



**CETESB**

**COMPANHIA DE TECNOLOGIA DE SANEAMENTO AMBIENTAL**

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CETESB - CIA. DE TECNOLOGIA DE SANEAMENTO AMBIENTAL  
BIBLIOTECA Prof. Dr. Lucas Nogueira Garcez  
Av. Prof. Frederico Hermann Junior, 845 - Pinheiros  
05469-000 - SÃO PAULO - BR. S.L.

**Relatório de Atividades do Projeto  
Bra/95/G31-Enabling Brazil to Fulfill its  
Commitments to the United Nations  
Framework Convention on Climate Change**

**Relatório Parcial nº01**

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## APRESENTAÇÃO

Este é o primeiro relatório parcial relativo ao projeto **BRA/95/G31-Enabling Brazil to Fulfill its Commitments to the United Nations Framework Convention on Climate Change**. Refere-se ao levantamento de *dados estatísticos de 1990* e de *bibliografia preliminar* para avaliação das emissões de metano gerado pela disposição e/ou tratamento de resíduos sólidos e líquidos.

O projeto é financiado pelo **Programa das Nações Unidas para o Desenvolvimento (PNUD)** conforme contrato firmado entre o PNUD e a CETESB em 19 de agosto de 1996. Os resultados deverão compor o **Inventário Nacional de Gases de Efeito Estufa** a ser apresentado em 1997 a **Convenção Quadro das Nações Unidas sobre Mudança de Clima**.

## GRUPO TÉCNICO

CETESB - Companhia de Tecnologia de Saneamento Ambiental

Avenida Professor Frederico Hermann Junior. 345

CEP.: 05489-900 - São Paulo, SP - Brasil

Telefone: (011) 3030-6156 - 3030-6157 - 3030-6595

Fax: (011) 3030-6401

e-mail: <http://www.cetesb.br>

Sonia Maria Manso Vieira	Coordenação / Execução	<a href="mailto:soniav@cetesb.br">soniav@cetesb.br</a>
João Wagner Silva Alves	Execução	<a href="mailto:joaoa@cetesb.br">joaoa@cetesb.br</a>
Oswaldo dos Santos Lucon	Execução	<a href="mailto:oswaldol@cetesb.br">oswaldol@cetesb.br</a>
Katia Sakihama Ventura	Execução	
Carlos Alberto Sequeira Paiva	Suporte	<a href="mailto:carlossp@cetesb.br">carlossp@cetesb.br</a>
Cibelle Marques Pedrosa	Suporte	
Robinson Tadeu Gomes	Suporte	
Neusa Maria Maciel	Suporte	

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VOLUME V

## 1 INTRODUÇÃO

O inventário de emissões de metano oriundo do tratamento de esgotos e da disposição de resíduos sólidos, em execução pela *Companhia de Tecnologia de Saneamento Ambiental (CETESB)*, segue as recomendações do *Intergovernmental Panel on Climate Change (IPCC)*, *Greenhouse Gas Inventory*, Volumes 1, 2 e 3, respectivamente *Reporting Instructions*, *Workbook*, e *Reference Manual* (IPCC, 1995).

De acordo com o *Reference Manual* as emissões de metano oriundo do tratamento de esgotos são estimadas para dois tipos diferentes de esgotos, segundo a sua origem, que pode ser *Doméstica*, *Comercial* ou *Industrial*.

O IPCC define na metodologia de estimação de emissões de metano oriundo do tratamento desses esgotos diferenciados pela sua origem, dois métodos, para cada um deles: um usando tratamento de dados simplificado (*método A*) e outro usando tratamento de dados detalhado (*método B*).

Por sua vez, a metodologia de estimação de emissões de metano oriundo da disposição de resíduos sólidos, não diferencia os resíduos pela sua origem. São definidas para a estimativa dessas emissões, dois métodos, um usando tratamento de dados simplificado e outro usando tratamento de dados detalhado.

Dessa forma, seguindo a metodologia do IPCC, estão previstas 6 (seis) estimativas de emissões de metano que são:

1. Estimativa de *Emissões de Metano* oriundo do tratamento de resíduos *Líquidos* de origem *Doméstica* ou comercial pelo método A (EMLD<sub>A</sub>) em GgCH<sub>4</sub>/ano,
2. Estimativa de *Emissões de Metano* oriundo do tratamento de resíduos *Líquidos* de origem *Industrial* pelo método A (EMLI<sub>A</sub>) em GgCH<sub>4</sub>/ano,
3. Estimativa de *Emissões de Metano* oriundo da disposição de resíduos *Sólidos* pelo método A (EMS<sub>A</sub>) em GgCH<sub>4</sub>/ano,
4. Estimativa de *Emissões de Metano* oriundo do tratamento de resíduos *Líquidos* de origem *Doméstica* ou comercial pelo método B (EMLD<sub>B</sub>) em GgCH<sub>4</sub>/ano,
5. Estimativa de *Emissões de Metano* oriundo do tratamento de resíduos *Líquidos* de origem *Industrial* pelo método B (EMLI<sub>B</sub>) em GgCH<sub>4</sub>/ano e
6. Estimativa de *Emissões de Metano* oriundo da disposição de resíduos *Sólidos* pelo método B (EMS<sub>B</sub>) em GgCH<sub>4</sub>/ano.

Cada estimativa, de acordo com o *Reporting Instructions*, do IPCC, apresenta a sua correspondente incerteza.

O *segundo relatório* conterà três das estimativas e correspondentes incertezas descritas acima, que são as de números 1, 2 e 3. As estimativas e correspondentes incertezas de números 4 e 5 serão apresentadas no *terceiro relatório*. Quanto à estimativa e incerteza de número 6, a viabilidade da sua execução está sendo avaliada frente aos dados disponíveis no Brasil, sendo que a discussão a seu respeito também fará parte do *terceiro relatório*.

## 2 METODOLOGIA

### 2.1. Levantamento dos Dados Bibliográficos

A bibliografia, apresentada no próximo capítulo, foi definida a partir das bibliotecas da CETESB e do IBGE. A biblioteca da CETESB, especializada em controle de poluição ambiental dispõe de um acervo composto de 24.500 volumes, 14.500 títulos de relatórios técnicos em microficha da *Environmental Protection Agency* (EPA), 492 títulos de periódicos e normas técnicas. A biblioteca do IBGE dispõe dos Censos realizados no Brasil e das diversas pesquisas estatísticas realizadas agregando informações oficiais, que refletem a estrutura do país.

A metodologia proposta pelo IPCC conduz, inicialmente ao levantamento de dados estatísticos para a definição das características populacionais e do parque industrial do país. É necessário conhecer a população nacional em 1990 e a sua fração urbana, além das condições de saneamento em que vive. É necessário conhecer o montante produzido pelas indústrias de transformação do país, bem como o correspondente volume lançado de resíduos, a concentração de matéria orgânica e os recursos de saneamento empregados naquele ano.

Ainda se faz necessário conhecer, da literatura nacional, informações técnicas como a eficiência de remoção de matéria orgânica de cada sistema empregado, as características de degradação dos aterros, a geração potencial de biogás e as oportunidades de recuperação deste gás encontradas naquele ano.

Portanto, para o pleno cumprimento da metodologia proposta foi realizada uma pesquisa bibliográfica de caráter preliminar, que servirá como apoio à estimativa das emissões de metano oriundo dos resíduos no Brasil no ano de 1990.

Inicialmente, foram consultadas algumas bases de dados utilizando-se as palavras-chave: *mudanças climáticas, resíduos sólidos, digestão anaeróbia e metano*. Da consulta a essas bases de dados resultou uma seleção pertinente ao objeto deste trabalho e que em parte encontra-se disponível, como acervo da CETESB ou através dos recursos que a biblioteca dispõe, como o empréstimo entre bibliotecas e o Programa de Comutação bibliográfica (Comut). Foram ainda adquiridos determinados documentos e informações, como os dados de produção do setor da alimentação e bebidas junto à *Associação Brasileira da Indústria Alimentícia* (ABIA). Por fim, muitas informações de caráter técnico são oriundas da participação ativa da equipe de técnicos da CETESB junto a instituições e grupos de trabalhos de especialistas em tratamento anaeróbio.

As bases de dados consultadas foram: Wasteinfo - 1972-12/1995 AEA Technology, Poltox I - 1994 - 12/1995 - Cambridge Scientific Abstracts, Water Resources Abstracts 1967 -01/1996 - Cambridge

Scientific Abstracts, a Environment Abstract e a *Rede Pan-Americana de Informações e Documentação em Engenharia Sanitária e Ciências do Ambiente* (REPIDISCA).

A Wasteinfo - 1972-12/1995 AEA Technology é uma base de dados que contém resumos de relatórios técnicos, monografias, conferências, patentes, teses e mais de 900 jornais. A base de dados inclui informações a respeito de gerenciamento de lodo, resíduos sólidos, líquidos e gasosos, incluindo resíduos comerciais, industriais e domésticos.

A Poltox I - 1994 - 12/1995, é um base bibliográfica de dados que contém referências de materiais publicados no campo da poluição e toxicologia. Poltox é derivado de três diferentes fontes o banco de dados da National Library of Medicine's *Toxline* (TOX), Jornais da *Cambridge Scientific Abstracts* (CSA) e o *International Food Information Service's* (IFIS) *Food Science and Technology Abstracts* (FSTA).

A Water Resources Abstracts 1967 -01/1996 é produzida pela Cambridge Scientific Abstracts. Trata-se de uma base de dados que inclui artigos de jornais, monografias, relatórios e outros formatos de publicações. Esses documentos tratam de recursos de água abordando a forma como são tratados nas ciências físicas e sociais e na engenharia além de abordarem os aspectos legais das características de abastecimento, conservação controle uso e gerenciamento dos recursos d'água.

A Environment Abstract é uma base de dados que contém referências bibliográficas de artigos publicados, relatórios, e trabalhos contendo críticas e informações atuais em todos os aspectos de impacto das atividades humanas e da tecnologia ambiental, incluindo ar, água, poluição sonora, resíduos sólidos e tóxicos, gestão e conservação de recursos energéticos e naturais, contaminação radiológica, crescimento populacional e mudanças climáticas e geofísicas.

A REPIDISCA, da qual a CETESB é coordenadora local, é uma base de dados que funciona descentralizadamente nos 24 países da América Latina e Caribe, conta com 85.000 registros, 900 títulos de revistas especializadas e 3.000 registros de termos técnicos usados em Saúde Ambiental em vários idiomas.

De modo complementar ainda foram consultadas as bibliotecas da *Universidade de São Paulo* (USP).

Além das referências bibliográficas convencionais, também foram consultados os 'WebSites', e seus diversos 'link's' do *Ministério da Ciência e Tecnologia* (MCT) do Governo Brasileiro e o da *Manchester Metropolitan University* da Inglaterra, '[www.http.mct.gov.br](http://www.mct.gov.br)' e '<http://www.doc.mmu.ac.uk/aric/arichome.html>' respectivamente.

## 2.2. Levantamento dos Dados Estatísticos

Os dados estatísticos oficiais do Brasil, de responsabilidade do *Instituto Brasileiro de Geografia e Estatística* (IBGE) de interesse para este inventário enfocam o ano de 1990, tratando de informações a respeito da população brasileira, condições de saneamento, taxa de crescimento e proporção entre habitantes em área rural e área urbana. Todos esses dados são encontrados no Censo Demográfico Nacional de 1991.

Os dados da produção industrial nacional encontram-se no último Censo Industrial Nacional realizado em 1986 e, a respeito do ano de 1990, nos Anuários Estatísticos de 1992, 1993 e 1994. Na ausência de informações tidas como importantes dentre os levantamentos do IBGE, foram utilizados os dados das associações industriais dos diferentes setores de atividade no Brasil como *Associação Brasileira da Indústria Alimentícia* (ABIA), *Associação Nacional de Fabricantes de Papel e Celulose* (ANFPC), *Associação Brasileira da Indústria Química* (ABIQUIM) e *Associação da Indústria Têxtil* (ABIT).

Informações específicas a respeito das condições de saneamento em que vive a população brasileira encontram-se na *Pesquisa Nacional de Saneamento Básico* (PNSB) de 1989.

Como pode ser observado, o Censo Demográfico Nacional foi realizado no ano de 1991, o que leva a necessidade de uma estimativa para a população do país no ano de 1990. Desta forma é válido considerar também os números da *Pesquisa Nacional por Amostra de Domicílios* (PNAD) de 1990, onde é estimada a população nacional daquele ano por meios estatísticos.

Dentre os dados estatísticos da CETESB está a coleção de "Relatórios de *Diagnóstico de Poluição Ambiental, Monitoramento Ambiental e Capacitação de Recursos Humanos e Transferência de Tecnologia*" (Anexo 1) onde, para onze (11) Estados<sup>(1)</sup> (CETESB & PRONACOP, 1989), foram relatados dados das emissões de poluentes industriais. Realizada entre 1988 e 1989, esta coleção de relatórios abordando onze Estados Brasileiros, e que infelizmente não se completou estendendo-se para os demais Estados da República, forma uma amostra significativa do perfil nacional de lançamento de efluentes, feita a exceção para os Estados de São Paulo e Rio de Janeiro.

Além disso, há também, o Relatório do *Sistema de Licenças e Penalidades* (SILP), de controle de poluição industrial da CETESB realizado no Estado de São Paulo no ano de 1990 (Anexo 2). Este relatório, que não é publicado pela CETESB, contém informações confidenciais de caráter

<sup>1</sup> Compõem a coleção de Relatórios de "Diagnóstico de Poluição Ambiental, Monitoramento Ambiental e Capacitação de Recursos Humanos e Transferência de Tecnologia", os Relatórios dos seguintes Estados brasileiros: Bahia, Ceará, Minas Gerais, Goiás, Rio Grande do Sul, Pará, Pernambuco, Santa Catarina, Maranhão, Espírito Santo e Paraná.

ambiental das principais indústrias do Estado de São Paulo, abrangendo 85% da geração de efluentes.

Resguardando o caráter confidencial das informações que compõem o SILP, foram selecionadas para a elaboração da estimativa proposta neste inventário:

Tipo de efluente,

Quantidade de efluente lançado potencialmente pela indústria, baseado em fatores de emissão,

Emissão remanescente, também baseada em fatores de emissão,

Efluente amostrado,

Número de funcionários,

Código de atividade do IBGE e

Descrição da atividade.

O Código de atividades apresentado neste relatório pode ser interpretado de maneira simplificada considerando-se apenas os dois primeiros algarismos, de cada código. A seguir está definida a atividade industrial a que se refere cada código:

Código de atividade	Descrição
00	Extrativas
10	Minerais não metálicos
11	Metalúrgica
12	Mecânica
13	Material elétrico
14	Material de Transporte
15	Madeira
16	Mobiliário
17	Papel e papelão
18	Borracha
19	Couro e peles
20	Química
21	Produtos farmacêuticos
22	Perfumaria e sabões
23	Produtos e matérias plásticas
24	Têxtil
25	Calçados e artefatos de tecidos
26	Produtos alimentares
27	Bebidas
28	Fumo
29	Editorial e gráfica
30	Diversos
31	Utilidade pública
40	Agrícola e criação animal
51	Transportes
52	Alojamento e alimentação
53	Reparação e manutenção
54	Serviços pessoais
55	Serviços comerciais
56	Serviços de diversões
59	Entidades financeiras

Continuação

Código de atividade	Descrição
60	Comércio atacadista
61	Comércio varejista
63	Loteamentos
70	Cooperativas
80	Fundações e associações
90	Administração pública
99	Outras atividades

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**CONGRESSO BRASILEIRO DE ENGENHARIA SANITÁRIA E AMBIENTAL (17., 1993: Natal)**

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CATUNDA, P.F.C., HAANDEL, A.C.V., HIDALGO, N.D. Pós-Tratamento em Lagoas de Estabilização de Esgoto Digerido Anaerobiamente.

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**CONGRESSO BRASILEIRO DE ENGENHARIA SANITÁRIA E AMBIENTAL (18:1993: Salvador)**

NEDER, K.D. et al Reator Anaeróbio compartimentado seguido de filtro intermitente. ETE torto, uma solução de baixo custo.

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