main cause of death and incapacity) and 42% of strokes are related to environmental impacts. "Environmental impacts are the second main cause for death worldwide, and they can be prevented through the reduction or elimination of exposure to chemical substances. One thing is having an illness factor for genetic reasons; another thing is getting sick due to an external exposure that can be controlled."

This chemical exposure is present on environmental air pollution, passive smoking⁴, plumb, heavy metals, agrochemicals, solvents, paints, detergents, carbon monoxide and even in medication, responsible for non intentional intoxication cases at home and at work. About 193,000 deaths registered every year are caused by non intentional intoxication, most of them due to an avoidable exposure to chemical substances. An example of a disease impacted by the contact of society with these elements is cancer. In the occupational environment, for example, from 2% to 8% of all cases of cancer occur due to the presence of substances that are harmful to human health, and 14% of lung cancer cases result from environmental air pollution. In Latin America, the percentage of global diseases ascribable to chemical substances per age is higher among children, which are particularly vulnerable to the acute and chronical effects of chemical substances (acute intoxication, exposure to air pollution and pre-birth exposure), and the elderly, which present chronical effects of pollution and vulnerability to many carcinogens. Per gender, the amount of deaths ascribable to chemical elements (not to mention environmental air pollution coming from combustion sources) are higher for men. Back to the evaluation of environmental impacts per disease group, Nery stress suicide. 20% of its occurrence is related to the use or ingestion of agrochemicals - and Brazil is the first place in the use of these substances.

When the speaker linked the issue of unequal development in the work, she related that only 47% of the countries have Poisoning Control Centers (PCC). Specifically regarding Latin America, she highlighted countries such as Guatemala and Haiti, which have high indices of chemical exposure. Although Brazil is farther from those regions in the analysis spectrum, it also present expressive values. In 2021, a study on child mortality in Latin American cities, where a reflection of that exposure is seen in many places in this continent. Regarding child mortality, Latin American and the Caribbean present higher numbers. Likewise, in these areas, life expectancy at birth is lower. When the professional addressed some specific factors, she highlighted air pollution, considered to be the most serious risk to human health and one of the main avoidable

³ ATSDR was created in 1980 by the Congress of United States, within the Comprehensive Environmental Response, Compensation and Liability Act – CERCLA. It became responsible for evaluating the presence and nature of risks to the health of populations that live in places affected by pollution and where there is waste considerable to be hazardous. In 1984, after the Resource Conservation and Recovery Act – RCRA, ATSDR began to conduct public health evaluations in these places and to determine which chemical substances should be regulated and what levels of exposure would pose a threat to human health. ATSDR's mission is to "serve the public, using the best scientific knowledge, adopting actions for public health in response to necessities and providing trustable health information in order to prevent noxious exposure and diseases related to toxic substances." (MANUAL..... 2011).

⁴ Tobacco smoke has more than 7,000 chemical compounds and substances considered to be harmful to human beings. Studies show that at least 69 of these elements cause cancer. The smoke that gets out of cigarette tips contains about three times more nicotine, carbon monoxide and 50 times more carcinogenic substances than the smoke that is inhaled. On account of that, involuntary exposure to it may cause diseases such as rhinitis, cough and conjunctivitis in a short term and myocardium infarction and cancer if the exposure is longer (TABAGISMO..., 2022).

causes of death and diseases. In 2020, fires⁵ were responsible for 50,000 hospitalizations caused by air pollution. This pollution is more frequent in the so-called developing countries and it affects mostly low-income populations; more specifically, women, children and elders.

Nery highlighted September 16 (the day this panel was held) as an extremely favorable moment for discussing this theme, as it was the International Day for the Preservation of the Ozone Layer. She also mentioned September 7, which was elected by the United Nations (UN) as the International Day of Clean Air, stressing that need to transform the existing reality, which registers 7 million premature deaths every year. Currently, in poorer regions, about 3 billion people use fossil fuels or kerosene for heating, energy generation and cooking, thus aggravating the scenario of air contamination. The Pan-American Health Organization (PAHO) has a vast material, as the study "El Asesino Invisible" (The invisible murderer), pointing out alarming numbers such as: The air population is responsible for 36% of deaths by lung cancer, 34% of deaths by cardiovascular accidents and 27% of deaths by cardiopathies. The speaker mentioned that many countries have public policies for air pollution. According to data by the World Health Organization (WHO), about 91% of people that live in cities do not breathe clean air.

Regarding agrochemicals, Nery asserted that they are the main causes of death by poisoning, especially in low-income and medium-income countries. As they are toxic and spread on the environment in a deliberate way, its production, distribution and use require rigid regulation and control. Likewise, it is necessary to regularly monitor residues in food and in the environment. "The WHO is worried about this theme and seeks to develop actions to forbid the ones that are most toxic for humans, and the ones that remain the longer in the environment. Likewise, it works in order to protect public health, defining maximum limits for pesticide residues in food and in the water."

She mentioned a publication from 2020 entitled "Agrochemicals

in Latin America: a violation against the right to proper food and nutrition," describing the situation of each country. In this study, Brazil is identified as the champion at using agrochemicals, with high indices of exposure in the water, for example. Through a study by the geographer Larisa Bombardi, from 2007, she presented worrying numbers when she compared the limits of residues in the water for human consumption. Unlike the European Union, where the glyphosate⁶ e index amounts 0.1 ug/liter, in Brazil, it reaches the mark of 500 ug/ liter. In Colombia, agrochemicals were responsible for 28.67% of the poisoning cases by chemical substances in 2014. At the end of Nerv's lecture, she made an invitation to every one. As a member of the International Society for Environmental Epidemiology, she stressed that the main mission of that organization is joint work for environmental health in Latin America. So she presented this institution's website, as well as a vast collection related this theme and courses conducted in partnership with the PAHO, made available to public in order to expand these discussions. At the end of her lecture, she stressed the message sent at the beginning: "Let's try to repeat history through other perspectives.

At the beginning of the Biologist Mônica Lopes Ferreira's speech, she confessed she had done a first lecture but when she watched the lectures at the Technical Meeting and identified the richness of the information that had been shared, she decided to change her material. "Who am I in face of you? I have no condition to teach anything but I have the following condition: make reflections because I have been doing this. Perhaps throughout my 54 years or perhaps the pandemics has done this to me, or this reflection of how I am as a citizen and as a scientist." According to her, the conveyed information was a lot and really precious, and it made her reflect on the country that we want and that we need to live, and which is the healthy environment that the humankind needs to survive. Her first reflection began when Ferreira was still very young, and the scenario that conquered her was the environment of almost transparent waters, with the presence of many healthy marine organisms, resulting from her life in her birthplace, the state of

⁵ Data from the Environmental Satellites Application Lab (Lasa), of the Federal University of Rio de Janeiro (UFRJ), point out that in 2020, 3,878,650 hectares were burned in Pantanal alone. In 2021, this number decreased to 1,253,950 hectares (BRONZE, 2021). Generally speaking, in 2020, the number of fires in Brazil increased in 12.73%, compared to 2019, according to data registered by the Fires Program of the National Space Research Institute (Inpe), which amounted to the highest number of fires in a decade (BRASIL..., 2021).

⁶ Glyphosate, an active principle developed in the manufacture of chemical products, was created in 1950 and became known in the 70s when the company Monsanto – which currently belongs to Bayer – created a herbicide. After the creation of transgenic seeds line Roundup, resistant to glyphosate, its use on crops for killing weeds only increase. Currently, its harmful effects for human health are already known and Bayer was even sentenced guilty by the American justice under the allegation that glyphosate caused cancer and other diseases (ENTENDA..., 2019).

⁷ https://www.iseepi.org/

Alagoas. In that moment, when she was still a child, she began to think about the existence of an infinity of living beings, of such a lush nature, which woke up the curiosity in her, an important characteristic for a researcher, a scientist, a biologist.

Out of those years. Ferreira records dialogues with fishermen. In her study about poisonous fish, they began to tell that there was a decrease of fish, both in quantity and in variety. According to her, the change was on the environment, which became full of risks and underwent a noxious transformation caused by human action. "We are incomprehensibly getting used to this environment. We are inuring to this landscape, this water that ceased to be transparent because it is unfortunately full of oil, leaving it completely turbid. And we do not even know the origin of this oil which contaminated our sea or if it went actually away, if it still keeps contaminating our species." Not a child anymore, the speaker tells her journey as a scientist, her profession and her way of contributing to prevent risks, in order to share knowledge and to become more aware. Ferreira presented four stories regarding water in Campina Grande, Brumadinho, São Paulo and Brazil, stressing that "water is the source of life and it is essential for the survival of all species. We need good-quality water and in a great amount. We are living a critical moment, when all we talk about is the water crises. So it is an important moment for us to reflect on those matters."

According to the speaker, she lived the first story in Campina Grande, when this city was undergoing a serious drought and she was requested by doctors in that region, as they had detected anomalies in babies during gestation, teratogenicities. For that research, the professional used an experimental model, a fish called *Danio rerio* (zebrafish or *paulistinha*, as it is commonly called)⁸. The tests were conducted in the embryo and in the larva as they were transparent, since they absorb a non-invasive material that is introduced, and also for the fact that humans are extremely similar to this species (70% of homology with humans) and 84% of the genes are related to human diseases. "When we analyzed the waters from dams that supplied Campina Grande, such as Boqueirão and Araçagi, we identified that the water caused anomalies and teratogenicities."

Embryos and larvae had scoliosis, body problems, and had no eyes nor mouth." This discovery came to the knowledge of society before it was a scientific work. "This should be science's and a scientist's role." Even before she published that study, Ferreira decide to show her discoveries in the local Legislative Assembly.

In face of society's pressure on managers, the city began to announce measures for water quality, through its Municipal Secretariat of Health, raising people's awareness about the use of sinks, wells, tank cars, tanks and springs, where several compounds that are toxic for human consumption were detected. Also as consequence of the study developed by the researcher, the Federal Public Ministry began an investigation the possible presence of agrochemicals in the Boqueirão Dam's water, in Paraíba, in order to identify if water was contaminated and if its consumption could bring harm to the health of humans, animals and to the vegetation of the municipalities supplied by the reservoir. "Science needs to work for and along with society," Ferreira related.

The second story that was told occurred in Brumadinho, in the state of Minas Gerais. The professional had the opportunity to evaluate the water there when the accident occurred and six months later. The identified the presence of a lot of iron (100x), aluminum (1000x) and mercury (720x), using metagenomics, which is when the genetics of what is happening in the water is analyzed. Several bacteria responsible for severe gastrointestinal disturbances were also found there. Just like the specimens in the water in Campina Grande, many embryos and larvae had a delay in their development: absence of mouth, hemorrhage, etc. "After the accident, people lived along with that contaminated water." The research developed in Brumadinho became a scientific paper but it also became a legal piece. "That our scientific papers work as an element for justice to fight for damages caused to that population." But how can society have access to those papers written in English?" the speaker asked. In order to make the research more accessible, the study was adapted to video, enabling the population to better understand it. She remarked that papers such as this are essential, but they must be conducted a lot time before such

⁸ The use of this species as a model organism has helped to find new genes related to cardiovascular diseases, for the understanding of vascular development and disorders to aspects of the formation of those tissues based on mesodermal cell lines, kidney disorders, and also contributed for the study of the regeneration capacity of the heart, retina and central nervous system (DANIO..., 2022).

^{9 &}quot;A teratogenic agent corresponds to any substance, organism, physical agent or disability which, being present during the embryonic or fetal life, causes an alteration on the offspring structure or function. Reproductive damages in human species may be grouped in main classes: (1) death of the conceived one, (2) malformations, (3) retardation in the intrauterine growth, and (4) functional disabilities, such as mental impairment. These damages may have a genetic or environmental cause and they are often a combination of both (multifactorial etiology)." (SCHÜLER-FACCINI et al., 2022).

events occur. "It was a tragedy foretold, and this is something that happens a lot in Brazil. We know many things that are about to happen and nothing is done. So Brumadinho is one of those cases."

Her first story happened in São Paulo. From 2015 to 2016, water samples were collected from Water Resources Management Units (UGRHIs) such as Alto Tietê; Mogi Guaçu, Tietê Jacaré; Mantiqueira; Piracicaba, Capivari e Jundiaí; Alto Paranapanema; Paraíba do Sul; and Peixe. The main characteristics of those areas were the high population density, the use of water for public supply. "We conducted a proteomic analysis, seeing everything that existed in those waters, and also a toxicity analysis." According to the speaker, samples of caffeine, fungicides, insecticides, herbicides, natural hormones, synthetic hormones, antibacterial agents, plasticizers and surfactants. "When you mix all of that, this cocktail is what we consume every day." Besides those, the speaker also mentioned substances such as atrazine, carbendazim, diuron, malathion, 2.4-D, tebuconazole and tebuthiuron, with concentrations over what the tolerable limits. When she tested that water on embryos, all the teratogenic effects were seen. This study gets really close to the data published in the Diagnosis of Contamination of Superficial and Subterranean Waters, and Sediments by Agrochemicals, developed by the Environmental Company of the State of São Paulo (CETESB), in 2021. "This is a warning to us. Much than a file or data, it must work for us to take measures."

Finally, Ferreira addressed the relation of Brazil with agrochemicals. According to her, Brazilians live daily with this enemy, present in the war, on air and in food; a true risk to people's health. Its contamination causes countless diseases, such as neurological symptoms, hearing loss, heart alterations, DNA damage, fetus malformation, poisoning symptoms, anomalies and brain death, disturbances in the digestive system, alterations in the pulmonary function, excessive salivation, ocular irritation and psychiatric disorders. She mentioned a report published in the news website Repórter Brasil, which related that all 27 agrochemicals that were tested were found in the water, in 1 out of 4 municipalities. Currently, there is a program called Água Boa de Beber, by the Federal Public ministry, a platform which informs which agrochemicals are present in the municipal waters. Regarding that, the professional analyzed 10 substances present in our water, food and on air, using the so-called Ideal Daily Dose (IDA), considered to be excellent. "At IDA, all of them cause death. When you dilute those doses to see what happens, they cause teratogenesis. So

this 'Ideal Daily Dose' is not ideal. Diluting it is not ideal either, as it is causing teratogenesis on us. It is making people sick." These results suggest the need for a change in the procedures of risk evaluation for agrochemicals, as those evaluates based on IDA's criteria underestimate their risk

"This information shows that we must change what is said to be ideal, and it is essential to pay attention to science, to evaluate what this field is telling, to take science into consideration and to respect it." According to her, we must take into consideration the principle of precaution and not treat this situation as normal, looking without seeing the existing problems. "We should not even have pictures of contamination scenes. We should not undergo scenes like these, and not see and take it as a normal thing. It should not be like this. We should have and want images like this, recovering our environment, paying attention to risks, take measure, conduct actions, reflect in order to act. Therefore, I think that things will change as we share knowledge, especially with our children, in our schools. Everything changes through education. These are the reflections for us to try together to change, modify, transform it in a healthy environment that we all_deserve, with potable Owater. Tesso Nacional

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Ana Lucia Fonseca Rodrigues Szajubok



Rafael Cabral Gonçalves

Sanepar

Speakers:

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We live in an era when environmental management and actions for sustainability must be part of any company or initiative, since resources in our planet have generally been used without measuring the consequence of their use. Sanitation, in essence, contributes with that but this issue must still be optimized. In order to better address this theme, at 32nd AESabesp Technical Meeting, the panel Environmental Management and Sustainability in the Operation of Sanitation Systems, which had the goal of promoting a debate on the importance of the adoption of environmental management tools in this segment. For introducing this theme, the Social Scientist Josilene Ticianelli Vannuzini Ferrer stressed that "we are in an era with several challenges for the expansion of sustainability in many areas, and sanitation cannot stay out of that effort." Based on that, this panel addressed the benefits and experiences of implementing environmental management systems and initiatives for the transformation of sanitation by-products in sustainable resources.

The Engineer Rafael Cabral Gonçalves began his lecture

PANEL: ENVIRONMENTAL MANAGEMENT AND SUSTAINABILITY IN THE OPERATION OF SANITATION SYSTEMS

relating his experience at Sanepar, about what they have been doing through the Environment Management System (EMS)⁵, which comprises from water withdrawal to the treat sewage emissions. Sanepar is a state sanitation company that serves 346 municipalities in Paraná, with 100% of access to the water network. In urban areas, there is water availability and in rural sanitation too, with the help of the community, to implement this system and convey that knowledge for people to use. Currently, the sewage network coverage is at 75.08%. Gonçalves stresses the quality of the service provision. "It is a treated sewage network. So there are state-of-the-art sewage treatment stations in front of those networks that treat sewage in order to release what has been treated on water bodies.

According to him, Sanepar has a system with a 57.5-thousandkm water network and a 38.5-thousand-km sewage collection network. There are a few million water and sewage connections, which could make two laps around if they were joined. With such a big extension, the greatest challenge is the maintenance and expansion of these places, as they are increasingly the places for implementing sanitation. "This is our goal. I imagine that every one share it, sanitation universalization," he state. Sanitation as a whole is predictable, resilient business, with a diverse client base with credibility on the market. Sanepar is a traditional company renowned in the market for its operational excellence, generating quality and health, and it has a high quality index for its water service (100% of compliance) and an index of sewage collection and treat above the average in Brazil, with a positive social impact to the health and quality of life of its clients. "We are proud to work with sanitation due

¹ Basic Sanitation Company of the State of São Paulo.

² Sanitation Company of Paraná.

³ Environmental Company of the State of São Paulo.

⁴ Sabesp's Engineers Association.

⁵ The seed for the creation of the Environmental Management System occurred after the United Nations Conference for the Environment in Stockholm, where the concept of "sustainable development" arose in 1972. With the expansion of the environmental issue in the world, companies felt the pressure from society for them to adopt more environmentally friendly postures. Throughout the years, new methods and procedures were created with the purpose of making the productive process less impactful for nature. From there, the ISO 14001 was created in the 90s, developed by a committee at ISO (International Standardization Organization) and throughout the years, new standards were created, such as NBR ISO 14001:2015, the most recent standard associated with the creation of a more sustainable regime (SISTEMA..., 2020).

to that, as we take quality and health to people. That is very edifying," he concluded.

Just like any company, financial return is important to operate and evolve, as well as to contribute with the environment, organizing and managing impacts, respecting and meeting the local laws. In the state of Paraná, Sanepar has a grant to discharge effluents and to withdraw water, which is a challenging legal requirement which uses the concepts of mixing zone, dilution zone, recomposition capacity of the receiving water bodies, among other legal requirements. "It is important to organize procedures, actions and trainings, as they are essential to maximize the search and increase the pace to reach full environmental sustainability6," the speaker highlighted. Sanitation is very complex, just like the environment. This organization within the Environmental Management System (EMS) is really important to achieve these goals and also to engage all collaborators to be aligned to the procedure and the actions.

According to Gonçalves the implementation of the EMS brings provides some benefits, such as: cost reduction, requiring processes to be thought out and discussed with all people involved; environmental liability reduction, as the system with work directly for that reduction, preventing the generation of new liabilities and also correcting existing liabilities that may be; satisfaction for the granting authorities, as city halls may access information on the environment in the audit phases; quality improvement for products and services, providing satisfaction for clients, and this can be seen in measures, metrics and indicators, as better services and greater environmental conservation can be seen; brand strengthening, as there is compliance with ISO 14,0017, an international renowned standard; improvement of the relation with the community, the civil society, students and scholars in general; and the increase of the integration and motivation of the employees, as every one feel better when they know exactly what must be done.

According to the speaker, the biggest challenge for organizing and having an EMS is the sustainability bias, deeply understanding the environmental law⁸. "Just to give an idea, the river-to-river⁹ scope has 2,128 analyzed legal requirements and 1,063 applicable ones, that is, environmental law is really broad, with many requirements. Without an organization on how to do it and how to simplify this process for people who

are operating and the system and making the investment, this challenge becomes huge." Their EMS has a broad concept, with a revision of the ISO 14,001 on stakeholders' needs and expectations. "The clients expect water with quality, quantity and reduction of fees, while suppliers expect quality for the projects provided for execution, for example. The ISO gives standards for the EMS," Gonçalves asserted.

An important point is that the system gives the employees the possibility of seeing an evolution both intellectual, individual, and organizational, for the organization where they work. And it can also strengthen the execution of Sanepar's environmental policy, which is classified by the speaker as a policy that is simple in itself but complex to fully achieve. However, the system organizes and seeks environmental, social and economic sustainability for internal activities and commitments, preventing and reducing environmental risks and damages. "The system complies with the applicable environmental law, conserves water resources, conduct the management of environmental purposes and goals, and also provides and consolidates internal and external social environmental actions."

The system helps the organization to deal with situations of risk and opportunity. The procedures, both internal and external, along with the environmental organizations and the Civil Defense, make a huge difference at getting effective answers. The ISO and the EMS also turn the research process into an innovation process, making it operational for the daily routine. Both help to identify aspects, map impacts and show how to deal with procedures and actions. At the Foz do Iguaçu's system, there are 134 environmental aspects and impacts associated and 107 procedures and information model registered. Without the EMS, it would not be possible to deal with so many aspects in an organized way. We could not control or show the environmental and control organizations how we make to meet those requirements." At Sanepar, the procedures aim at: social environmental education, energy efficiency, quality and service standards, reduction of losses, solid waste management, water sludge and sewage, and sewage collection network service.

The Biologist Ana Lucia Fonseca Rodrigues Szajubok presented her experiences with Sabesp. Previously, the activities where entitled as basic sanitation but they always went beyond the

⁶ According to a concept by the French economist Ignacy Sachs, this refers to ecosystems' capacity of sustenance, absorption and recomposition. Environmental Sustainability may be achieved in three ways: through the intensification of the use of potential resources for socially valid purposes; the limitation of consumption of fossil fuel and other easily exhaustible or environmentally harmful resources and products, changing them for renewable and/or abundant and environmentally harmless resources or products; volume reduction of waste and pollution; and intensification of research on clean technologies (SUSTENTABILIDADE..., n.d.).

⁷ This standard specifies the requirements for an Environmental Management System and enables an organization to develop a structure to protection the environment. The implementation of this standard must be sought by companies that wish to establish or improve and EMS (FURRIEL, n.d.).

⁸ Brazil is pointed as one of the countries that have one of the most complex and advanced environmental laws on Earth, obviously created to protect the environment and reduce the consequences of devastating actions to a minimum. Brazil has the Art. 225, which addresses environmental laws, besides many others, such as the New Forest Code (Act 12,651 – 2012), Environmental Crimes Act (Act 9,605 – 1998), National Environmental Policy (Act 6,938 – 1981), among others (AS..., n.d.).

⁹ Name given to the 14001 certification, implement by Sanepar since 1999.

theme in question, to the extend that they were considered to be about environmental sanitation. Sanitation's calling can go much beyond and move toward sustainability. In this sense, Sabesp's environmental management is structured on two big lines of work: environmental compliance programs on a side, and cultural change on the other, focused on sustainable STSs (Sewage Treatment Stations) and the environmental management system on WTSs (Water Treatment Stations) and STSs. The speaker explained that an Environmental Management System is a set of procedures that seek to protect the environment, to meet the law and to identify opportunities for operational performance improvement. It is a voluntary practice and it establishes reference standards, which is very important for the operation, and it aims at pollution prevention, a legal service and continuous improvement. Its main goals are the operation engagement, improvement for operational procedures, the infrastructure of the installations and awareness and cultural change.

Choosing an Environmental Management System is sometimes associated with the ISO 14,001 but this is not the only way to implement an EMS. "At Sabesp, for example, there is the Corporate Program to Progressively Implement the Environmental Management System and the ISO 14,001 Certification in STSs and WTSs. It considers the ISO 14,001 compliances and environmental grants, licenses and permits, as Standard in a limited scope of stations, according to the Business Units' strategy, but it also has EMS-Sabesp, which is an original model for the other stations," she stated. In face of that, Sabesp has a mixed model, which began in 2009. Initially, the works were based on the ISO 14,001 and later on EMS-Sabesp which also was part of that journey. Currently, there are 533 stations with an EMS, and 36 of them have an ISO 14,001 certification, and 497 of them are based EMS-Sabesp. Other 76 stations are still being implemented. Our goal is that all 831 stations have an EMS in operation by 2024.

Throughout the stages of the sanitation process, the Environmental Management System is established in the treated water production, in the sewage treatment and in the final disposal. This priority scope met some criteria, which were: the stakeholders' expectations, the company's core activity, environmental risks and impacts, a framework of legal requirements and the need for the dissemination of cultural change. Within this, the main care and operational control points were: management of effluents, waste, chemical products, odors and noise. It is also necessary to pay attention the periodical evaluation of legal compliance, such as license renewal, grants and environmental permits, environmental determinants and standards compliance. In this sense, engagement is important for the operation in order to embrace this cause. In the view of the speaker, the main actions for this engagement are: periodical training, with retraining and knowledge update, besides

the inclusion of new collaborators; periodical meetings for critical analysis, which fosters discussion and the involvement throughout all management levels; actions by the Environmental Management Centers (EMCs), the advanced units from the Environmental Management superintendency, Business Units' executive branches; awareness, so that the EMS does not compete with the operation but becomes a complementary tool for organization, optimization and standardization; and groups structured to help with the conduction of the implementation, such as the tactical group, the operational group and the group of facilitators.

The results from the EMS implementation are diverse. We may highlight the maintenance of the environmental compliance and the excellence for operational management, but this is only possible due to the implementation of a culture of preventive actions, reduction of environmental risks (be them accidents, liabilities, inquiries, actions and sanctions), improvement of the environmental performance, cultural change with a direct involvement of the operational base, development of the best environmental practices and a systemic view on processes involved of all the levels in the company. The Environmental Management System becomes a reference standard for the operation when there is a convergence of environmental well as the control of emissions, through practices focused on sustainability, such as environmental education, management of Greenhouse Gases (GGs), sustainable installations, among other measures. All these efforts and results made Sabesp implement a new program, Sustainable STSs. "Its main goal is to disseminate the culture of sustainability at Sabesp, which defines a sustainable STS as a station that interacts with the environment and seeks to minimize the consumption of natural resources and energy through the friendly use of its by-products - especially biogas, effluents and sludge, focused on energy efficiency," Szajubok stated.

The nature of the program considers continuous improvement to be a reference for Sabesp's STSs toward sustainability. "Sustainability is not a place, but a path. We have a strong premise in this program regarding environmental compliance. In order to be part of them, an STS need to have its EMS and conduct sustainable actions through that," Szajubok highlighted. This program arose due to some motivators, both internal and external. World mobilization for achieving the Sustainable Development Goals (SDGs) was one of them, just like the essence of sanitation itself, which grants more sustainable uses for natural resources, promotes public health, quality of life and more economic development for the area it comprehends - and the stage of environmental actions at Sabesp. "The goal of this challenge is to follow the current trend of efficiency regarding the use of natural resources,

applying technologies and practices toward sustainability," the speaker. The program began in 2019 with 6 STSs and currently it has 39 stations – 4 of them are certificated by the ISO 14,001. The Sustainable STS is divided in four blocks: Environmental Management Superintendency, which coordinates and manages the corporate program and manages the dedicated account; Research Superintendency, Technology Development and Innovation, dedicated to and for the application of proper technology; Operational Development Superintendency, with technical support and operational development; and Business Units, with the implementation of actions and operational management.

The Sustainable STS also feature two main work groups: the Tactical Group (GTAT), which planning, monitoring and control activities, comprising the Corporate, Environmental, Energy, Operational Development and R&D (Research and Development); the Operational Group (GOPE), with activities of implementation, composed of the Business Units and EMCs. The program has been giving results as it transforms sanitation by-products in sustainable resources, finding opportunities for biogas, sludge and effluents. Based on legal and environmental compliance, it developed by-products for friendly use with added value to the market, such as the use of biomethane as fuel in Franca, sludge biodrying in Botucatu – producing a conditioner for agricultural use – and hydroelectricity in Jales. Besides the requalification of the STSs, this initiative has ONCIESSO NaCIONA already identified a series of opportunities are being or will be carried out. For the friendly and sustainable use of sludge in Teamento e agriculture, in the recovery of degraded areas, in elements for the civil construction, energy generation, drying for disposal in landfills (volume reduction) and other initiatives. There is also the reuse of the final effluent, which may be: at the STS itself or on operational services; for industrial and urban purposes; agricultural purposes, with recycling of nutrients; recharge of body waters and others.

It will also be possible for the use and treatment of biogas, such as: capture and installation of burners or substitution for more efficient burning units; energy generation, through Small Thermoelectric Centers (STCs); installation of Small Hydroelectric Centers (SHCs); and installation of solar panels, ang others. Each STS taking part in this program is awarded sustainability labels, which are divided in three levels: Level 1, the STS must have equate and implemented sustainable solutions for the disposal of sludge, effluents and gases generated by the treatment; Level 2 or 3, when the STS is supposed to have already implemented sustainable solutions for the sludge, the effluent or biogas. Based on that, the generation of electric energy or the selling of products, with income generation for the company, enables the STS to upgrade.

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