Ministry of Environment and Energy
Environmental Quality Management Direction

National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (POPs) Management in Costa Rica

2015

Stockholm Convention on persistent organic pollutants (POPs)

gef

UNIDO

FOREWORD

Nine years ago, Costa Rica started a commitment, within the Stockholm Convention framework, to make a continuous effort aimed at reducing or eliminating the so called persistent organic pollutants (POPs). These components represent a threat to health and the environment due to their persistence in the environment, easy transportation, bioaccumulation and toxicity.

In 2009, the first National Implementation Plan (NIP) for the Stockholm Convention considered both the elimination of 12 pesticides used in agriculture such as polychlorinated biphenyls (PCBs), which are used in the electric industry, and the decrease of unintentional emissions of dioxins and furans.

Since then, new substances to eliminate were added to the Stockholm Convention list. Among these were endosulfan insecticide and a number of products for industrial use that are also classified as POPs. This addition of new substances raised the need to update the National Plan, that is being presented here, which involves actions to be taken between the years of 2015-2020.

A distinguished group of experts has designed this plan with the valuable collaboration and participation of individuals from the public and private sectors who are somehow involved with the use or handling of these substances.

Compared to the previous one, this new plan is more complex, since many of the new POPs are difficult to identify and control. The reason for that is because they are part either of a wide range of everyday use products or of a production process where users often ignore such substances are present. This implied a significant methodological challenge which first stage has been satisfactorily overcome through the development of inventories and proposals for action presented in this document.

This plan, besides addressing this international commitment, allows the country to move forward to key execution points of the brown agenda, that is, the handling of environmental pollution which might pose a danger to human health and the environment.

It is important to emphasize that, in the establishment of this plan, we have been guided by a definition of national priorities that are aligned with the Strategic Approach to International Chemicals Management (SAICM). This approach reinforces the United Nations Environment Program worldwide.

In implementing the Stockholm Convention, the Rotterdam Convention, and the Basel Convention, all of which are related to hazardous chemicals management, the importance of the stakeholders' joined efforts to improve the efficiency and efficacy of the battle for a healthier environment stands out at an international level. This same approach of collaboration and participation of all stakeholders is essential at the local level to know the hazard that these substances pose to environmental sustainability and human health. This way, with everyone involved, actions can be taken towards eliminating and substituting those substances for products and productive processes that are less harmful and more environmentally friendly.

This is why we encourage participation from all stakeholders involved in the management of chemicals, especially those from the agriculture and industrial sectors, and from academia, cooperation agencies and public institutions with knowledge of the topic, all of this in an effort to lead this plan to success.

The implementation of this plan poses great challenges as a country, such as a modern legislation, which is aligned with the new requirements in terms of POPs, more efficient information systems, strengthened capabilities in handling this topic both in the private and public sectors, and the spreading of information among individuals on POPs management.

All the actions described in this plan can only be taken with everyone's joined effort. These actions one way or another represent the expectations and dreams of many people who, just like us, make an effort to achieve social, economic and ecological sustainability, which is a fundamental principle to sustainable development.

Dr. Édgar Gutiérrez Espeleta
Minister of Environment and Energy

COMMENDATIONS

NATIONAL PROJECT MANAGEMENT
Licda. Shirley Soto Montero (DIGECA)

PROJECT COORDINATION COMMITTEE
PhD. Elidier Vargas Castro
MSc. María del Mar Solano Trejos
Lic. Jose Alberto Rodríguez Ledezma
Licda. Manuela Mata Zúñiga

NATIONAL PROJECT COORDINATION
MSc. Luis Diego Jiménez Góngora – National technical coordinator
Licda. Priscilla Quesada Solano – Administrative coordinator

RESEARCH TEAM
PhD. Floria Roa Gutiérrez – Unintentional POPs inventory
PhD. Luis Guillermo Romero Esquivel – Unintentional POPs inventory
Máster Noemy Quirós Bustos – Unintentional POPs inventory
Máster Gerardo Barrantes Moreno – Socio-economic study
MSc. Bernardo Mora Gómez – Pesticides POPs inventory
Máster Rolando Castro Córdoba – Update to regulation on chemicals
Licda. Alejandra Fernández Sánchez – Industrial POPs inventory
Licda. Georgina Jiménez Elizondo – Integrated PCB Management Project
Inga. Anna Ortiz Salazar – Integrated PCB Management Project

EDITOR
Marcela Eugenia Hidalgo Solís

PUBLISHING PRODUCTION
Roxana Marín Segura
(506) 8392-6650

ISBN: 978-9977-50-121-5

ACKNOWLEDGEMENTS

We would like to thank the public institutions, non-governmental organizations, the academia, companies, laboratories, authorized environmental managers, and representatives from business chambers, for their help in the development of the National Implementation Plan (NIP) for the Stockholm Convention. Their collaboration has made it possible for this country to advance in terms of environment topics as important as integral POPs management.

We also thank the Global Environment Fund (GEF), the United Nations Industrial Development Organization (UNIDO), and the United Nations Development Program (UNDP-Costa Rica), for their financial, technical and administrative support during the execution of this project.

TABLE OF CONTENTS

INDEX OF TABLES

INDEX OF FIGURES

EXECUTIVE SUMMARY

According to Costa Rica's established commitment on adhering to the Stockholm Convention, approved by Law 8538, on August 23, 2006, and ratified by executive decree number 33438, from November 2006, the National Implementation Plan (NIP) for topics related to the existence of Polychlorinated Biphenyls (PCB), generation of dioxins and furans, existence of POP pesticides and those which are expired, institutional and legal strengthening, and citizens' awareness and communication.

In the NIP, 10 new pollutants have been incorporated into the inventories, considering the fourth and fifth meetings of the parties of the Stockholm Convention which took place in 2009 and 2011 respectively. The state of this situation is updated as far as the regulations associated to POPs.

From the update of the inventories of these POPs, 2013, it is stated that all the components from the initial list of POP pesticides are regulated by different regulations. As far as the new POP pesticides, registered products are found such as endosulfan, sulfluramid (compound associated with the PFOS and used as formicide and lindane), from which only a register was found at the Ministry of Health (MINSALUD, Spanish acronym), and corresponds to a chemical reagent used as an "analytical standard" in chemical analysis processes. In the case of pentachlorobenzene, no regulations were found that restricts its use in Costa Rica, neither were imports registered for it.

The use of endosulfan is allowed in the country as long as established rules on 34782-S-MAG.MINAET are followed. This set of regulations states that pesticides with endosulfan are only sold with a professional prescription, issued in official forms by a person registered at the Costa Rican Association of Agronomists. The agricultural use of endosulfan is only

allowed in liquid formulations or micro-capsulated that have a concentration of 35% of active ingredient or less.

In terms of importation and exportation, about 165 845 kg of active ingredient have been imported into the country since 2008, and 32 872 kg have been exported. This means that 80,2% of imports are destined for domestic consumption, this equals about 132 973 kg of active ingredient, which in turn equals about 379 922 L of formulated products.

In regards to the new POP pesticides, with sulfluramid only two products registered were found in the country: Mirex-S 0,3 GB y Blattanex Gel. In total, since 2008 623 kg of sulfluramid active ingredient have been imported, which equals around 207 000 kg of finished product Mirex-S 0,3 GB.

In the category of industrial POPs, the polybrominated diphenyl ethers, which are two commercial mixtures that have Octabromodiphenyl ether (c-octaBDE) and Pentabromodiphenyl ether (c-pentaBDE), were included in the 2013 inventory. Of these compounds, the c-octaBDE is present in electrical and electronic appliances (EEE) and their waste (WEEE), whereas the c-pentaBDE is found in polyurethane foams used in vehicles.

Given the fact that Costa Rica does not have an inventory for EEE/WAEE, the one for c-octaBDE focused on monitors and televisions CRT as major historical reservoirs for these compounds. With this equipment as a starting point, calculations were made based on data from net proceeds (imports/exports), possession in households, public institutions and private companies, as well as quantities of WAEE that get in the stream of waste management and recycling. The inventory determined an estimated 17 595 kg of c-octaBDE in 2013, from which 90% of AEE is in consumers' use.

In regards to the c-pentaBDE, it was detected that its main use in the country was in vehicles manufactured between 1975 and 2004. This constitutes 72% of the vehicle fleet registered in 2013. The c-pentaBDE inventory was of 8 376 kg in 2013, and such quantity was determined by adding up all the vehicles in circulation manufactured in the affected range (1975- 2004) plus the quantity reported of those that have deregistered, which are now allegedly part of the residue stream.

In the same category of industrial POPs, the perfluorooctanesulfonic acid (PFOS), its salts and the perfluorooctanesulfonyl fluoride (PFOSF), were also included in the 2013 inventory. Considering that these compounds have a wide range of uses, because of their surface active properties that protect surfaces from the effect of water and oils residues, among other uses, for the purpose of this inventory were analyzed both activities that imply the use of these substances as part of their production process in the industrial sector, and also products of mass consumption that could have it.

Among the activities that use these compounds as part of their production process, the following were analyzed:

1. Electronic compounds: the material safety data sheets (MSDS) from two companies that import additives and from nine manufacturers of electronic compounds (which use PFOS as media for etching baths) were reviewed. No evidence was found that the substances were used.

2. Metallic coatings: 12 SMEs were asked about the use of PFOS in the chrome plating process and, by reviewing the MSDS from two of these companies, the use of PFOS as antifoaming agent in acid chrome baths was discarded.

For massive consumption products that may have it, the following were analyzed:

1. Firefighting Foams: After asking Costa Rican firefighters and their foam products suppliers, no evidence was found that they use PFOS products.

2. Food packaging: Investigation on graphic industry associations and packaging manufacturers led to finding no evidence of the use of PFOS products, due to a self-regulation from the industry.

3. Carpets: Four companies that import carpets were interviewed, where the PFOS is protective against stains, but no evidence was found of the use of PFOS products.

In the category of unintentional POPs, the inventory includes the results obtained by using the calculation tool provided by the PNUMA in its reviewed version from 2013 (UNEP, 2013). This tool includes new categories and subclasses, as well as modifications to the equivalent conversion factors, in some of the categories reported in the first inventory of 2005.

Dioxins and furans emissions showed that, in 2013, Costa Rica produced 271 g TEQ, which corresponds to 57,5 µg TEQ/inhab. The groups with more emissions in 2013 were group 6 (open field burning), with a 73,5% and group 9 (final residue disposition), with a 21,1%. Those two groups contribute to 95% of total emissions.

In 2005, it was reported that groups 6 and 9 (same as 2013 inventory) represent 97% of emissions corresponding to 157 g TEQ. Therefore, we have an increase of 58% compared to emission per capita reported in 2005 (36,3 µg TEQ/inhab).

In the legal and institutional framework section for POPs management in Costa Rica, we identified the national and international legislation that applies to these compounds, as well as the analysis of the legal weaknesses related to their management, as per the requirements of the Stockholm Convention.

Based on a costs structure that included transportation, supply, packaging and exportation, plus profit, a range of 0,50-0,60 US$/kg of WEEE was determined. With an average cost of 0,55 US$/kg, it is claimed that the investment for total EEE inventory for 2013 equals 30,5 million US$.

In sum, the National Implementation Plan for the Stockholm Convention posts the following:

1. Results from inventory updates in initial POPs reported in 2009 NIP.

2. Results from inventory in new POPs.

3. Review of the legal and institutional framework for POPs management in Costa Rica.

4. Recommendations and action plans that establish a commitment in order to improve POPs management in Costa Rica.

INTRODUCTION

This first update of the NIP was triggered by the decision taken in 2009 on the fourth meeting of the Conference of the Parties, to change the Stockholm Convention on persistent organic pollutants (POPs) by including nine new substances. In annex A: alpha hexachlorocyclohexane, beta hexachlorocyclohexane, chlordecone, hexabromodiphenyl, hexabromodiphenyl ether and heptabromodiphenyl ether, lindane, pentachlorobenzene (also in annex C), tetrabromodiphenyl ether and pentabromodiphenyl ether. Annex B includes: pentadecafluorooctanoic acid (PFOS) and its salts and perfluorooctane sulfonyl fluoride. In addition, in their fifth meeting, the parties do another change to the convention, in annex A, by including endosulfan and its salts.

Due to these changes, each party is responsible for reviewing and updating their NIP. This process will make it possible for Costa Rica to establish inventories of products and items that have the 10 new substances and to identify the industrial processes where these new persistent organic pollutants (POPs) are used or unintentionally produced.

In 2009, Costa Rica submitted to the Stockholm Convention Secretariat its first National Implementation Plan, which describes the different action plans on PCB, pesticides, dioxins and furans, plus cross-cutting topics, such as the legal and institutional strengthening in an effort to comply with that established by the Convention.

Among the actions is one of the most important projects in regards to POPs management and focused on the integral management of PCB, which is under implementation at the present time, and will last four years. One of its main objectives is creating an inventory, searching for options for treatment or destruction, and the strengthening of the national capacity for PCB management and analysis.

As far as pesticides, a unit has been designated for registration in the country which purpose is to perform an Eco toxicological evaluation, where one of the aspects to consider is persistence of pesticides. Such process allows to define the necessary actions to be taken when using or managing new pesticides, and also when restricting or prohibiting their use, when necessary.

For unintentional POPs, specifically dioxins and furans, the implementation has been slightly slower. There are established parameters for emission of dioxins and furans in cement kilns. As far as open field burnings, especially burnings of biomass in agriculture, the regulations controlling this activity states that a gradual plan will be put in place to reduce it and eliminate it.

In the present NIP, the inventories have been updated for previous substances and for the recently included ones, reason why the different stakeholders were interviewed: public institutions, academia, companies, which have been involved in different moments of the creation of the inventories.

Beside the inventories, a legal study was performed to identify the regulations that require some modification, or if it is necessary to create new ones, despite the actions to implement. In case of an update taking place, it will be necessary to have inter-institutional participation, since the topics under discussion are interdisciplinary.

Objective

Strengthen the national capacity for persistent organic pollutants (POPs) management through review and update of the National Implementation Plan (NIP) for the Stockholm Convention.

1.1. NATIONAL CONTEXT

1. NATIONAL CONTEXT

1.1. Geography

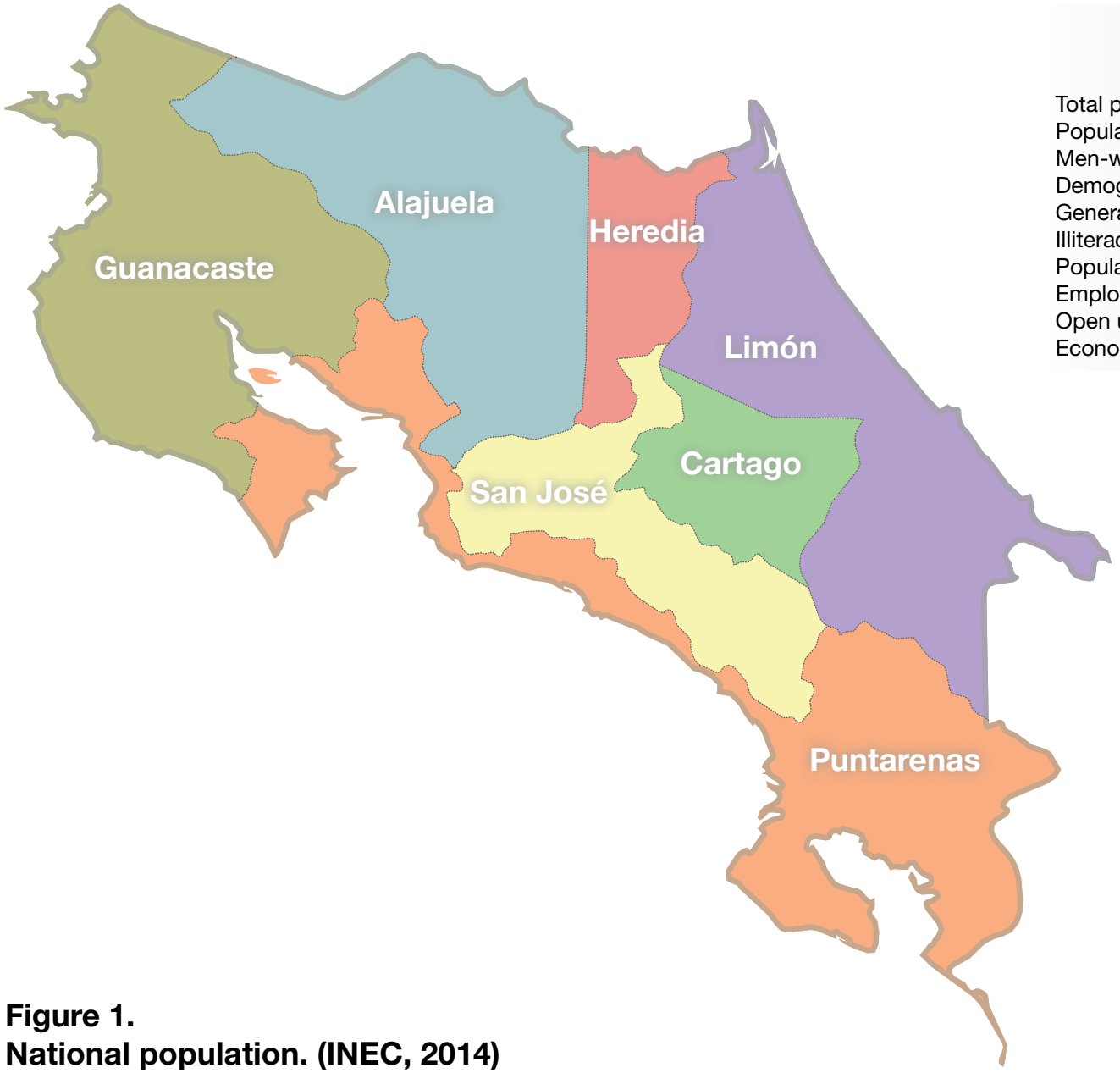
Costa Rica is considered one of the 20 countries with the greatest biodiversity in the world, with an area of only 51 100 km^2 (0,03% of the world's total) and 589 000 km^2 of territorial waters. (INBIO, 2015). It is located between the geographic coordinates 8° 03' and 11° 13'of north latitude and 82° 32' and 85° 57' of west longitude, including its insular area.

Its privileged geographical location, as it has two coast and a mountain range that provides many and diverse microclimates, is one of the reasons that explains this natural wealth, including not only species but also ecosystems. Next to Belize and El Salvador, Costa Rica is one of the smallest republics in Central America. It borders Nicaragua to the north, Panama to the south, the Caribbean Sea to the east and the Pacific Ocean to the west.

The coast length is 1 228 kilometers of which 1 016 are in the pacific coast and 212 are in the Caribbean Sea (BCIE, 2014). The pacific coast has irregular landforms: peninsulas, gulfs and bays that help in the establishment of harbor areas. On the other hand, the Caribbean coast is more regular but less suitable for this type of installations. In both of them, the harbor commerce is developed as Puerto Limon is located in the Caribbean coast and Caldera is located in the Pacific.

1.2. Demographics

Costa Rica has a population of 4 301 712 people which is divided by gender in the following way:
2 106 188 men and 2 195 524 women (INEC, 2011).
Additionally, it is important to mention that there is a moderate density of 92 inhabitants per km^2.



Provinces of Costa Rica

Census 2011, country total

Total population:	4 301 712
Population density:	84,4
Men-women relative rate:	95,9
Demographic dependency ratio:	47,2
General fertility rate:	1,4
Illiteracy rate:	2,4
Population aged 15 or more:	3 233 882
Employment rate:	51,7
Open unemployment rate:	3,4
Economic dependency ratio:	1,5

Figure 1.
National population. (INEC, 2014)

San José, Census 2011	
Total population:	1 404 242
Population density:	282,8
Men-women relative rate:	91,6
Demographic dependency ratio:	44,4
General fertility rate:	1,3
Illiteracy rate:	1,5
Population aged 15 or more:	1 087 315
Employment rate:	54,1
Open unemployment rate:	3,5
Economic dependency ratio:	1,3

Heredia, Census 2011	
Total population:	433 677
Population density:	163,2
Men-women relative rate:	95
Demographic dependency ratio:	42,9
General fertility rate:	1,3
Illiteracy rate:	1,6
Population aged 15 or more:	334 474
Employment rate:	55,6
Open unemployment rate:	2,9
Economic dependency ratio:	1,3

Alajuela, Census 2011	
Total population:	848 146
Population density:	86,9
Men-women relative rate:	98,5
Demographic dependency ratio:	48,1
General fertility rate:	1,5
Illiteracy rate:	3
Population aged 15 or more:	632 572
Employment rate:	51,3
Open unemployment rate:	3
Economic dependency ratio:	1,5

Guanacaste, Census 2011	
Total population:	326 953
Population density:	32,2
Men-women relative rate:	98,2
Demographic dependency ratio:	50,9
General fertility rate:	1,6
Illiteracy rate:	3
Population aged 15 or more:	241166
Employment rate:	45,4
Open unemployment rate:	4,2
Economic dependency ratio:	1,9

Limón, Census 2011	
Total population:	386 862
Population density:	42,1
Men-women relative rate:	100,2
Demographic dependency ratio:	54,7
General fertility rate:	1,3
Illiteracy rate:	1,7
Population aged 15 or more:	270 157
Employment rate:	48,3
Open unemployment rate:	4,3
Economic dependency ratio:	1,8

Cartago, Census 2011	
Total population:	490 903
Population density:	157,1
Men-women relative rate:	96,3
Demographic dependency ratio:	45,2
General fertility rate:	1,4
Illiteracy rate:	2,1
Population aged 15 or more:	372 280
Employment rate:	51,7
Open unemployment rate:	3,2
Economic dependency ratio:	1,5

Puntarenas, Census 2011	
Total population:	410 929
Population density:	36,5
Men-women relative rate:	100,5
Demographic dependency ratio:	53
General fertility rate:	1,7
Illiteracy rate:	3,8
Population aged 15 or more:	295 918
Employment rate:	47,3
Open unemployment rate:	3,3
Economic dependency ratio:	1,8

1.3. Political Profile

Even though, Costa Rica has a small area and population, it stands out for its solid democratic and republican system. It has a president and two vice-presidents who are elected directly by the universal and secret vote for a period of four years. They can be reelected for another period but not in a consecutive way. Additionally, the vice-president can be presidential candidate after four years out of the position (Sibaja, 1949).

The Legislative Branch is practiced by the Legislative Assembly. It is formed by 57 representatives. They are elected directly by the universal and secret vote, according to the electoral district system and the national list. The legislators are elected for a period of 4 years (Obregon, 1995).

The Judicial Branch in Costa Rica is formed by the judges and the magistrates of the Supreme Court of Justice. It has 3 action areas: 1) Judicial, 2) justice auxiliary, and 3) administrative. Its role is to administrate the justice and make sure the constitutions and laws are obeyed.

1.4. Economic sectors profile

During the last years, Costa Rica has diversified its traditional agricultural industry venturing in the specialized manufacture and increasing its offer of services, especially the ones related to business services and tourism. Besides that, it has had a policy of open market based on the export promotion which has been diversified. During the last years, the attraction of high-tech companies and companies from the medical sector has increased the export growth.

In 2013, the GDP at current prices was estimated at 49 236,71 billion dollars (BCCR, 2015). The principal economy sectors in Costa Rica include: industrial production (high technology), and all the sectors related to tourism (commercial sector, hotels, and restaurants, among others), agriculture, silviculture, and fishing. As a result of the diversification, the composition of the exportations in Costa Rica has greatly changed. In 2013, 74% were goods and 26% were services and the ones related to tourism standing out with 14%.

Also, Costa Rica is a world leader in ecotourism. This sector has been developed thanks to the variety of animal and plant species found in the territory where most of them are under the system of conservation areas by means of public and private reserves.

1.5. Environmental Profile

During the last 25 years, the environmental policies in Costa Rica has been oriented to consolidate efforts related to the use, protection and conservation of the natural resources, focusing on protected areas and power generation from renewable sources (MIDEPLAN, 2010).

Now, the creation of abilities to join the environmental policy with the national development strategies has allowed to reinforce cross-sectoral planning framework ensuring the leadership on the sustainability of the national development plans. It is expected that a management system of environmental policy in this direction, provides a greater clarity on the total investments that this country carries out in this matter.

However, despite the improvements already mention, it is important to point out that in the last report of the Environmental Performance Index of the Yale University (EPI), Costa Rica scored 54 in 2014 from an overall rank of 178 countries which means a loss on the score number 5 it obtained in 2012 (EPI, 2014). Although, this is explained on the change in the methodology used to calculate this index.

The result highlights the challenges faced by the country in sustainable development matters (MIDEPLAN, 2014):

1. preservation of water resources,
2. rational utilization of the marine resources,
3. waste management,
4. adaptation and mitigation mechanism facing the climate change,
5. land management,
6. use of clean energies to reduce the dependency on the fossil fuels,
7. and the environmental culture and education reinforcement.

Also, it is a significant challenge to enforce the law and that the institutional framework achieves a better environmental resource management, joining environmental sustainability and economic and social development.

2. LEGAL AND INSTITUTIONAL FRAMEWORK

2. LEGAL AND INSTITUTIONAL FRAMEWORK

This chapter presents an analysis of the national and international legislation applied to persistent organic pollutants and also the legal weaknesses related to the management of POP's in accordance with the compliance of the Stockholm Convention on Persistent Organic Pollutants.

2.1. International Conventions

Costa Rica is part of three international conventions that have an important impact on the subject: Stockholm Convention on Persistent Organic Pollutants, Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, which establish obligations to the countries that are part.

The Stockholm Convention on Persistent Organic Pollutants was adopted in Stockholm, Sweden on May 22th, 2001 and it was approved by Costa Rica through Act Nº. 8538 on August 23rd, 2006, ratified by Executive Decree Nº. 33438 on November 6th, 2006.

Costa Rica´s obligations for being part of this Convention are:

- Prohibit the production, import and use of POPs (Article 3.1).
- Allow POP exports for its environmentally sound disposal.
- Develop and implement an action plan aimed at identifying, characterizing and addressing POP unintentional releases listed in Appendix C (Article 5).
- Develop appropriate strategies to guarantee that the POP products and its residues requirements, management, collection, transportation and storage are conducted in an environmentally sound manner and its disposal in a way that the content of the persistent organic pollutant is destroyed or transformed in an irreversible manner. Also, identify POP contaminated sites and in case of sanitation of those sites, it must be done in an environmentally sound manner. Similarly, guarantee that the POP is not carried through international borders without taking into account international rules, standards and guidelines (Article 6).

- Incorporate the national application plans for POP and the strategies for sustainable development whenever applicable.
- Raise the awareness of supervisors in charge of establishing policies and making decisions about POPs by communicating to the public all information available for POP, developing and applying public outreach programs on the effects on health and the environment and its alternatives. Encourage the industrial and the professional users to promote and facilitate the provision of information (Article 10).

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was signed on March 22nd, 1989 in Basel, Switzerland and it was approved by Costa Rica through Act N°.7438 on October 6th, 1994. Other types of waste are also included with the aim to control the illegal trafficking of hazardous waste, which can be hidden as not hazardous.

The member States to this Convention have the following obligations:

- Ensure that the generation of hazardous waste and transboundary movements be reduced to a minimum (Article 4.2.a).
- Establish proper facilities for the disposal of hazardous waste in an environmentally sound manner (Article 4.2.b).
- Not to export waste if the importing country has not given its written consent or if it is prohibited by law (Article 4.2.e).
- Ensure that the participants in waste management take the necessary measures to avoid any contamination or to reduce its consequences in human health and the environment (Article 4.2.c).

To perform a transboundary movement, the following requirements should be fulfilled:

- There should be a contract between the exporter and the remover (person that manages the waste), which outlines an environmentally sound plan for the waste to be sent (Article 6.3.b).
- The waste should be accompanied by a document describing them and they should be packed, labelled and carried according to international uses (Article 6.7.c).
- One written notification and consent can cover several shipments in a period of twelve months (Article 6.8).

- The States of import (recipients) of waste can demand that all imports be accompanied by its insurance, surety or warranty (Article 6.11).
- The movement should only be done if the State of the import does not have the technical skills, required services nor proper waste sites to dispose the waste in an environmentally sound manner or in cases in which the waste are necessary raw material for the recycling industries of the import State (Article 6.9.a).

The parties can impose additional requirements according to the provisions of the Basel Convention and in accordance with the international law to improve the protection of human health and the environment from an inappropriate management of this type of waste (Article 6.11).

The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade was adopted in Rotterdam, Holland on September 10th, 1998 and it was approved by Costa Rica through Act Nº.8705 on February 13th, 2009. It was ratified by Executive Decree Nº.35416 on June 30th, 2009.

This convention´s aim is to protect human health and the environment from possible harm due to the international commerce of certain hazardous chemicals and to contribute to the environmentally sound use by facilitating the exchange of information about its characteristics and by establishing a national process for imports and exports, decision-making and disseminating decisions to the involved Parties. This applies to the chemical prohibited products or severely restricted and the extremely hazardous pesticides formulations.

Following are some the obligations of member countries:

- Inform the Secretariat when a regulatory action has been adopted for the products subject to this Convention (Article 5.1).
- Apply the necessary legislative or administrative measures to guarantee the appropriate adoption of decisions related to the import of chemical products listed in Appendix III (Article 10.1). This decision can allow the import, not allow the import or allow the import with some specific conditions.

- Facilitate the interchange of scientific, technical and legal information related to the chemical products included in the scope of application of the present Convention, including toxicological, ecotoxicological and safety information (Article 14.1).
- Establish and reinforce the infrastructure of national institutions for the adequate application of the present Convention. These measures can include: the establishment of records and national databases including information related to the safety of chemical products, the encouragement of industrial initiatives to promote the safety in the use of chemical products and the promotion of voluntary agreements (Article 15.1).
- Ensure that the public has adequate access to information about the handling of chemicals, accident management and safer alternatives to human health and the environment (Article 15.2).

2.2. Institutional Framework

Before analyzing the Costa Rican legal framework related to POP, it is necessary to get to know the existing institutional structure for the application of this Convention, as well as the responsibilities of the institutions part of this structure, the possible spaces for coordination and the overlaps between them.

2.2.1. Ministry of Environment and Energy

In accordance with its constitutional law, the Ministry of Environment and Energy (MINAE) is in charge of formulating, planning and implementing policies related to natural resources and environment protection of the Government of this Republic. Likewise, the MINAE is in charge of the control, audit, promotion and development of the field mentioned.

The MINAE is the responsible national authority in charge of coordinating the actions derived from the application of Stockholm Convention, according to article 5 of the Executive Decree N°.33104, therefore, it is the entity with the jurisdiction to establish prohibitions, allow exports, and determine an action plan and the strategies for the POP management. Similarly, regarding hazardous residues (MINAE, 2013, Article 13), the MINAE has the following responsibilities:

- Support the Ministry of Health (MINSALUD), in the formulation and implementation of the National Policy for the Management of Hazardous Residues and the National Plan of the Integrated Management of Hazardous Residues, as well as to evaluate and adapt them regularly.

- Inform promptly to the public and private entities of the guidelines in relation to the compliance with international conventions about hazardous residues at a national level.
- Promote in coordination with MINSALUD, the creation of specific regulations for hazardous residues, according to the productive sectors that generate it.
- Establish the Pollutant Release and Transfer Register (RETC, Spanish acronym).
- Exercise the functions of the Environmental Impact Assessment Comptrollership for the hazardous residues management sites, included in Act N°.7554 on October 4th, 1995 "Environment´s Organic Act" and to establish by way of regulation, the specific requirements and procedures for those sites.

The MINAE has two entities with the expertise in this area: General Direction of Environmental Quality (DIGECA, Spanish acronym) and Environmental Comptrollership.

In accordance with the Organic Regulation of the Ministry of Environment and Energy (Executive Decree N°.35669-MINAET on December 4th, 2009 and its reforms), following are some of functions of the DIGECA:

- Validate technical standards and regulations of environmental quality which aim to avoid water, air or soil pollution.
- Manage the establishment of mechanisms and processes of quality control.
- Coordinate the design and implementation of pollution detection mechanisms.

The Environmental Comptrollership was created by the Environmental Organic Act in its article 102, ascribed to the office of Ministry of Environment and Energy. Its responsibility is to monitor the correct application of the objectives of this law and other laws related to the environment. Similarly, it is obliged to denounce any violation of this law and report it to the Environmental Office and Public Prosecutor. Its responsibilities were established in the Executive Decree N°.25802-MINAE on April 26th, 1996.

In accordance with the Regulation of the Handling of Industrial Hazardous Residues (Decree N°. 27001-MINAE on April 29th, 1998) and the Regulation of General Classification and Management of Hazardous Residues (Executive Decree N°. 37788-S-MINAE on February 15th, 2013), the monitoring of hazardous residues is shared with the Ministry of Health and the Comptrollership.

2.2.2. Ministry of Health

The Ministry of Health (MINSALUD) is the governing body of public health; it is responsible for protecting the environmental conditions that can risk human health.

The Ministry of Health establishes the policies, regulations, technical regulations and it has control over topics related to hazardous products, pesticides, handling of residues and atmospheric pollution.

Similarly, it is the legal and responsible national entity in charge of coordinating the actions derived from the application of Basel Convention (Article 4, Executive Decree N°.33104); it also processes the permits for exports of hazardous residues such as POP.

Regarding residues, in accordance with Law for Integrated Management of Hazardous Residues (Law 8839), the Ministry of Health leader is the rector for addresses, monitoring, assessment and control. The leader is also accountable for encouraging and implementing the coordination between institutions, especially between the MINAE and MAG.

2.2.3. Ministry of Agriculture and Livestock

The Ministry of Agriculture and Livestock (MAG, Spanish acronym) has a Phytosanitary Government Service (SFE, Spanish acronym), which has functions and responsibilities documented in article 5 of the Law N°.7664. The "Phytosanitary Protection Law" mandates that the marketing of agrochemicals comply with the current technical and legal regulations and seeks to protect human health, biodiversity and the compliance of the phytosanitary regulations that apply for the national and international marketing of vegetables.

Furthermore, it is the legal and responsible national entity in charge of coordinating actions derived from the application of Rotterdam Convention (Article 6, Executive Decree N°.33104) that controls the imports of pesticides and prohibits the entry of hazardous pesticides.

2.2.4. General Directorate of Customs of the Ministry of Finance

The Department of Finance - General Directorate of Customs objective is to obtain a timely and effective control of the import and export of goods to the national territory, protecting the interests of the community such as health, safety and the environment (Department of Finance, 2014). The General Customs Law (N°.7557 on October 20th, 1995) states that the General Directorate of Customs is the national hierarchical superior body of customs, which it is in charge of the technical and administrative functions of customs and creating policies and regulations for the activities of customs and related departments.

It is accountable for the implementation of international conventions and the national legislation of POP, in cooperation with other ministries, which inform Customs of the prohibitions or restrictions for the import of specific products through technical notes.

With the aim to obtain better control of products and residues that come in and out of the country, the Law for Integrated Management of Hazardous Residues stated in its article 36 that the General Directorate of Customs should have an inspection plan in the site in order to verify in the field the concordance between what it was declared versus what is packed. Therefore, the law authorizes the Directorate or the inspectors of the Ministry of Health, once properly identified, to implement a verification scheme for imports and exports, which can be a seal or something similar. However, as of 2015, the import of residues and recoverable materials will be subjected to an immediate verification process for the declared goods, thus no selective and random verification process will be applied.

2.2.5. Occupational Health Council

The Labor Risk Law (N°.6727 on March 24th, 1982) created the Occupational Health Council (CSO, Spanish acronym) as a technical entity ascribed to the Ministry of Labor and Social Security, whose function is to provide the best occupational health conditions in all work centers within the country, perform studies and investigations in the field and promote the necessary regulations to guarantee appropriate working conditions in all work centers.

The Council is composed of representatives of different sectors, for example, Ministry of Labor and Social Security, Ministry of Health, National Insurance Institute, Caja Costarricense de Seguro Social *(Costa Rican Department of Social Security)*, as well as employers and employees (Article 275).

2.2.6. Technical Coordination Secretariat for Chemical Substance Management

It was created by Executive Decree Nº.33104 on January 2nd, 2006 and it is viewed as *"a support body for the competent and national focal point authority of the different conventions as well as linked authorities, whose aim is to promote an effective and efficient conveyance of the topic of chemical substances at a national level".* Therefore, it is a body for coordination between institutions and sectors, as well as platform for synergies between the Stockholm, Basel and Rotterdam conventions.

It is composed of representatives of the following or sectors:

- Ministry of Agriculture and Livestock.
- Ministry of Health.
- Ministry of Environment and Energy.
- Ministry for Foreign Affairs and Worship.
- Custom Services of the Ministry of Finance.
- Occupational Safety Council.
- Non-governmental organizations (NGO).
- Union of Private-Sector Chambers and Associations.
- National Council of Rectors.

The established functions of the Secretariat are to ensure and support:

- The ratification, implementation and follow-up of the chemical substances management related conventions.
- The policies, strategies, programs and actions for the chemical substances management in the country.
- The actions of national authorities and focal points of the different conventions and other international entities regarding chemical substances management.
- The national authorities and the follow-up of adopted resolutions and recommendations by the conferences of the parties of chemical substances.
- The national authorities in charge of the dissemination of information generated at the different conventions and conferences of the parties.

- Technical and legal recommendations related to the bills and technical regulations of chemical substances.
- Actions plans created by the related ministries.

2.2.7. Pesticides Registration and Control Department

The Pesticide Registration and Control Department was created through Executive Decree Nº. 36549-MAG-S-MEIC-MINAET on April 28th, 2012 to register pesticides of agricultural use, contributory and related substances. Its main purpose is to receive, process and resolve the registration requests together with other entities such as MAG, MINSALUD and MINAE.

This department is physically located in the Phytosanitary Government Service; it is composed of the mentioned ministries, which are in charge of resolving the registration requests according to the ministry that they represent. Each ministry should nominate a coordinator, who will be accountable for verifying the technical reports and to communicate the final decision to the SFE, functioning as the body in charge of administrating the registration of pesticides of agricultural use, contributory and related substances. The SFE should provide a final resolution by taking into account the opinion of the ministries involved.

2.3. National Legislation

In Costa Rica there is a legislation that controls the POPs such as pesticides or hazardous products in some cycles of their lives. The analysis of the national legislation will vary according to each type of POP:

- Pesticides.
- Chemical industrial products.
- Unintentional emissions (dioxins and furans).

In the cases of the first two, the legislation will be analyzed through different stages of the cycle: registration, import, handling, storage, transportation, treatment and final disposal. In the case of the unintentional emissions, due to its characteristics, the legislation will not be analyzed based on its cycle.

The national legislation has defined POP as:

"Organic substances that have a combination of physico-chemical properties that allow them to: a) remain in the environment without degrading for long periods of time; b) spread out in the environment as part of the processes that occur in the soil, water

and air; c) accumulate in the fatty tissue of the body, including in humans and increase the concentration through the food chain; d) present risks of toxicity in humans and wildlife (MINAE, 2013, page Article 3.5).

2.3.1. Pesticides

Among the POP, the pesticides are the most controlled products, especially because Costa Rica is an agricultural country with a tropical weather, where the use of these products is necessary to control pests and diseases.

The list of POP in its majority is composed of mainly pesticides: In the appendix A: aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, BCP, which should be eliminated; in the appendix B: DDT, which is restricted and in appendix C: hexachlorobenzene.

A. Registration

The registration is the process that allows the responsible national authority to approve the sale and use of a synthetic formulated pesticide, technical-grade active ingredient, adjuvants, and related substances with prior integrated evaluation and scientific data that prove the product to be effective for its purpose and without any risk for human, animal or environmental health (MG, MINSALUD, MINAE, MEIC, 2006, Article 3.55).

The Phytosanitary Protection Law (N°.7664 on April 8th, 1998), states that all chemical, biological or related substances should register in the Phytosanitary Government Service to provide the information about its characteristics and ensure its correct usage (Article 23).

For this reason, the Regulation for Registration, Use and Control of Synthetic Formulated Pesticides, Technical-grade Active Ingredient, Adjuvants, and Related Substances (Executive Decree N°.33495 on October 31st, 2006) has been created. To register a formulated pesticide or its ingredients, a form should be filled out and present information such as composition, toxicity, ecotoxicity and confirm that it is registered in its country of origin. The information provided has a nature of a sworn statement and it is important because it determines if the pesticide is prohibited or hazardous to be registered in the country. The registration is valid for 10 years, which is extendable.

In order to coordinate the responsibilities of each ministry in agricultural matters, environment and health, the Pesticides Registration and Control Department for Agricultural, Contributory and Related Substances was created (MINAE, 2012).

The Phytosanitary Government Service can deny, suspend or cancel the registration of chemical, biological or related through a technical resolution that will be adapted to the proper process (Article 25).

In this manner several pesticides registrations have been prohibited since the Stockholm Convention requires to restrict or eliminate them. Due to the Decree N°.27773 MAG-MS-MTSS on May 19th, 1998, the registration of the following components were banned: DDT, lindane and its isomer, pentachlorophenol, endrin, chlordane and heptachlor, aldrin, dechlorant, dieldrin, toxaphene, chlordecone, chlordimeform, dibromochloropropane, etilendibromuro, dinoseb and nitroben as active ingredient because of its hazard, persistence and toxicity. Similarly, the Decree N°.31997-MAG-S on June 28th, 2004 prohibits several obsolete pesticides that are not made nor registered in the country such as the hexachlorobenzene.

B. Import

The pesticides must be registered for its import in accordance with article 24 of the Phytosanitary Protection Law and the Registration, Use and Control of Synthetic Formulated Pesticides, Technical-grade Active Ingredient, Adjuvants, and Related Substances (Article 2.2). For unloading the pesticides, there should be an authorization of the Phytosanitary Government Service (Article 18.3).

The SFE officers perform inspections on the imports when they enter the country; in this inspection, the officer verifies the concordance between the information provided in the unloading authorization and the one provided in the physical material (Article 18.3.6). The products must enter the national territory with a harmonized label matching its registry (Article 18.3.7).

The Ministry of Health can deny a permission for import of a pesticide if this product or mix of products is excessively toxic or capable of causing serious damages to people, animals, objects or goods that had been declared as hazardous by the Ministry of Health (Article 252 LGS).

As of now, the import of organochlorine pesticides listed originally in the Stockholm Convention has been banned, either of high or low persistence (Executive Decree N°.18451-MAG-S-TSS on September 19th, 1988), as well as other products that have DDT, lindane and its isomer, pentachlorophenol, endrin, chlordane and heptachlor, aldrin, dechlorant, dieldrin, toxaphene, chlordecone, chlordimeform, dibromochloropropane, etilendibromuro, dinoseb and nitroben as active ingredient (Decree N°. 27773 MAG-MS-MTSS on May 19th, 1998), and the hexachlorobenzene (Decree N°.31997-MAG-S on June 28th, 2004).

Import waste and residues that have or are composed of POP, as stated in the Stockholm Convention, is prohibited for the Classification and Handling of Hazardous Residues, therefore, the residues of pesticides included in the Stockholm Convention cannot be imported to the country.

C. Handling

The Regulation for Registration, Use and Control of Synthetic Formulated Pesticides, Technical-grade Active Ingredient, Adjuvants, and Related Substances establishes the following regulations for handling pesticides:

To handle pesticides, these must be registered. Those classified as extremely and highly hazardous and those that are restricted, could only be sold to the user with a signed prescription by a professional in agricultural science and registered at the College of Agronomists (Article 19.1).

Individuals and corporations that formulate, sell, pack and repackage pesticides given with a professional prescription must keep a registry approved by the Ministry, in which will document all the movements of the product that manipulated, imported, repacked and sold (Article 19.4). The pesticides should be used according to the recommendations of usage provided by the MAG (Article 19.5).

The Executive Decree N°.18451-MAG-S-TSS on September 19th, 1988 prohibits the sell and use of all organochlorine pesticides either of high or low persistence to address parasites in livestock, horses, pigs, poultry and domestic animals due to its hazard and persistence. However, its usage in crops is allowed if it appears in the label and with a professional prescription.

Likewise, Decree N°.27773 MAG-MS-MTSS on May 19th, 1998 prohibits the formulation, production, storage, and sale and agricultural, veterinarian or medical use that contain the following products: DDT, lindane and its isomer, pentachlorophenol, endrin, chlordane and heptachlor, aldrin, dechlorant, dieldrin, toxaphene, chlordecone, chlordimeform, dibromochloropropane, etilendibromuro, dinoseb and nitroben as active ingredient due to its hazard, persistence and toxicity.

Similarly, Decree N°.31997-MAG-S on June 28th, 2004 prohibits the formulation, production, repackage, export, transit, deposit, storage, sale and agricultural use of hexachlorobenzene.

According to Executive Decree N°.38417-MINAE-RE on February 10th, 2014 the insecticide endosulfan of technical quality and its isomers were added to the appendix A of Stockholm Convention as a new persistent organic pollutants.

It is important to highlight the existence of a Regulation of Occupational Safety and Use of Agrochemicals (Executive Decree N°.33507-MTSS on October 24th, 2006) that establishes the conditions for work and occupational safety that should be adopted in work centers, where agrochemicals are used and manipulated, with the aim to protect in an effective manner the life, health and physical integrity of the workers.

D. Storage

The Regulation of Stores and Warehouses of Agrochemicals (Executive Decree N°.28659-S on April 13th, 2000) refers to the regulations and requirements for storing pesticides. Specifically, article 5 establishes the regulations to take into account for storing as follows:

- The shelves for the products stored must be of a fire-resistant and impermeable material. The storage of the products in the shelves should allow internal air circulation. The maximum height of the products cannot exceed three quarters of the premises. There shall not be any uncovered premises nor artificial light above the shelves.

- The products should be stored identified with the corresponding labels; be grouped by its physico-chemical affinity, taking into account their toxicity level and keeping an appropriate distance between each group, among them and the wall, so the air can circulate. The flammable products should be kept in an especially designed area for this type of materials, which shall be separated from other agrochemicals with a minimum resistance of one hour in fire.

Article 4 establishes the physico-sanitary conditions of the premises and article 3 its location.

The synthetic formulated pesticides, technical-grade active ingredient, adjuvants, and related substances cannot be stored next to the following products and articles according to the Regulation for Registration, Use and Control of Synthetic Formulated Pesticides, Technical-grade Active Ingredient, Adjuvants, and Related Substances Agricultural Use:

1. Food products for human or animal consumption.
2. Medicines for human or veterinarian use.
3. Household utensils.
4. Fabric, clothing or any other article of personal use.
5. Any other product that does not have affinity with the agricultural activity.

E. Transportation

The Regulation for Registration, Use and Control of Synthetic Formulated Pesticides, Technical-grade Active Ingredient, Adjuvants, and Related Substance for Agricultural Use highlights the following regulations for the transportation of pesticides:

The transportation of synthetic formulated pesticides, technical-grade active ingredient, adjuvants, and related substances can only be done in vehicles authorized by Ministry of Transport and Public Works (MOPT, Spanish acronym) according to the current legislation (Article 19.9), which it also includes the Regulation for Handling Industrial Hazardous Waste (Decree N°.27001 on April 29th, 1998).

The synthetic formulated pesticides, technical-grade active ingredient, adjuvants, and related substances cannot be carried next to the following products and articles:

1. Food products for human or animal consumption.
2. Medicines for human or veterinarian use.
3. Household utensils.
4. Fabric, clothing or any other article of personal use.
5. Any other product that does not have affinity with the agricultural activity.

F. Treatment and final disposal

The Regulation for Registration, Use and Control of Synthetic Formulated Pesticides, Technical-grade Active Ingredient, Adjuvants, and Related Substances for Agricultural Use establishes the following regulations and for the treatment and final disposal of pesticides:

The person who produces, formulates, packages, repackages, transports, manipulates, commercializes and uses synthetic formulated pesticides, technical-grade active ingredient, adjuvants, and related substances is accountable for the collection of spills, the destruction of remnants, empty containers and not used pesticides, which must be handled according to the registrant of the product (Article 20.1).

Therefore, it is prohibited to leave synthetic formulated pesticides, technical-grade active ingredient, adjuvants, and related substances or empty containers of pesticides abandoned in the field, yard or other places (Article 20.2). It is also prohibited to destroy them by a not controlled incineration of packages, containers or remnants of synthetic formulated pesticides, technical-grade active ingredient, adjuvants, and related substances.

The procedures and authorizations for this type of destructions must be requested in the Ministries of Health and Environment and Energy (Article 20.3)

The operations for the decontamination of the application equipment and the denaturation of remnants of synthetic formulated pesticides, technical-grade active ingredient, adjuvants, and related substances must be performed by properly trained personnel, under the employer's responsibility, based on safety and hygiene guidelines laid down by the Executive, in accordance with their respective powers. The water used in washing the application equipment must be collected in appropriate facilities that have treatment systems, as provided by Ministry of Health in its legislation (Article 20.4)

The system for disposal of remnants of synthetic formulated pesticides, technical-grade active ingredient, adjuvants, and related substances or residues polluted with such substances should have an authorization of the Ministry of Health or any other ministry, according to the current national regulation in this topic (Article 20.5).

Individuals and corporations that formulate, pack, repackage, store or commercialize synthetic formulated pesticides, technical-grade active ingredient, adjuvants, and related substances must keep a record of all products that are deteriorated and need to be destroyed, thus, they will be accountable for its final disposal. This registry that will be available for the corresponding authorities, should have the following information:

1. Generic and commercial name of the product.
2. Quantity of the product to be disposed.
3. Method of destruction used.
4. Place and date when the waste was made.
5. Number of the registry (Article 19.11).

2.3.2. Chemical industrial products

In the IV Conference of the Parties of the Stockholm Convention, it was decided to amend the appendixes A, B and C, so the following chemical products could be included:

- Alpha hexachlorocyclohexane.
- Beta hexachlorocyclohexane.
- Chlordecone.
- Hexabromobiphenyl.
- Ether of hexabromobiphenyl and ether of hep tabromodiphenyl.
- Lindane.
- Pentachlorobenzene.
- Perfluorooctane sulfonic acid, its salts and the perfluorooctane sulfonate fluoride.
- Ether of tetrabromodiphenyl and ether of pentabromodiphenyl.

Based on the aforementioned, in Costa Rica, the Executive Decree N°.36738-MINAE-RE on February 21st, 2011, new persistent organic pollutants were added to appendixes A, B and C in the Stockholm Convention on Persistent Organic Pollutants.

Next, the current legislation in this topic will be analyzed to monitor the different cycles of chemical industrial products or hazardous substances to determine which mechanisms exist to monitor their entry to the country, its handling and final disposal.

A. Registry

The Ministry of Health can deny a permission for import of a pesticide if this product or mix of products is excessively toxic or capable of causing serious damages to people, animals, objects or goods that had been declared as hazardous by the Ministry of Health (Article 252).

Therefore, The Ministry of Health establishes the need to register those substances and to label its containers and packages, with indications in Spanish and with its corresponding simbology, the product´s nature, its possible risks, contraindications and corresponding antidotes (Article 241).

The Regulation for the Registration of Hazardous Products (Decree N°.28113-S on September 10th, 1999) establishes the requirements for the registrations in the country, which is crucial for customs clearance.

Although the permission is granted indefinitely (Article 6), the Ministry of Health can cancel, deny or revoke it when the legal requirements are not met, new technical information is released stating the risks for human health or when the product has been prohibited by the Ministry (Article 7).

B. Import

The Ministry of Health should monitor the import of hazardous substances or toxic products, hazardous substances or declared hazardous (Article 240 LGS).

According to the Regulation for Registration of Hazardous Products, obtaining a registry for a hazardous product will allow the registrant to clear customs without the Ministry of Health´s permission, except for precursors, chemical essentials or any other hazardous products that require a special permission. Therefore, the Directorate General of Customs must provide the Ministry with the pertinent information related to the import of hazardous products on a regular basis (Article 8).

Whenever samples of hazardous products of non-commercial purposes are imported, the importer should clear customs without requiring a previous registry; the importer would need to present the form properly filled out indicating that it is a sample. This indication does not apply in case of controlled products such as precursors and chemical essentials for which the prior registration and authorization by the Ministry of Health to clear customs will be necessary (Article 8).

Importing waste or residues that contain or are composed of POP, as stated in the Stockholm Convention, is prohibited by the Regulation of General Classification and Management of Hazardous Residues; consequently, the residues of the new chemical industrial products cannot be imported to the country.

C. Handling

The Regulation for the Registration of Hazardous Products (Decree N°.28113-S on September 10th, 1999) states that it will only be permitted the handling of the hazardous products registered before the Ministry of Health as long as the permission is still valid (Article 4).

The Ministry of Health will issue certificates of registration and sale in the country to individuals and corporations that manipulate hazardous products that are registered in the Ministry of Health (Article 10).

It is prohibited to commercialize, transfer and donate hazardous products that had been imported by a national industrial company that has not done the corresponding registration. It is also forbidden that minors of 18 years old, disqualified people or pregnant women or in breastfeeding period participate in activities that require contact with hazardous products without the proper permission from the Ministry of Health (Article 10).

Executive Decree N°.30050-S on December 4th, 2001 prohibits the production, import, transit, registry, commercialization and use of raw material or products that contain Polychlorinated Biphenyls (PCBs). This includes coolants and lubricants in transformers and electrical enablers, ECG for fluorescents, components for televisions, refrigerators, ovens and any other electrical equipment such as plastic components, waxes and other materials for coatings such as additives, adhesives, and paper for copies without coal, domestic pesticides, and fluids for vacuum pumps, lubricants and in air turbines, among others.

D. Storage

Regulation on hazardous products management (Decree N°.28930-S, on August 9th, 2000) establishes that to storage hazardous products, in any stage or place, the storage instructions on the product label and their Safety Data Sheets must be followed. Besides, incompatible criteria must be considered in the storage of hazardous products. Finally, the proper personal protection equipment must be provided and used when doing this job or similar. Employers are responsible for their workers; they must keep them informed and trained about the risk and precaution of using the products.

E. Transportation

To transport hazardous products or substances it is a must to accomplish with the established in the Regulation for General Classification and Management of Hazardous Residues (Decree N°. 24715-MOPT-MEIC-S, on October 6th, 1995). Some of the obligations established in that regulation are:

- During loading, transportation, unloading, transfer, cleaning and decontamination of vehicles and equipment used to transport hazardous products, the vehicle must carry risk signs and meet all the specific safety measures according to the technical regulation from the Costa Rican Fire Department (Article 6).
- To carry, inside the vehicle, a safety equipment for emergency situations. For example, extinguisher, reflective triangles, chocks, etc. To carry an extinguisher for the motor only and another for the load (Article12).
- To carry, inside the vehicle, a copy of the document to identify the load or a transport manifest (Article 23).
- The contractor or the person who appears as responsible or interested in the transportation of the hazardous products must make sure that the employers, mainly the transporters, be properly trained and use the protection equipment (Articles 26, 48 y 51).
- The vehicle must be correctly identified with signs and labels related to the hazardous nature of the product or good it is carrying, according to Regulation for Road Transportation of Hazardous Products (Article101).

Similarly, according to the Regulation for General Classification and Management of Hazardous Residues (Executive decree N°.37788-S-MINAE, on February 15th, 2013), if the products were residues that must be treated o final disposed, the transporter has the following obligations:

- To guarantee the integrated management and handling of the hazardous products that he receives to transport.
- To carry and comply with the established on the transport manifest related to routes, schedules, designated drivers and authorized receivers.
- To deliver all the hazardous residues received from a generator to an official receptor authorized by the Ministry of Health and designated by the generator.
- In case the transporter has to pack out or label hazardous products or wastes for the generator, the transporter must follow the requisites established in the current regulation, in the last edition of the Recommendations on the Transport of Dangerous Goods edited by the United Nations, and in the article 9 of the Regulation for Managing Industrial Hazardous Products.
- To deliver for verification, at the local level of the Ministry of Health request, the Risk Management and Emergency Response Plan and have trained personnel to implement it. This plan has to be updated each year to handle any accident or contingency.
- The transportation of incompatibles hazardous products in a same vehicle is prohibited, according to the classification in Article 7 of the Regulation for Managing Industrial Hazardous Products, the Recommendations on the Transport of Dangerous Goods edited by the United Nations, or the residue reporting card.
- Vehicles that had transported hazardous residues or substances and products that could generate them can be washed only in those places with a Sanitary Permit. These places must demonstrate that their treatment and disposal systems do not generate a risk for the environment or human health.
- Be accountable in case of spills of hazardous residues or wastes during loading, transportation and unloading them, contractually and in accordance with Article 71 of the Regulation for Road Transportation of Hazardous Products.

Likewise, according to Article 10 of the Regulation for Managing Industrial Hazardous Products (Decree N°.27001, on April 29th, 1998), every motor vehicle that transport hazardous wastes must carry the following documents:

- A document named: Manifiesto de Transporte de Desechos Peligrosos (hazardous waste manifest) (Appendix 5).
- Documents or cards with emergency information to transport hazardous products, validated by regent (chemist, chemical engineer), registered in the corresponding professional association (Appendix 5).
- A certificate from the hazardous residues generator with the information contain in Appendix 1.

Finally, through the Decree N°.35505-MOPTS-MEIC-MINAET and its reform, the "Guía de respuesta en caso de emergencia para el transporte de materiales peligrosos 2008" (Guide for emergency response for the transportation of hazardous materials 2008) is formalized.

F. Handling and final disposal

Related to hazardous residues accumulation, the Regulation for Managing Industrial Hazardous Products, establishes that:

- It is not allowed to accumulate different hazardous residues together (Article 6.2).
- Accumulation areas must be kept in such a way that it minimizes the possibilities of fire, explosion or releasing of hazardous residues that could alter human health and the environment (Article 6.3).
- The cumulated volumes must be the proper to assure a suitable environmental storage (Article 63.1).
- In the hazardous residues identification sheet and in each container the generator must clearly indicates the type of hazardous residue it contains, its hazardous characteristics, date the accumulation started and its code number (Art. 6.3.2).
- Accumulation areas must be near the point of generation where the suitable containers must be load with the hazardous residues generated. These areas must be supervised by, at least, an operator of the residues generator process. The operator is also in charge of filling the containers and inspecting the area to detect leaks or spillage, or any anomalous situation that could endanger the work routine or environment.

- It is necessary to have at least the following safety implements: internal communication or alarm system, a telephone or similar to call in case of emergency, water in the suitable volume and required pressure, portable fire extinguisher, leaking control equipment, liquid absorbing materials, etc.
- The accumulation site must be identified with the correct signs and a protocol indicating the routine and emergency actions must be available.
- Workers must be provided with the proper safety equipment in all the stages of the hazardous residues management.

Related to the responsibility to residues containing POPs, the Law for Integrated Management of Hazardous Residues (N°.8839, on June 24th, 2010) clearly defines the residues generators responsibilities. They are obligated to keep an updated plan on integrated residues handling (Article 14). They are responsible for the damage residues cause in life, health, environment or the rights of third parties during all residues life cycle. Therefore, even when they deliver the residues to an authorized agent, they must ensure, by contracts and delivery/transportation/reception manifests, the environmentally appropriate management and avoid any damage to health and environment. In case of not accomplishing this obligation, they could be considered jointly liable for the damage that the company can cause to health or environment, and applicable sanctions could be applied (Article 43).

Hazardous residues generators have the following obligations in accordance with the Law N°.8839:

- To proper separate and do not mix hazardous residues particularly avoiding those mixture that increase the level of danger or complicate their management.
- To pack and label the hazardous residues containers according to actual national and international regulation. At least, the information must include risk classification and sanitary, environmental, handling and storage preventive measures.
- Keep a register that includes type, composition, amount and destination of the hazardous residues generated, to assure complete traceability of the residues all the time.
- To provide to authorized agents in charge of residues management the required information for the proper handling, transfer, transportation, treatment and final disposal.
- To deliver biannual reports to the Ministry of Health specifying, at least, the amount of hazardous residues produced, its nature and final destination.

- To immediately report to the Ministry of Health any disappearance, loss or spilling of hazardous residues.
- To hire only authorized agents to manage hazardous residues.
- To have areas for temporary storage which location, design, building and operation meet the actual regulation (Article 44).

Likewise, offenders will be civil and jointly liable for damages and loss caused to environment and human health. They must restore the damage and, to the extent possible, let everything in the condition it was before the illegal action. The owners of the companies or activities where the damage is caused will be jointly liable.

Also, the Regulation for General Classification and Management of Hazardous Residues (Executive Decree N°.37567, on November 2nd, 2012) establishes the following:

- Hazardous residues can be stored only during six months before the use, treatment or final disposal (Article 3.2).
- Integrated hazardous residues management and hazardous residues agent definitions (Articles 3.11 and 12).
- The "Plan de gestión de devolución de productos posconsumo," as a management instrument, contains the rules, actions, procedures and means available to facilitate the return and stockpile of post-consumer products that when they are disposed become hazardous residues. These products are sent to some facilities to be processed to allow its use or valorization, treatment or final disposal according on the actual regulation (Articles 3.15).
- The notion of "professional expert" to the State is responsible for the hazardous residues management in accordance to the actual legislation (Article 3.16).
- Mixing a hazardous with a non-hazardous residues makes the last one dangerous; thus, the mixture must be handled as a hazardous residues (Article 5.2).
- Generator and agent are responsible to guarantee the integrated management of hazardous residues according to this regulation. To achieve it, they must elaborate an integrated management of hazardous residues plan in which origin, amount and danger characteristics of the generated hazardous residues can be identified to assure complete traceability. Likewise, they must notify to the Environmental Comptroller's Office on the movement and releasing of hazardous residues

and, to DIGECA, on those hazardous residues regulated by international conventions as POPs. They must also notify to the local level of the MINSALUD any disappearance, loss or spilling of hazardous residues and call 911 in case of leaking. They are obligated to elaborate the Occupational Safety Plan and the Emergency Plan, according to the amount and danger of residues (Article 7).

Related to POPs final disposal, as required in the Regulation for General Classification and Management of Hazardous Residues, when designing a hazardous residues treatment or conditioning system, the possible effects and risks of the different substances must be evaluated because, in some cases, new residues or emissions with a highly risk for health and environment can be generated.

Thus, all sub-products and packaging, containers and wrapping generated from the hazardous residues handling processes, must receive the appropriate conditioning according to their characteristics. It may be atmospheric emissions, wastewater effluents or solid residues. The physicochemical analysis required in the regulation must be carry out to determine toxicity and danger.

The methods that lead to a resource recovery, recycling, regeneration, direct reuse are considered appropriate treatment or conditioning methods according to Appendix IV, Section B, of the Basil Convention. The hazardous residues treatment facilities must meet the established requirements in Article 13 of the Regulation for Managing Industrial Hazardous Products.

According to the Regulation for General Classification and Management of Hazardous Residues, final disposal is considered the export of hazardous residues under the Basel Convention requirements. Any other possibility must be authorized by the Ministry of Health and accomplish national regulation on environmental impact (Article 11). Selection, building, operation and technical closure of final disposal facilities must not pollute soil, subsoil, water, air and ecosystems (Article 11.2).

2.3.3. Unintentional emissions (dioxins and furans)

Stockholm Convention, Annex C, establishes as POPs polychlorinated dibenzo-p-dioxins and dibenzofurans, known as dioxins and furans. They are unintentionally formed as a result of combustion processes, mainly, or some chemical reactions.

A. Air pollution

The Law of General Health prohibits in a general way any action, practice or operation that cause damage to the environment or alter the composition and characteristics of its basic elements as air. Thus, every person must be diligent and respect what the competent authority demands to avoid atmospheric and environmental pollution in the workplaces.

Specifically, it is prohibited for industries the discharge or emanation of atmospheric pollutants from banned nature and dimensions that provoke atmospheric pollution. The responsibility to have the means and systems to avoid the discharge, emission or emanation of atmospheric pollutants lies with the building owner. It is prohibited that factories or industrial facilities operate in buildings that do not have these elements or systems.

Article 49 of the Law of Organic Environment declares air as a communal heritage; thus, it must be used without damaging the general interest of all citizens. For this, air quality within the national territory must accomplish the permissible levels of air pollution established in the corresponding regulations. It also establishes the need to reduce and control direct, indirect, visible and invisible emissions from atmospheric pollutants, in particular, greenhouse gases and those that affect the ozone layer. Major advances have been carry out the latest years since the approval of the Montreal Protocol on Substances that Deplete the Ozone Layer (Law N°.7223 on April 8th, 1991), the Regulation of the Monitoring of Substances Causing Depletion of the Ozone Layer (SAO), according to regulation N°.7223 y its amendments (Executive Decree N°.35676, on August 6th, 2009) and the “Reglamento para implementar un mecanismo de cuotas de importación para la eliminación gradual del uso de HCFC limitados en el grupo I del anexo C del Protocolo de Montreal” (Executive Decree N°.37614, on November 9th, 2012).

B. Emissions

The Law of Organic Environment establishes that the Executive Branch must submit the corresponding technical standards to avoid and control atmospheric deterioration by demanding the installation and operation of the proper systems to prevent, reduce and control the emissions above the permissible limits. Even though it is not implicitly indicated, these requirements must be supervised by the Ministry of Environment and Energy and the Ministry of Health as required by the Ley General de Salud. However, there are no regulations for most of the activities that produce air pollution.

The Regulation for Building, 1982 and its reforms stipulates that those facilities with smoke nuisance must have the combustion apparatus with the recommended assemblies and accessories to achieve a complete combustion. Likewise, they must have chimneys built at least five meters above the highest building within a radius of 25 meters. Chimneys must have the combustion apparatus with the recommended assemblies and accessories to achieve a complete combustion (Articles X.19 and X.20).

The Regulation for Immission of Atmospheric Pollutants from Boilers and Kilns of Indirect Type (Decree N°.36551-S-MINAET-MTSS, on April 27th, 2011), annex 4, contains the "Guía de inspección de muestreo de gases de chimeneas de fuentes fijas" and points out that among the analysis dioxins and furans must be measured. It also establishes biofuel, obtained from biomass (living organisms), as one of the possible fuel for calderas and ovens.

The Regulation of Requirements, Conditions and Controls for Alternative Fuels in Cement Kilns (Decree N°.31837-S on April 1st, 2004) regulates cement ovens that use alternative fuel or both conventional and alternative fuels. According to this regulation, to use liquid fuels from PCB-free oils, plastic products from banana plantations (bags and polypropylene strings) and plastic containers that had contain agrochemicals, the person interested must deliver specific samples and emission analysis of dioxins and furans, taken from the chimney, biannually. The parameters and limits of atmospheric emissions in cement ovens that use alternative fuels is 0,2 ng/m3-TEQ (equivalent), for continuous as well as specific sampling, in the case of dioxins and furans.

A tool that could help to have more control on dioxins and furans unwanted emissions is the Registry of Emissions and Transfers of Pollutants established in the Regulation for General Classification and Management of Hazardous, as a MINAE responsibility; however, it has not been created yet.

C. Immissions (Air Quality)

The Regulation for Atmospheric Pollutant Immissions (Decree Nº.30221-S) aims to establish the upper limits for air immission (air quality), to preserve and keep human, animal and plant health and to decree the corrective actions when the upper limits are exceeded. For those purposes, the Network on Air Monitoring Control (was established to know the main atmospheric components to prevent and, its case, decree the preventive required standards. However, among the standards to measure, dioxins and furans are not included.

D. Open burning of residues

One of the activities that more dioxins and furans generate is open burning of residues. However, to open burn common, hazardous on any other type of residues that can generate danger emissions for health and environment, without the Ministry of Health permission, is prohibited (MINAE, 2013, Art. 14.3).

With regard to this, the Law of the Fire Brigade (Nº.8228 on March 19th, 2002), establishes a fine equivalent to the amount of three to ten base salaries to whom, negligent or imprudently, open burns garbage or wastes that hinder health, life, safety or goods. Likewise, the Law for Integrated Management of Hazardous Residues (Nº.8839 on June 24th, 2010) considers as a serious infringement to open burn or incinerate common residues in unauthorized sites.

In the same way, due to many projects to incinerate residues as an option to manage them at the municipal level, in the Executive Decree Nº.38500 on June 11th, 2014, a national moratorium was dictated on the activities of thermal transformation until national authorities from the ministries of Environment and Health provide technical and scientific certainty that the activity will not cause any impact on health and environment. They shall also guarantee that the practice does not set against the principles in Law Nº.8839, named Law for Integrated Management of Hazardous Residues.

Costa Rica has a Regulation for Controlled Burnings (Executive Decree N°.35368 on May 6th, 2009), that establishes an authorization to carry out open burning for agriculture with the purpose to keep control and do not affect forests or protected area. The impact on health or environment caused by this practice is not a main consideration. Due to conflicts among people and neighboring communities, an open burning can be canceled but only temporarily: *"If as a consequence of the controlled burning imminent and notorious risk for health and safety is produced, the Ministry of Health, the Ministry of Agriculture and Livestock as well as the Ministry of Environment, Energy and Telecommunications, together or individually, can cancel the burning temporal or permanently, taking a minute justifying the reasons to order the cancellation. Once the risk has been controlled, the cancellation order will be lifted, making possible to continue the burning"*. (Art. 22).

An Interinstitutional Standing Committee, in which MINAE, MAG and MINSALUD are members, was established to follow up on controlled open burnings for agricultural purposes by recommending policies aimed to improve control and inspection activities. Besides, another of its functions is to promote the reuse and exploitation of agricultural residues by implementation processes of technological and energy options.

Table 1: Summary of the POP applicable legislation

Laws and regulations	Number and date of publication	Controlled substances	Institution in charge	Aspects related to POP
Stockholm Convention on Persistent Organic Pollutants	Law N°.8538 on August 23rd, 2006, Executive Decree N°.33438 on November 6th, 2006	Industrial chemical products Unintentional emission pesticides	MINAE	Prohibits the production, import and use of POP It is necessary to create a plan for unintentional emissions
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Law N°.7438, October 6 1994	Industrial chemical products Pesticides	MINSALUD	Monitors the imports, exports and transit of hazardous residues
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	Law N°.8705 February 13 2009 and Executive Decree N°.35416 June 30 2009	Industrial chemical products Pesticides	MAG	Allows the exchange of information in the trade of hazardous pesticides and chemical products

Laws and regulations	Number and date of publication	Controlled substances	Institution in charge	Aspects related to POP
Environment´s Organic Law	N°.7554 on October 4th, 1995	Unintentional emissions	MINAE MINSALUD MAG	Monitors air pollution
The General Health Law	N°.5395 on October 30th, 1973	Insecticides	MINSALUD	Monitors imports, registration and management of hazardous insecticides and substances. It monitors air pollution
Law of Integrated Management of Hazardous Residues	N°.8839 on June 24th, 2010	Industrial chemical products Insecticides	MINSALUD MINAE MAG	Establishes the obligations for residues generator and authorized operators for its handling
Law of the Fire Brigade	N°.8228 on March 19th, 2002	Dioxins and furans	Fire Brigade	Punishes residues burning

Laws and regulations	Number and date of publication	Controlled substances	Institution in charge	Aspects related to POP
Law of General Customs	Nº.7557 on October 20th, 1995	Insecticides	MHacienda	Regulates the imports of insecticides, hazardous products and residues
Registration and Control Department	Nº.36549-MAG-S-MEIC-MINAET on April 28th, 2012	Insecticides	MAG MINAE MINSALUD	Receives, processes and resolves all the requests for insecticides registration. Coordinates the ministries competencies
Technical Secretariat for the Coordinating of the Chemical Substance Management	Decree Nº.33104-RE-MAG-MINAE-S on January 2nd, 2006.	Insecticides Industrial chemical products	MINAE MINSALUD MAG	Supports and coordinates for the Basel, Stockholm and Rotterdam Conventions
POP Incorporation to Stockholm Convention	Decree Nº.36738-MINAE-RE on February 21st, 2011	Industrial chemical products Insecticides	MINAE	Incorporation to Stockholm Convention on Persistent Organic Pollutants of new persistent pollutants listed in Appendix A, B and C
Prohibition of organochlorine insecticides	Executive Decree Nº.18451-MAG-S-TSS on September 19th, 1988	Insecticides	MAG MINSALUD MTSS	Prohibits the production, import, traffic, sale and use of organochlorine insecticides of high or low persistence

Laws and regulations	Number and date of publication	Controlled substances	Institution in charge	Aspects related to POP
Registration, Use and Control of Synthetic Insecticides, Technical-grade Active Ingredient, Adjuvants, and Related Substances for Agricultural Use	Decree N°.33495-MAG-S-MINAE-MEIC on October 31st, 2006	Pesticides	MAG MINSALUD MINAE	Monitors the registration, import, handling, transportation and final disposal of insecticides
Prohibits DDT and others	Decree N°.27773-MAG-MS-MTSS on May 19th, 1998	Pesticides	MAG MINSALUD MTSS	Prohibits the registration, formulation, production, storing, sale and agricultural, veterinarian and medical use of products with DDT, lindane and its isomer, pentachlorophenol, endrin, chlordane and heptachlor, aldrin, dechlorant, dieldrin, toxaphene, chlordecone, chlordimeform, dibromochloropropane, etilendibromuro, dinoseb and nitroben as active ingredient

Laws and regulations	Number and date of publication	Controlled substances	Institution in charge	Aspects related to POP
Prohibition of hexachlorobenzene	Decree N°.31997-MAG-S on June 28th, 2004	Pesticides	MAG MINSALUD	Prohibits formulation, production, repack, repackaging, export, traffic, deposit, storage, sale and agricultural use of hexachlorobenzene
Incorporation of endosulfan	Decree N°.38417-MINAE-RE on February 10th, 2014	Pesticides	MINAE	Incorporates the endosulfan insecticide of technical quality and its isomers as an organic pollutant of Appendix A of Stockholm Convention
Regulation for stores and warehouses of agrochemicals	Decree N°.28659-S on April 13th, 2000	Pesticides	MINSALUD	Establishes the regulations and requirements for storing insecticides
Prohibition of PCB	Decree N°.30050-S on December 4th, 2001	Industrial chemical products	MINSA MINAE	Prohibits the production, import, traffic, registration, marketing, and use of raw materials or finished product that has polychlorinated biphenyls (PCB)

Laws and regulations	Number and date of publication	Controlled substances	Institution in charge	Aspects related to POP
Regulation for the Registration of Hazardous Products	Decree N°.28113-S on September 10th, 1999	Chemical industrial products	MINSALUD	Establishes the requirements to register a hazardous product and for its storage
Regulation for Handling Hazardous Products	Decree N°.28930-S on August 9th, 2000	Chemical industrial products	MINSALUD	States that hazardous products should be handled with containers with labels
Regulation for Road Transportation of Hazardous Products	Decree N°.24715-MOPT-MEIC-S on October 6th, 1995	Chemical industrial products Pesticides	MOPT MEIC MINSALUD	Establishes the requirements for the cargo, transportation, unloading, cleaning and decontamination of vehicles for the transportation of hazardous products
Regulation for General Classification and Management of Hazardous Residues	Decree N°.37788-S-MINAE on February 15th, 2013	Chemical industrial products Pesticides	MINSALUD MINAE	Establishes the conditions and requirements for the classification of hazardous residues, regulations and procedures for its management
Regulation for the Management of Hazardous Industrial Residues	Decree N°.27001-MINAE on April 29th, 1998	Chemical industrial products Pesticides	MINAE	Monitors the storage, handling, treatment and the final disposition of hazardous industrial residues

Laws and regulations	Number and date of publication	Controlled substances	Institution in charge	Aspects related to POP
Regulation for Controlled Agricultural Burning	Decree N°.35368 on May 6th, 2009	Unintentional emissions	MAG MINAE MINSALUD	Grants the permissions to perform burnings with agricultural purposes, which can be suspended temporarily due to damages to the health or environment
National Moratorium of Activities for Thermal Transformation of Solid Urban Residues	Decree N°.38500 on June 11th, 2014	Unintentional emissions	MINSALUD MINAE	Establishes the moratorium until there is a scientific certainty that such activity does not have a negative impact on the health and environment and it does not contradict the LGIR
Regulation for Immission of Atmospheric Pollutants	Decree N°.30221-S	Unintentional emissions	MINSALUD	Establishes maximum values for immissions in the air
Regulation of Requirements, Conditions and Controls for Alternative Fuels in Cement Kilns	Decree N°.31837-S on April 1st, 2004	Unintentional emissions	MINSALUD	Controls the use of alternative fuels in cement kilns. Establishes maximum values for air quality for those activities

Laws and regulations	Number and date of publication	Controlled substances	Institution in charge	Aspects related to POP
Regulation for Immission of Atmospheric Pollutants from Boilers and Kilns of Indirect Type	Decree Nº.36551-S-MINAET-MTSS on April 27th, 2011	Unintentional emissions	MINSALUD MINAE MTSS	Establishes maximum values for air quality for those activities

2.4. Conclusions

The management of persistent organic pollutants is a topic little studied in Costa Rica because it has not been a political and institutional priority.

However, there is an important quantity of legislation that controls POP in its different stages of life, especially in pesticides and industrial chemical products. The legal development during the last years since the National Implementation Plan (2009) has been especially in the handling of hazardous residues.

Although the unintentional emissions have been mentioned in the legislation, there is still little control. There are some tools that will be very useful to improve this situation, some examples are:

- Register of Emissions and Pollutant Release, which has been established, but it requires legal regulations to put it into practice.
- Network on Air Monitoring Control, which requires additional investment in equipment to obtain the capacity to monitor dioxins and furans.

Therefore, it is necessary to improve the regulation, specifically regarding POP to implement the commitments derived from the Stockholm Convention. The introduction of obligations, prohibitions and incentives can be a new approach to innovate and seek more efficient regulations.

An important limitation is the different responsibilities assigned to different ministries such as Ministry of Health, Environment and Agriculture and Customs. Besides of the lack of monitoring from the State, so it is necessary to delimit the responsibilities and seek new mechanisms for the required coordination. In this case, the Technical Secretariat of Coordination for the Chemical Substances Management can be an entity of coordination. Another weakness is the lack of analysis and sampling in the country.

Even though the country has advanced a lot in satisfying the obligations related to the Stockholm Convention, it is necessary to take new measures or establish mechanisms to accomplish other pending topics:

- Evaluate the efficiency of the policies, laws and existent regulations.
- Promote the education, training and raise awareness of the different people involved.
- Perform a test every two weeks about the strategies.
- Raise awareness of the people in charge to encourage new policies and decisions-making.

Since this is a new topic in the country, it is convenient to analyze the trajectory of other Latin-American countries in good practices or successful experiences in legislation, economic instruments, incentives, monitoring and others before developing new legal instruments in the country.

It is essential to develop public policies in the matter that establish plans and programs for an integrated management of chemical substances, including POP.

2.5. Institutional and Legal Action Plan

Based on the legislation that controls POP and the findings from technical reports, it was identified the need to improve/strengthen the current legislation, improve the coordination between three ministries: Ministry of Health, Ministry of Environment and Energy and Ministry of Agriculture and Livestock.

The gaps and weaknesses became a priority; thus, they can be corrected through legal regulations or the adoption of a new regulation. Some of those regulations need to be processed through the law, which it will imply the creation of new regulations approved by the Legislative Assembly (Asamblea Legislativa).

In the cases of the regulations proposals for the current legislation or through new bills, it is necessary a work of articulation among the ministries and also with the sectors involved, so all of them can be implemented correctly.

The majority of the regulations were discussed during the POP workshops with the sectors involved. Therefore, the technical, legal and political considerations mentioned in the workshops were taken into account to prioritize the regulations and offer new solutions.

One aspect that can make these regulations feasible is that they are a solution for the commitments acquired by the country for being part of the international environmental instruments on chemical substances such as Stockholm Convention on Persistent Organic Pollutants, Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.

Table 2. Legal actions proposals for industrial POP

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
Used Vehicles	Costa Rica allows the imports of used vehicles without a restriction for its year. Some vehicles with POP in its bodywork models made from 1975-2004 have entered the country.	Prohibit the imports of used vehicles made in the range from 1975 to 2004.	Reform the article 5 of Law of Transit on Public Roads and Road Safety (Nº.9078).	Costa Rica and Paraguay are the only countries in the continent that allow the imports of used vehicles. Countries such as Argentina, Peru and Uruguay have banned the imports due to environmental and safety issues. The import of vehicles declared as total loss is currently prohibited due to security reasons. The country is obliged to take actions to prohibit the import of organic persistent compounds according to article 3 of Stockholm Convention about Persistent Organic Pollutants.
Estimated time				**Responsible**
5 years				MINAE, MINSALUD and MOPT with law proposals at Legislative Assembly (Asamblea Legislativa) for approval.

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
Used Vehicles	There are no conditions to disassemble vehicles and treat its parts in an environmentally sound manner.	Declare the vehicles at the end of their useful life as special handling residues by applying the extended responsibility to the producer. The importers should be accountable for those residues and should offer a solution to the owners.	Reform the Regulation for Special Handling Residues (N°.38272-S) to add the vehicles to the list of Appendix 1.	The State should legislate to achieve an adequate handling. For example, it is necessary a disassembling plant to give an appropriate environmentally treatment to all parts. The importers of vehicles and residues managers should look for a solution together. It is possible that the import of vehicles should be done in order to find a profitable solution, which is allowed by the article 35 of Law for Integrated Residues Management.
Estimated time				**Responsible**
5-10 years				MINSALUD

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
Used Vehicles	There is no obligation that the vehicle owners should unsubscribe their vehicles in the Public Register when these reach the end of their useful lives not should they have to hand in to an operator for its treatment.	It should be mandatory that in order to unsubscribe a vehicle, the owner should hand in to an authorized operator according to what is stated in the Law for Integrated Management Residues, so it can receive an adequate treatment.	Reform the article 7 of Law of Transit on Public Roads and Road Safety (N°.9078).	This will be possible once a new legislation is implemented, in which the vehicles are defined as a special management residue.
Estimated time				**Responsible**
5-10 years				MINAE, MINSALUD and MOPT with law proposals at Legislative Assembly (Asamblea Legislativa) for approval.

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
Electronic Equipment	All computer equipment either second-hand or unusable that come to the country are classified in the same tariff heading and it is impossible for Customs to distinguish which ones are second-hand and which are unusable.	Prohibit the import of second-hand and unusable computer equipment.	Reform the Regulation for the Integrated Management of Electronic Residues (N°.35933-S).	The imports of second-hand computer equipment corresponds to only 5% of the equipment in the country. The electronic equipment are considered hazardous residues by the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The country has the obligation to prohibit and monitor the products that contain POP, according to the article 3 of the Stockholm Convention on Persistent Organic Pollutants.
Estimated time				**Responsible**
1 year				MINSALUD, General Directorate of Customs

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
Electronic Equipment	Authorized operators of electronic residues are not obliged to do a detail inventory of the equipment treated.	Request an inventory to the operators with the aim to analyze the information by the MINSALUD or MINAE about treated equipment and its composition to establish measures accordingly.	Include this obligation in the Technical Guides of CEGIRE.	The Ministry of Health is creating the technical guides, where the information can be included.
Estimated time				**Responsible**
1 year				MINSALUD MINAE

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
PFOS	There are present as ingredients of several products that come to the country (e.g. water repellent or fire retardants), but they are reported at registration at the Register of Hazardous Products at the Ministry of Health, since its concentration is low and they are declared in a generic way as “OTHERS” at registration.	Oblige the registrant to present a certificate from the manufacturer indicating that this product is free of PFOS according to a technical criteria at the moment of registration. If the product contains PFOS, this should not be granted its registration, import and sale in the country through a bill at the General Directorate of Customs and the requirement of a technical note specifying that the products that come to the country do not have PFOS.	Reform the article 5 of the Regulation of Hazardous Products (Nº.28113) with aim to oblige the registrant to present a certification specifying that the product is free of PFOS.	The country has the obligation to prohibit and monitor those products according to article 3 of the Stockholm Convention on Persistent Organic Pollutants.
Estimated time				**Responsible**
1 year				MINSALUD

Table 3. Proposed legal actions for POP pesticides

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
Pesticides	Obsolete and expired pesticides in hands of distributors and producers without any environmental solution for its treatment. According to the Law for Integrated Management of Residues and the Regulation General for Classification and Management of Hazardous Residues, it is the responsibility of the generator to hand them in to an authorized operator but currently there are no authorized operators of pesticides.	Declare the pesticides as residues of special management and give the responsibility to distributors and importers.	Reform the Regulation Declaratory of Residues of Special Management (N°.38272-S) to add the pesticides in list of appendix 1.	The importers of pesticides have a special supply chain, so they can be accountable for an appropriate treatment through the authorized operator.
Estimated time				**Responsible**
2 years				MINSALUD MAG/MINAE

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
	In the Register of Household Pesticides of MINSALUD, there are some suspicious registered products that may contain PFOS.	Prohibit through a decree the registration, import, use and commercialization of household pesticides that contain PFOS.	Create and approve an executive decree that prohibits these products.	The country has the obligation to prohibit and monitor these products according to article 3 of Stockholm Convention on Persistent Organic Pollutants.
Pesticides	There is poor monitoring regarding the sale of restricted products by the Phytosanitary Government Service and the College of Agronomists.	Establish a mandatory reporting system from the regents to SFE, every three months through an online form.	Reform the articles 3 and 20 of the Regulation Agricultural Regency of College of Agronomists (Decree Nº.26503-MAG) to make mandatory the report of regency of the restricted products sold.	The restricted products should be easy to track their destiny, applications and existence.
Estimated time				**Responsible**
1 year				MINSALUD/MINAE MAG/MINAE

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
PFOS	Even though they are not coming to the country, its import or manufacturing is not prohibited (pentachlorobenzene and perfluorooctane sulfonic acid).	Prohibit the import and manufacturing of these chemical substances and request the General Directorate of Customs the technical note 73 to guarantee they do not come to the country.	Create and approve an executive decree that prohibits these products.	The country has the obligation to prohibit and monitor these products according to article 3, subsection 1 of Stockholm Convention on Persistent Organic Pollutants.
Estimated time				**Responsible**
1 year				MINAE

Table 4. Proposed legal actions for unintentional POPs

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
Agricultural burning	Agricultural burnings are allowed in the country for cleaning the lands and for harvest, which generates dioxins and furans.	Prohibit the agricultural burning.	Derogatory of article 5 of the Law of Dividing Fences and Burning, Law number 121 on October 26th, 1909 that allows the controlled burning. Derogatory of article 24 of Management and Preservation of Soils Nº.7779 on April 30th, 1998 that monitors the agricultural burnings.	Since 2002, the Constitutional Chamber through Vote Nº.4847 demanded MAG and other institutions to organize a plan to solve the problem. The country has the obligation to implement some measures to reduce the release of dioxins and furans that come from burnings in open sky according to the article 5 of Stockholm Convention on Persistent Organic Pollutants.
Estimated time				**Responsible**
10 years				MAG MINSALUD MINAE

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
Emissions	There is no restriction in the import of motorcycles with two-stroke engine, which produce more atmospheric pollution because they use lubricant oil as fuel. There is no control of the emissions of these vehicles in the Vehicular Technical Revision.	Prohibit the import of new and second-hand motorcycles with two-stroke engine.	Reform the article 5 of Law of Transit on Public Roads and Road Safety (N°.9078)	The country has the obligation to take measures to reduce the release of dioxins and furans from fuel burning according to the article 5 of Stockholm Convention on Persistent Organic Pollutants.
Estimated time				**Responsible**
5 years minimum				MINAE, MINSALUD and MOPT with law proposals at Legislative Assembly (Asamblea Legislativa) for approval

Product / Activity	Gap or weakness	Legal recommendation	How	Feasibility
Biomass	Wood treated with chemicals as fuels is used in restaurants and chicken sales, which releases dioxins and furans and puts in risk the health of people who consume it.	Prohibit the use of wood treated with solvents and sealers (e.g. platforms and pulleys) as fuels to cook food.	Create and approve an executive decree that prohibits this practice.	The country has the obligation to take measures to reduce the release of dioxins and furans from wood burning according to the article 5 of Stockholm Convention on Persistent Organic Pollutants.
Estimated time				**Responsible**
1 year				MINAE MINSALUD

3. INDUSTRIAL POPs INVENTORY

3. INDUSTRIAL POPs INVENTORY

3.1. c-OctaBDE inventory

3.1.1. Situation regarding c-OctaBDE

The main use of c-OctaBDE, until its cessation of manufacture in 2004, was as a flame-retardant additive for acrylonitrile-butadiene-styrene (ABS) polymers. This type of polymer is the main component of the casings of electrical and electronic equipment (EEE), especially from CRT (cathode ray tube) TV and computer monitors. It is estimated that the latter contain more than 50% of the POP-PBDE present in EEE (UNIDO, UNITAR, UNEP, Stockholm Convention, 2012), due to which quantifying it constitutes the scope of this inventory.

Worldwide, the volume of electronic waste (WEEE) is increasing rapidly every year. For Costa Rica, it was estimated that, on average, the percentage of WEEE could represent 2,4% of the waste generated annually. The country regulates the management of WEEE by means of Law Nº.8839 on Integrated Waste Management and Regulation Nº.35933 on Integrated Management of Electronic Waste, driving a model of creation of compliance units, in which EEE importers must take responsibility to recover and properly manage waste products and formalize environmental agents charged with their treatment and disposal. By 2013, it was estimated that the national WEEE recovery rate was 9%.

3.1.2. Inventory methodology

Key stakeholders and sources of primary and secondary information were identified. Such information related to:

- local production of c-OctaBDE and products containing it,
- flow of CRT TV and computer monitors entering and leaving the country,
- presence of CRT TV and computer monitors in households, public sector, and private sector,
- practices concerning disposal and presence of CRT TV and computer monitors in waste and recycling streams.

The Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants (UNIDO; UNITAR; UNEP; Stockholm Convention, 2012) was followed, with the variation of certain assumptions to calculate the presence of CRT TV and computer monitors at different consumer levels. The inventory of industrial POPs used data of 2013 as the reference.

3.1.3. Results

After determining each component of the c-octaBDE flow for the reference year, the sum of imports + consumers + waste streams + recycling streams is performed. The results are shown in the following table.

Table 5. OctaBDE distribution

Congeners	c-OctaBDE in net imports (kg)*	c-OctaBDE in EEE consumers (kg)	c-OctaBDE entering the waste stream (WEEE) (kg)	c-OctaBDE in recycled polymers (kg)	Total (kg)
Inventoried c-OctaBDE	8,71	15 851,01	1 753,04	No data	17 595,34
Hexa-BDE	0,96	1 743,61	192,83	No data	1 935,49
Hepta-BDE	3,75	6 815,93	753,81	No data	7 565,99
Octa-BDE	3,05	5 547,85	613,56	No data	6 158,37
Nona-BDE	0,87	1 585,10	175,30	No data	1 759,53
Deca-BDE	0,09	158,51	17,53	No data	175,95

* For 2013, the statistical value of exports is greater than that of imports, so the value of net imports is interpreted as a smaller amount of c-OctaBDE to be treated in the country.

From the above table, the term "consumer" refers to household users, private sector, and public institutions (public sector). Additionally, a negative value in the net imports column indicates that, regarding CRT TV and computer monitors, more of them were exported than imported in 2013, showing a national trend of reducing its historical stock of this type of equipment.

Table 6 shows the breakdown of amounts from the consumer section and their corresponding residues; the total amount of 17 604 kg of c-OctaBDE includes the subtotal of EEE at the consumer level (15 951 kg) and WEEE entering the waste stream by 2013. The amount of exported WEEE (8,71 kg, Table 5) is not taken into consideration as the inventory considers the stocks that the country has at this moment and that will have to be eventually disposed of or eliminated in a comprehensive manner.

Table 6. Summary of OctaBDE inventory

Amount of c-OctaBDE in households (kg)	Amount of c-OctaBDE in public sector (kg)	Amount of c-OctaBDE in private sector (kg)	TOTAL at consumer level (kg)	c-OctaBDE from household waste (kg)	c-OctaBDE from public sector waste (kg)	c-OctaBDE from private sector waste (kg)	TOTAL c-OctaBDE entering the waste stream (WEEE) kg
14 397,87	600,41	852,73		1 439,79	100,07	213,18	
		Subtotal	15 851,01				1 753,04
						Total de c-OctaBDE	17 604,05

3.1.4. OctaBDE treatment costs

The analysis of inventories and annual waste streams indicates that by 2013 there are 17 604 kg of c-OctaBDE in plastics from CRT TV and computer monitors in use that entered the country, which then entered the waste stream (Table 6) and must be treated.

According to a cost structure based on a pilot project developed at the Technological Institute of Costa Rica (TEC, Roa, 2009) which looked at transportation, storage, packaging, and export, plus a profit, a range of 0,50-0,60 US$/kg was determined, and taking an average cost of 0,55 US$/kg, it is apparent that the cost to treat the total EEE inventory for 2013 would amount to US$30,5 million.

This inventory will be moved to the waste stream, according to the estimated lifetime of the equipment in each sector, so the cost will be prorated over the next 10 years.

Table 7. OctaBDE treatment costs for 2013 EEE inventory

Sector	Televisions (kg)	Monitors (kg)	Total (kg)
Households	52 829 291	799 766	53 629 057
Enterprises	NA	1 119 075	1 119 075
Public	NA	787 936	787 936
Total			55 536 068
Treatment cost US$/kg			0,55
Total treatment cost of equipment in use (US$)			**30 544 837**

3.1.5. Bromine analysis pilot test

A. Introduction

During the preparation of this NIP, an inventory of industrial POPs was conducted, based on UNEP-proposed guidelines, which allowed for an approximation of the amount of PBDEs present in equipment items and electrical and electronic waste.

The inventory is tier II, in which the results are due to a series of calculations using data from various sources and the factors listed in the guidelines. In order to advance to a more quantitative tier III, it was decided to run a pilot test that, initially, assessed the country's analysis capability for bromine screening and bromine screening in WEEE.

To this end, samples of CRT TV and computer monitors were taken from the main authorized management centers, seeking to determine the presence of bromine in said equipment and then estimate the amount of PBDEs in the polymer fraction.

B. Methodology

Sampling

The samples were collected from four approved e-waste management sites. In each of these, random samples of plastic parts in TVs and monitors were collected, for a total of 160. The samples were labeled, and the data of the equipment that they came from were noted: brand, year of production, color, and country of origin.

Next, the samples were prepared for analysis, their size was adjusted to dimensions about 1x1 cm, and they finally underwent basic cleaning with ethanol.

Equipment and conducted analysis

Equipment used: Hitachi TM-1000 Tabletop Microscope coupled to an elemental x-ray analysis system (EDS).

For each sample, a micrograph of its surface was taken, which varied from one sample to another, and, generally, all micrographs were taken at a magnification of x100, calibrated with low brightness and high contrast.

An electronic data system (EDS) analysis was performed on the micrograph, which took the center of the image and analyzed an area of 9 mm^2. The elements present in the sample were thus determined. Therefore, the result is expressed as percentage of bromine present in the sample.

C. Discussion of Results

The results show the presence of bromine in the polymer matrices of the sampled equipment. Most samples were from a historical inventory that has been managed in recent years, and, due to its age, the likely presence of bromine was greater.

As shown in Figure 2, computer monitors show an average percentage of 5,4% bromine, which is greater than that of televisions (3,8%). It should be also noted that the quantified bromine levels are not specific to an Octa-PBDE molecule; that is, the presence of other brominated compounds in the matrix could produce an overestimate result.

With the bromine percentages reported and using the respective molecular weights, the Octa-PBDE percent was obtained, wherein average values of 6,79% Octa-PBDE for monitors and 4,76% Octa-PBDE for televisions were calculated, as shown

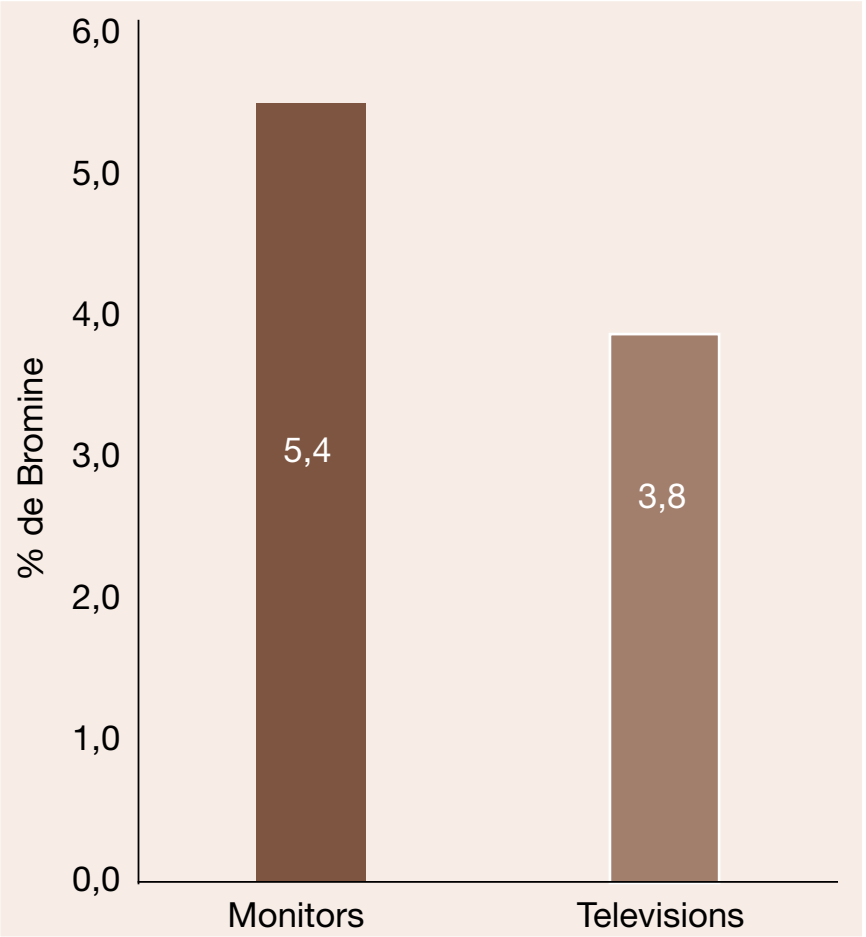


Figure 2.
Average values of bromine percentages

in Figure 3. This relationship coincides with that reported in UNEP's guidance, in which computer monitors have a greater percentage amount of Octa-PBDE than televisions.

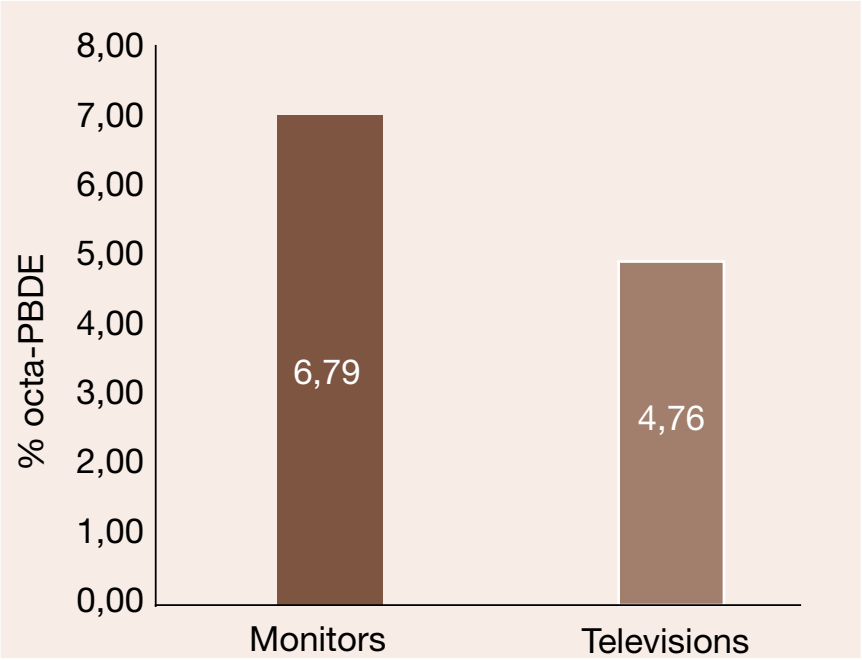


Figure 3. Average values of Octa-PBDE content in samples

The results show the need for more specific chemical analysis to differentiate Octa-PBDE concentrations from other brominated organic compounds and thus determine the concentration of said compound in EEE and WEEE. Consequently, the country must strengthen its analytical capacity, so that private and public laboratories have the equipment, methods, and trained staff for physical and chemical analyses of industrial POPs and unintentional POPs.

A possible strategy may contemplate the creation of regulation that sets out the allowed parameters regarding POPs in EEE, thus preventing their entry into the country, and the creation of guidelines on processing, dismantling of parts, and disposal and elimination of WEEE, based on the characteristics of the equipment and Octa-BDE content, so that only Octa-BDE-free residue may enter the recycling stream.

Finally, to put this management system in place, coordination among key stakeholders (authorized managing bodies, MINSALUD, MINAE, ACEGIRE, EEE importers and distributors) is required, seeking to define actions enabling the country to advance in the elimination of POPs.

3.1.6. Conclusions

- It is estimated that there are 17 604,05 kg of c-OctaBDE in plastics from CRT computer monitors and televisions in use that enter the country and become part of the waste stream.
- Regarding WEEE management, there is legislation regulating it. However, the lack of monitoring and control on rule enforcement and the absence of guidelines on best practices make proper e-waste management doubtful.
- The WEEE sector contemplates two key stakeholders: authorized managing bodies duly registered at the Ministry of Health and informal collectors. The latter appreciably affect the flows from households to authorized agents.
- Authorized managing bodies only capture 9% of WEEE generated in the country, due to many factors, which include: tendency to store and reuse EEE in households, bureaucratic approval for removal by public institutions, and that fact that costs associated with disposal are not being met by all parties.
- Some environmental managing registered as such are actually collection centers for electronic waste.
- There is a tariff item that allows the import of used equipment, which facilitates the entry into the country of outdated technology or unusable equipment, thickening WEEE flows and ultimately lacking proper disposal.

3.2. c-PentaBDE inventory

3.2.1. Situation regarding c-PentaBDE

The main use of c-PentaBDE was in treating polyurethane (PUR) foam for automotive and upholstery applications. Its use was extensive in countries with flammability standards for consumer goods, such as the United States and the United Kingdom.

In Costa Rica, the main source of c-PentaBDE described in the scope of the inventory corresponds to imported vehicles manufactured between 1975 and 2004. Based on the country of origin, the likely presence of c-PentaBDE may vary, so different coverage factors are applicable according to the alleged place of manufacture.

Current restrictions on the import of vehicles relate to their functionality and not other factors, such as having reached end-of-life, energy efficiency, or presence of POP compounds.

Waste from vehicles that are no longer in use fall into a reutilization cycle as spare parts, based on market demand, but there are no regulations to encourage their disposal properly.

3.2.2. Inventory methodology

Key stakeholders and sources of primary and secondary information were identified. Such information related to:

- c-PentabBDE production and products containing it,
- inflow and outflow of vehicles manufactured between 1975 and 2004,
- presence of vehicles manufactured between 1975 and 2004 still in use,
- disposal practices and presence in waste and recycling streams of vehicles manufactured between 1975 and 2004.

The Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants (UNIDO; UNITAR; UNEP; Stockholm Convention, 2012) was followed.

3.2.3. Results

The results of breaking down the composition of c-PentaBDE content in each homologue and each aspect tested are shown in the table below, taking 2013 as the reference year.

Table 8. c-PentaBDE distribution

Congeners			c-PentaBDE in net imports	c-PentaBDE in vehicles currently in use	c-PentaBDE entering the waste stream (WEEE)	c-PentaBDE in recycled polymers	Total
Units			kg	kg	kg	kg	kg
Inventoried c-PentaBDE			**238,31**	**8 138,52**	**0,07**	**No data**	**8 376,90**
Tri-BDE	Tribromodiphenyl ether	0,5%	1,19	40,69	0,00	ND	41,88
Tetra-BDE	Tetrabromodiphenyl ether	33,0%	78,64	2 685,71	0,02	ND	2 764,38
Penta-BDE	Pentabromodiphenyl ether	58,0%	138,22	4 720,34	0,04	ND	4 858,60
Hexa-BDE	Hexabromodiphenyl ether	8,0%	19,07	651,08	0,01	ND	670,15
Hepta-BDE	Heptabromodiphenyl ether	0,5%	1,19	40,69	0,00	ND	41,88

3.2.4. c-PentaBDE treatment costs

Vehicle management in Costa Rica has a huge gap in terms of regulations establishing guidelines for handling and disposal of vehicle parts, which resonates in areas such as:

- Difficulty to estimate a stream of waste from vehicles as there is no restriction on their allowed lifetime.
- Lack of accredited agents for this purpose at MINSALUD.
- Lack of available information to estimate the cost associated with final treatment.
- No obligation on vehicle's owner to hand it over to an authorized agent upon completion of deregistration.

On the other hand, there is an informal market for used parts and scrap marketing, which retrieves vehicle parts when declared a total loss or no longer functional.

In this context, it was impossible to estimate the cost of treating c-PentaBDE in the 2013 inventory.

3.2.5. Conclusions

- It is estimated that, in 2013, there were 8 377 kg of c-PentaBDE distributed mainly in functional vehicles manufactured from 1975 to 2004.
- In the case of c-PentaBDE, there are no regulations governing the environmentally sound management of waste from vehicles; this is limited to handling of scrap metal.
- In addition, the country does not restrict the age of imported vehicles; however, there is a tendency to import more recent models, especially for reasons of market and consumer preference.

3.3. POP-PFOS inventory

3.3.1. Situation regarding POP-PFOS

PFOS-related substances, their salts, and perfluorooctanesulfonyl fluoride (PFOSF) are commonly used for the treatment of surfaces and production processes, given their surface-active properties. Although its main manufacturer stopped production in 2003, it simultaneously began to be produced in Asia because there are manufacturing processes of semiconductors and electronic equipment whose substitution at critical stages has not been achieved.

The inventory of PFOS and its derivatives was oriented, based on country's priorities, to:

- **Processes that may use it without incorporating it into the final product:** For example, metal plating and etching baths for electronics (microprocessors).
- **End products that may contain PFOS:** extinguishing foam, food packaging, and carpets.

3.3.2. Inventory methodology

Key stakeholders and sources of primary and secondary information were identified. Such information sources relate to:

- Production at the national level.
- Flows of products and articles containing them both entering and leaving the country.
- Presence of processes that may use PFOS without incorporating them into the final product.
- Presence of PFOS-containing products in the consumer market.
- Practices related to disposal and presence of products and articles containing PFOS in waste streams and recycling.

The Guidance for the inventory of perfluorooctane sulfonic acid (PFOS) and related chemicals listed under the Stockholm Convention on Persistent Organic Pollutants (UNIDO; UNITAR; UNEP; Stockholm Convention, 2012) was followed.

3.3.3. Results

As for processes that may use PFOS and related substances without incorporating them into the final product, no information on the presence or use of these substances for the semiconductor and electronics industries was obtained. Its use in metal-plating companies was not detected because they already use a substitute product as a defoamer.

When analyzing the final products that may contain PFOS, its use in fire-extinguishing foam, food-contact packaging, or textiles (carpets) was not detected.

As for practices related to disposal and entry into recycling streams, no information on the subject was obtained; however, because there is not a specific restriction or a way to monitor these substances, the possibility that they may be entering landfills or illegal dumps or being processed by incineration, in an unnoticed manner, is not discarded.

3.3.4. Conclusions

There are gaps on information control and management, which hinder determining uses or PFOS-containing articles. There is no restriction on import and use either.

Some companies empirically handle chemical reagents needed for their production by knowing the trade name or function of their inputs, due to which it was impossible to identify the use of PFOS in their production processes.

3.3.5. Recommendations

c-OctaBDE

- Considering that only about 29 companies of the 2500 that import EEE are registered as Compliance Units, importers must be required for EEE customs clearance purposes to submit a Ministry-of-Health-issued certificate of registration as Compliance Unit. Establishing this requirement as a mandatory compliance technical note will support the General Directorate of Customs (Dirección de Aduanas) in controlling entry of these products.
- Environmental guidelines on proper treatment of all WEEE must be issued in order to encourage the best available practices in the country, which include avoiding inadequate disposal.

To improve the rate of WEEE collection, it is recommended to:

- Promote awareness raising campaigns for WEEE to be collected through authorized channels and thus increase the collection rate.
- Strengthen the Institutional Environmental Management Program (PGAI, its Spanish acronym) to improve reporting of WEEE by public institutions. In the private sector, the solid waste management programs requested by the Ministry of Health must be strengthened.
- Simplify procedures throughout public institutions to dispose of WEEE through authorized agents and thus reduce the historical inventory.
- Coordinate with INEC to include in their household censuses certain EEE-related variables, which would be used as input for future POPs inventories.
- Prohibit the importation of used EEE and remove tariff headings from “used and useless equipment” to avoid thickening the waste stream.
- Distinguish between the role of an accredited environmental agent who carries out integrated

waste management and that of a collection center. Currently, both are registered at the Ministry of Health under the same category, which makes WEEE traceability difficult in the country.

c-PentaBDE

- Establish regulations requiring vehicle owners to deregister them and carry out integrated waste management once end-of-life is reached. The model adopted in other countries can serve as an example: In deregistering a vehicle, for any reason, it is mandatory to provide certification that their waste will be managed by an authorized agent in a comprehensive, adequate manner.
- Prohibit the importation of vehicles produced before or in 2004, the year when production of vehicles with c-PentaBDE was stopped. This could also help improve air quality in cities.

POP-PFOS

- Establish a list of articles and processes that may use PFOS for easy identification and entry control.
- Coordinate with professional bodies to incorporate the issue of industrial POPs management into their training programs.

3.4. PCB inventory

In 2004 and 2005, preliminary PCB inventories were conducted: the first one in the state companies Costa Rican Electricity Institute (ICE, its Spanish acronym) and National Power and Lighting Company (CNFL, its Spanish acronym) and the second one in cooperatives and municipal administration entities like Heredia Public Services Company (ESPH, its Spanish acronym) and Administrative Board of Electricity Services in Cartago (JASEC). The results were the basis for defining the priorities for environmentally sound management and disposal of PCBs in Costa Rica as part of the National Implementation Plan for the Stockholm Convention in 2009.

Among the action plans for NIP implementation, PCB management is one of the most important and requires the greater amount of estimated budget. Based on this definition of priorities, Costa Rica requested financial assistance from the Global Environment Fund (GEF) for the implementation of an integrated PCB management project.

The project “Integrated PCB Management in Costa Rica” was thus approved in 2013, and its implementation started in 2014 for a four-year term on an external budget of US$1 930 000 and

a national counterpart of US$8 709 274. The project and its four components were aligned with the objectives of that NIP and its action plans with institutional strengthening, regulation development, and environmentally sound PCB management.

3.4.1. PCB management

The results of the 2009 NIP showed that in the country it is necessary to develop integrated PCB management, based on the formulation of a legal framework, the development of technical guidelines, an inventory update, and the disposal of these stocks. Such needs are the project's cornerstones whose implementation began in 2014.

The Integrated PCB Management Project in Costa Rica has four components:

A. Strengthened institutional capacity in Costa Rica for the environmentally sound management of PCBs

One of this component's main outcomes is to strengthen the legal framework through the creation and approval of a regulation for PCB management and disposal. This component also seeks to enhance the institutional capacity to monitor and control the implementation of the PCB regulation.

In this first year of implementation, companies were provided with handheld field equipment, so that the inventory is done item by item and not by estimation. That way, the information is incorporated into the POP Information System immediately. The companies have the said field equipment as part of project support for the inventory process.

A second achievement this year has been the formulation of a draft decree to develop the PCB Management Regulation, which establishes the legal framework to which holders of electrical equipment must conform in seeking to identify PCB contaminated equipment, management guidelines, and the obligation for disposal implementation.

The project has assisted the electricity sector with logistical support in order to identify PCB contaminated equipment and oils by providing equipment for semi-quantitative analysis (Dexsil L2000DX), which, without replacing the analysis by gas chromatography, will enable an initial assessment of the inventory of contaminated equipment and oils and lead to determining potential PCB concentrations. This will enable decision-making regarding required technologies for disposal or decontamination.

B. Environmentally sound management and interim storage of PCBs

A best practices manual for technical management of PCB contaminated equipment and oils was developed, and training sessions in this regard with electricity sector employees were held.

C. Environmentally sound destruction of PCBs and management of contaminated equipment

An updated, tier-1 inventory of out-of-use equipment is expected to be completed by the end of the first half of 2015. With this information, a classification of EEE and oil stocks will be performed in order to begin the formulation of a strategy to remove said stocks.

The second phase of the inventory seeks to identify all equipment containing dielectric oil in operation in the country and its due registration in the existing information system.

To make the most of the funds available for disposal, a technical and economic analysis of the best available technologies for treatment or destruction of PCB contaminated oils and equipment will be conducted, and the best cost benefit ratio that each can provide will be also determined.

D. Awareness raising

An awareness-raising strategy on the issue of inadequate PCB use and its impact on environment and public health will be formulated and implemented.

3.4.2. Current situation

It is estimated that updating the inventory of out-of-use equipment and oils will be ready by mid-2015. The other equipment in use must be inventoried but within the 4-year term of project implementation.

In developing the project document, a small update to the inventories of electricity sector companies was performed using Clor-N-Oil kits to estimate the amount of PCB in the country.

The test kit is an initial assessment, and then the actual PCB concentration is verified by gas chromatography. By applying these test kits, it was determined that 87 tons of oil and 50 tons of equipment were contaminated. These preliminary data will be validated and corroborated during project execution in order to have more complete results on out-of-use equipment in 2015.

The main goal in the first half of 2016 is to have an updated inventory and remove all PCB contaminated equipment in use and their respective oils.

Costa Rica will have a dynamic, updated online inventory and information to monitor and control the management and disposal of the stockpiles of PCB contaminated equipment and oils, thus supporting the efforts to protect the environment and public health in accordance with the objectives of the Stockholm Convention.

3.5. Industrial POPs action plan

Table 9. Industrial POPs – Action plan on c-OctaBDE

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Prohibit entry of PBDE into the country	MHacienda's records on used EEE imports.	There is currently a tariff heading for used equipment that does not distinguish between EEE and WEEE. In 2013, 1 052 kg. were imported.	By 2017, prohibit the import of used EEE.	Develop the necessary regulations to ban used EEE and WEEE.	Short	MINSALUD MINAE MHacienda
	Legislation to regulate EEE imports.	There is no restriction on PBDE-containing EEE imports.	By 2018, regulate both entry and use of PBDE-containing EEE.	By 2018, establish rules governing the import of EEE with a maximum content of PBDEs in AEE.	Medium	MINAE MINSALUD CEGIRE

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Prohibit entry of PBDE into the country	Technical guide setting a maximum limit of allowed PBDE in EEE imports.	There is not a technical guide to limit the concentration of brominated compounds in EEE.	By 2018, have a technical guide.	Develop a technical guide to set a maximum limit of brominated compounds in imported EEE.	Medium	MINAE MINSALUD CEGIRE
	Technical guide for training the personnel in state institutions who purchase EEE, which includes restricting purchase of equipment containing PBDEs.	There is no purchase requirement by the state on maximum permitted levels of brominated substances in EEE.		Promote training on public procurement of electronic equipment among PGAI commissions in compliance with decrees 35933 and 3827.	Medium	MHacienda MINAE MEIC

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Reduce PDBE from waste stream	Number of registered EEE importers at MINSALUD.	In 2013, only 0,8% of importers of EEE were formed into compliance units. According to MINSALUD, starting September 2014, all EEE importers must be registered in one of these.	By 2015, ensure that all EEE importers are part of a compliance unit.	Verify that by 2015 all EEE importers are placed on a compliance unit, as required by Costa Rica's Regulation for Integrated Management of Electronic Waste (RGIRE, its acronym in Spanish).	Short	MINSALUD
	Technical note prepared.		By 2016, ensure that customs clearance and nationalization of EEE can be only performed by an importer registered at a compliance unit.	Generate a technical note that enables the Directorate of Customs to prohibit clearance and nationalization of EEE if the importer is not part of a compliance unit.	Short	MINSALUD MINAE

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Reduce PDBE from waste stream	PGAI format for data collection modified.	Each institution uses its own information management system.	By 2016, have historical WEEE inventory information from public institutions.	Modify the format for PGAI data collection so the historical WEEE inventory is included in public institutions.	Short	MINAE
	Format of waste management program corrected.	Private companies generally consider WEEE as part of their assets and do not track waste.	By 2016, have WEEE inventory information from private companies.	Modify the format for data collection in the Waste Management Program so the historical WEEE inventory is included in private companies.	Short	MINAE MINSALUD

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Reduce PDBE from waste stream	Format of waste management program corrected.	There are agents that collect and export electronic equipment in one piece, while others disassemble it and export the parts of greater market value.	By 2018, improve the procedure for registration of environmental agents in order to avoid task duplicity between the sanitary operating permit process and the registration as an authorized agent.	Improve registration of authorized agents so that the type of waste and process is indicated.	Medium	CEGIRE MINSALUD
	Number of campaigns reported.	There is a need to provide the population with a space for disposal of WEEE.	By 2018, conduct two WEEE-collecting campaigns.	Promote WEEE collection campaigns and strategic alliances with municipalities to facilitate the collection of said waste with final consumers (households, companies, institutions).	Medium	MINSALUD MINAE

Table 10. Industrial POPs – Action plan on c-PentaBDE

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Prohibit entry of PBDE in vehicle parts	Regulation governing import ban.	No ban on imports of vehicles with manufacturing year between 1975 and 2004.	By 2018, restrict the import of vehicles manufactured between 1975 and 2004, with the possibility of gradual restriction.	Modify the legislation so as to regulate the entry of vehicles with year of production between 1975 and 2004 (amended Traffic Act 9078, Ley de Tránsito) and generate a technical note.	Medium	MOPT MINAE MHacienda MEIC
	Technical note that differentiates imported cars with manufacturing year between 1975 and 2004.	Customs information on the year of manufacture of imported used cars must be requested by Single Administrative Document (SAD).	By 2017, modify or create tariff headings for imported cars with manufacturing year between 1975 and 2004.	Coordinate with the Directorate of Customs an extension of the tariff code or technical note (with the intent to issue a periodic report on entry of vehicles within this range of manufacture).	Short	MOPT MINAE MHacienda MEIC

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Prohibit entry of PBDE in vehicle parts	Percentage of vehicle fleet whose manufacture year is between 1975 and 2004.	There is no exchange of information between state institutions and private companies with regard to control of the vehicle fleet.	By 2018, have updated, reliable information on the ratio of PBDE-contaminated vehicles.	Promote the exchange of information among state institutions to create statistical data.	Medium	MOPT MINAE MHacienda MEIC
Reduce PBDE content in vehicle parts entering the waste stream	Number of recycled vehicles.	Lack of regulation that promotes recycling of vehicles.	By 2020, have 5% of deregistered vehicles entering the integrated waste management stream.	Establish legislation for the deregistration process to require an integrated waste management certificate on the vehicle.	Long	MINSALUD MINAE MOPT Registro Público

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Reduce PBDE content in vehicle parts entering the waste stream	List of key players in trading activities of vehicle parts.	POP-containing vehicle parts have no market value.	By 2018, have a model for recycling of vehicles and parts.	Identify key players (INS, scrap dealers, public institutions) involved in trading activities of vehicle parts.	Medium	MINSALUD MINAE MOPT Registro Público
	Proposed formalization model on the issue of vehicle recycling.	There is no formalization model on the issue of recycling of vehicle parts.	By 2016, have a model proposal to formalize the issue of recycling vehicle parts.	Create a model that formalizes the recycling of vehicle parts containing PBDEs (plastic parts, foams, and fabrics), including current practices of scrap dealers, in a way similar to that of WEEE compliance units.	Short	MINSALUD MINAE MOPT Registro Público

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Reduce PBDE content in vehicle parts entering the waste stream	Draft amendments to decree.	The law on Integrated Waste Management includes a section entitled "Regulation of waste requiring special handling," which includes scrap.	By 2020, have a law on recycling of vehicles as part of the regulation of waste requiring special handling.	Expand the coverage of the regulation of waste requiring special handling to include motor vehicles.	Long	MINSALUD MINAE MOPT Registro Público

Table 11. Industrial POPs – Action plan on PFOS

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Identify PFOS-containing products	Updated list of products requiring control due to their PFOS content.	No list of products.	By 2017, have a list of products that require control under sanitary registration by use.	Develop a list by category of PFOS containing products.	Short	MINAE
	Technical notes that outline registration restrictions.	No restriction on PFOS containing products.	By 2019, put a ban on registration of PFOS containing products in the above list.	Review the product technical information that must support the presence or absence of PFOS, such as the safety data sheet of all the product components.	Medium	MINAE MINSALUD MHacienda

Direct effects	Indicators	Base line	Goals	Activity	Term	Responsible
Identify PFOS using processes	Regulation in place to manage PFOS.	There is no regulation requiring products containing PFOS that this information be included on the label.	By 2018, establish further label registration requirements.	Consider a modification to the labels of these products so that all components are reported.	Medium	MEIC MINAE MINSALUD
	Updated list of potential PFOS containing processes.	There is no restriction in industrial processes using PFOS.	By 2018, have a list of industrial processes that require control on use of PFOS.	Make a list of industrial processes that may use PFOS.	Medium	MINAE MINSALUD
			By 2020, establish the requirement that a chemistry or chemical engineering professional monitor the processes that may use PFOS.	Request a certification by CQCR*/CIQPACR* on the use or not of PFOS in the process. ((*CQCR: Costa Rican Body of Chemists. *CIQPACR: Costa Rican Body of Chemical Engineers and Related Professionals)	Long	MINAE MINSALUD

4. POP Pesticides Inventory

4. POP Pesticides Inventory

According to established commitments acquired by the country regarding the adhesion to Stockholm Convention, approved through Law 8538 on August 23, 2006, a first POP pesticide inventory was done on the country that year. That element worked as input for the National Implementation Plan (NIP) presented on 2009.

At that time, the inventoried compounds found were the following:

Aldrin
Chlordane
Dieldrin
Endrin
Toxaphene
DDT
Heptachlor
Mirex
Alpha hexachlorocyclohexane (HCH)
Beta hexachlorocyclohexane
hexachlorobenzene

In that first inventory, a significant amount of DDT (almost 8,5 tons) was found in one of the warehouses of the Ministry of Health, as well as low amounts of Mirex and Heptachlor. However, large quantities of expired (obsolete) pesticides were reported that those investigators considered important to register even though those products do not contain POP.

Later, in the fourth meeting of the Conference of the Parties, on May, 2009, it was agreed to list the following four POP Pesticides for the Stockholm Convention:

Pentachlorobenzene

Lindane and its isomers

Chlordecone

Perfluorooctanesulfonic acid and its salts and derivatives

In the fifth meeting of the Conference of the Parties in May, 2011, the following POP was added to the list:

Endosulfan

4.1. Methodology

The development of a national inventory of POP pesticides in 2014 required the development of the following activities:

- Identifying POP substances in Costa Rica.
- Updating POP pesticides inventory, done in 2006.
- Developing new POP inventory.
- Validating the results.
- Elaborating recommendations of actions for the appropriate control, management and elimination of POP in Costa Rica.

4.2. Update of Initial Inventory

4.2.1 Uses of POP Pesticides in Costa Rica

On table 12, a summary of the main uses of those compounds is presented and, also, products registered at the Plant Health Government Service are shown.

Table 12. Uses and Registration of POP Pesticides on the Initial List

Compound	Names	Uses and Registration
Aldrin	Aldrin	It is a general purposes insecticide for the soil. Also, it is used as wood preservative even though there are no records about this in the country. No active records of this product in Costa Rica.
Chlordane	Chlorindan, Chlordane, Oktachlor, Oktaterr, Synklor, Topichlor, Toxichlor	Pesticide, wood preservative. No active records of this product in Costa Rica.
Dieldrin	Dieldrin	Aldrin's family. Insecticide, rodenticide, avicide. No active records of this product in Costa Rica.
Endrin	Endrin	Insecticide, rodenticide, avicide, acaricide. No active records of this product in Costa Rica.
Heptachlor	Heptagran, Basaklor, Drinox, Soleptax, Termite Gold Crest H-60, Velsicol	Insecticide used in the soil. No active records of this product in Costa Rica.
Mirex	Dodecachlorine, Dechlorane, Ferriamicide	Insecticide (mainly used against ants). No active records of this product in Costa Rica.
Toxaphene	Camphechlor, Chlorocamphen, Polychlorocamphen	Insecticide used on livestock, cotton fields, etc. No active records of this product in Costa Rica.
DDT	Agritan, Pentachlorine, Santobane, Tafidex, Zerdane, Ivoran, Citox, 4,4'-DDT; p,p'DDT	Insecticide (malaria, yellow fever). No active records of this product in Costa Rica.
Hexachlorobenzene	Amatin, Anticarie, Bunt-cure, Sanocide, Sniecotox	Fungicide for soil treatment. No active records of this product in Costa Rica.

As shown above, there are no registered products that contain any of those compounds, which initially indicates, as per investigation, that those products are not officially used in the country.

4.2.2. Analysis of Legislation Related to Pesticides

On Table 13, the regulations established for prohibitions and restrictions in Costa Rica regarding management of POP pesticides for the initial list of the Convention are presented.

Table 13. Regulations of Prohibitions and Restrictions of POP Pesticides

Active Compound	Decree	Date	Details
Chlordane, Aldrin, Dieldrin, Lindane (including their alpha- and beta-hexachlorocyclohexane isomers), Endrin, Chlordecone, Heptachlor, Toxaphene, Mirex	27773-MAG-S-TSS	1998	It prohibited registration, formulation, manufacturing, imports, exports, transit, deposit, warehousing, sale and agricultural, veterinary and medical uses of the products containing any of these active compounds.
DDT	27773-MAG-S-TSS	1998	It prohibited registration, formulation, manufacturing, imports, exports, transit, deposit, warehousing, sale and agricultural, veterinary and medical use. The Ministry of Health could use, as an exception, those DDT products already in the warehouse, on established areas and when there is no substitute, for emergency cases, to interrupt malaria's spread.
Hexachlorobenzene	31997-MAG-S	2004	It prohibited the imports, registration, formulation, manufacturing, re-packaging, re-bottling, exports, transit, deposit, warehousing, sale and agricultural use.

As stated above, all compounds on the initial list of this Convention are prohibited in several regulations.

4.2.3. Tariff Headings of POP Pesticides and Customs Movements

The investigation identified the corresponding tariff headings assigned to each POP and its respective technical notes which are general or specific dispositions that the government uses as instrument to alert about regulations that impact cross-bordering movements.

- Technical Note 0054: Authorization for customs clearance of toxic and dangerous substances granted by the Ministry of Health, Registration and Control Department (PROCOMER in Spanish.)
- Technical Note 0058: Authorization to import chemical precursors and chemical substances, including sealing, granted by the Ministry of the Presidency, Costa Rican Drug Institute (ICD in Spanish).
- Technical Note 0059: Verification and authorization from the Plant Health Government Service at time of nationalization, national and international transit of all chemical, biological or other similar substances and application equipment for agricultural use.
- Technical Note 0073: Prohibition of import.
- Technical Note 267: Verification and authorization by the Plant Health Government Service at time of exporting and re-exporting of all chemical, biological or other similar substances and application equipment for agricultural use.

Table 14. Tariff Headings and Related Technical Notes

Compounds	Tariff Headings	Technical Notes
Hexachlorobenzene	2903921000	0054
Mirex	2903892000	0054
Aldrin	2903821000	0054
Chlordane	2903822000	0054
Dieldrin	2910400000	0054
Endrin	2910901000	0054 0059 267
Toxaphene	2903891000	0054
Heptachlor	2903823000	0054
DDT	2903922000	0054
Formulated products that contain DDT, Aldrin, Dieldrin, Toxaphene, chlordimeform, Chlordane and Heptachlor	3808501200	0073
Mirex or Dechlorane	3808915000	0054

Notice that Mirex has two tariff headings, 2903892000 for pesticides derived from PFOS used as formicides and 3808915000 about organochlorine compounds used as insecticides.

From this information, it can derive that only formulated products that contain DDT, such as Aldrin, Dieldrin, Toxaphene, Chlordane and Heptachlor besides Chlordimeform (heading 3808501200), have technical notes of import prohibition to the country (TN 0073). Only entrance restrictions apply for all other POPs.

On the other hand, it was determined that any of these compounds register entrance or exit movements for the country since 2000.

4.2.4. Summary of Inventory

On Table 15, the results of the update of the initial inventory are shown.

Table15. Summary of Inventory Update

Place	Previous Inventory Status	Current Inventory Status
Experimental Station Los Diamantes, INTA	No POP Expired Products	POP: Endosulfan Previous products were destroyed. Current products were expired.
San Agustin Hacienda	No POP Expired Products	No POP Products on previous inventory were not found.
El Palmar Sugar Refinity, Miramar	No POP Expired Products	No POP Previous products still remain on site.
Enrique Jiménez Núñez Station. INTA	No POP Expired Products	No POP Same products as previous inventory along with new expired products were found.
CATIE: Experimental Farm	No POP Expired Products	POP: Endosulfan Previous products were destroyed or already used.
CATIE: Entomology Warehouse	No POP Expired Products	Closed warehouse Previous products were used.
CATIE: Old Weed Warehouse	No POP Expired Products	Closed warehouse Previous products were used.

Place	Previous Inventory Status	Current Inventory Status
La Argentina Sugar Mill	No POP Expired Products	Empresa cerrada No records.
Santa Lucia Farm, UNA	No POP Expired Products	No POP Previous inventory products were removed No new expired products.
Fabio Baudrit Farm: Main Warehouse	No POP Expired Products	No POP Previous inventory products were removed. No new expired products
Fabio Baudrit Farm: Herbicides Warehouse	No POP Expired Products	
Fabio Baudrit Farm: Vegetables Warehouse	No POP Expired Products	
Fabio Baudrit Farm: Fruits Warehouse	No POP Expired Products	

According to Table 15, there were no POP pesticides found on this inventory update. Only Endosulfan was found (new list.)

It is important to highlight that, same as in 2006 inventory, the warehousing of obsolete pesticides was detected. Even though those were not included on the POP list, those have to be taken into account as potential risk. In some cases, the same products included on the initial inventory were found along with "new" expired products. In some other cases, the reported expired products in 2006 were no longer there. However, there was no documented explanation about that. The interviewee mentioned that those were destroyed and even "used in a controlled way" without official records, methodology or controlled information.

4.3. Inventory of New POP Pesticides

On Table 16, some basic characteristics of the new POP pesticides taken into account for this National inventory along with registered existing products are shown.

Table 16. New POPs

Compound	Names	Description
Chlordecone	Kepone, GC-1189	Agricultural pesticide. Related to Mirex. No active records of this product in Costa Rica.
Endosulfan	Thionex, Endocil, Phaser, Benzoepin, Thiodan, Fenix	Insecticide mainly used for coffee berry borer control even though it has been used for onion, pepper, avocado, citrus and other products 17 records of formulated products with this compound were located.
Lindane	Lindane, gamma-BCH, g-HCH, Hortex, Jacutin Fog, cortilan	Broad spectrum insecticide, for veterinary and human use (ectoparasites), against lice and fleas. There was a register of the “analytical standard” product found on the Ministry of Health.
Pentachlorobenzene	N/A	Fungicide and pesticide. No active records of this product in Costa Rica.
Perfluorooctanesulfonic acid	PFOS	Baits for ant control Atta spp and Acromyrmex spp. One record contains sulfluramid, a salt of PFOS.

Records of endosulfan, sulfluramid (ant insecticide called Mirex-S 0,3 GB, compound linked to PFOS) and lindane (for which there is only one record at the Ministry of Health (number 50868) related to an "analytical standard.") were registered.

4.3.1. Regulations for New POP Control

Both lindane and chlordecone are ruled by Regulation 27773-MAG-S-TSS which prohibits the registration, formulation, manufacturing, imports, exports, transit, deposit, warehousing, sale and agricultural, veterinary and medical uses of the products containing those active compounds.

The use of endosulfan is allowed in the country under the dispositions on the Regulation 34782-S-MAG. MINAET in which the sale of pesticides containing endosulfan is authorized under professional prescription using approved official forms by a professional incorporated to the Costa Rican Association of Agronomists. The use of endosulfan is only allowed for liquid and microencapsulated formulas that contain concentrations equal to or less than 35% of this active compound. Also, to use of products that contain this compound is prohibited for rice growing. Currently, there is a pending publication of a decree regarding prohibition of the use and imports of endosulfan.

No associated control regulations were written regarding pentachlorobenzene and perfluorooctanesulfonic acid.

4.3.2. Tariff Headings for POP Pesticides and Customs Movements

The tariff headings used to set each one of the new POP, as well as corresponding technical notes described on previous sections, are shown on Table 17.

Table 17. Tariff Headings and Related Technical Notes

Compound	Tarif Heading	Technical Notes
Chlordecone	2914701000	0054
Lindane	2903810000	0054 0058
Pentachlorobenzene	2903991000	0054
Endosulfan	2920902000	0054 0059 267
Perfluorooctanesulfonic Acid	2904902000	0054
Sulfluramid	2903892000	0054
Hexachlorocyclohexane	2903810000	0054 0058
hexaclorociclohexano	2903810000	0054 0058

The tariff heading 2903892000 applies to commercial products derived from PFOS on its sulfluramid structure and used as formicide. In Costa Rica, there are two Mirex-S 0,3 GB and Blattanex Gel commercial products that come from different suppliers.

There is no entrance prohibition for new POPs in the country which would be applied through technical note 073 (import prohibition.)

According to the information on the previous table, only endosulfan and Mirex-S 0,3 GB have records some cross-bordering movements in Costa Rica.

4.3.3. Endosulfan Inventory in Costa Rica

A. Registered Products

Thirty six products, either formulations or technical grades, have been registered in Costa Rica since 1990. However, 19 of those are no longer valid since the records expired without revalidation from original requestors. Therefore, only 17 active records are shown on Table 18.

Table 18. Active Records of products related to endosulfan

Product Name	Record Number	Registering Company
Endosulfan, Farmagro 35 EC	4523	Farmagro, S.A.
Solicam 35 EC	3289	Delagro Corporation, S.A.
AG ENdosulfan 96 TC	8702116	Delagro Corporation, S.A.
Solicam 35 EC	8702131	Universal Hope International, S.A.
Usulfan 96 TC	5157	UPL Costa Rica, S.A.
THIOKILL 35 EC	8702299	UPL Costa Rica, S.A.
Endosulfan, Bioquim 90-99 TC	4672	Industrias BIOQUIM Centroamericana S.A. (BIOQUIM Central American Industries S.A.)
Fenix 35 EC	4696	Industrias BIOQUIM Centroamericana S.A. (BIOQUIM Central American Industries S.A.)
Thionex 35 EC	2860	Makhteshim- Agan Costa Rica, S.A.
Endosulfan, Fedecoop 35 EC	3912	Fedecoop Suministros, S.A. (Fedecoop Supplies S.A.)
Endosulfan, Transmerquim 90-99 TC	4772	Rainbow Agrosciences S.A.
Endosulfan 35 EC	4823	Rainbow Agrosciences S.A.
Endosulfan, Agromart 35 EC	3647	Distribuidora de Productos Agropecuarios S.A. (Distributor of Agricultural Products S.A.)
Endosulfan 94 TC	3555	Distribuidora de Productos Agropecuarios S.A. (Distributor of Agricultural Products S.A.)
Endosulfan, Agrial 35 EC	4769	Agricola Agrial, S.A. (Agrial Agricultural Products)
Endosulfan 36 EC	3792	Duwest Costa Rica, S.A.
Endosulfan, Drexel 35 EC	3964	Agrofuturo, S.A. (Agrofuture, S.A.)

Not all products with current records are sold at this time since some companies, foreseeing the prohibition of endosulfan use and new commercial conditions, opt for not using it anymore. Also, those with TC specification (technical grade) are used for manufacturing formulated products.

Table 19. Products with Endosulfan Currently Commercialized

Commercial Name	Record	Registering Company
Endosulfan, Agromart 35 EC	3647	Distribuidora de Productos Agropecuarios DPA, S.A. (Distributor of Agricultural Products S.A.)
Fenix 35 EC	4696	Industrias BIOQUIM Centroamericana S.A. (BIOQUIM Central American Industries S.A.)
THIOKILL 35 EC	8702299	UPL Costa Rica, S.A.
THIONEX 35 EC	2860	Makhteshim- Agan Costa Rica, S.A.

B. Uses of Endosulfan in Costa Rica

The registered crops and pests for which endosulfan is used in the country are:

Registered Crops

Avocado *(Persea Americana)*, cotton *(Gossypium hirsutum*), celery *(Apium graveolens)*, oat *(Avena sativa)*, broccoli *(Brassica oleracia var italica)*, coffee *(Coffea Arabica)*, sugar cane *(Saccharum officinarum)*, barley *(Hordeum)*, onion *(Allium cepa)*, sweet peppers *(Capsium annum)*, citrus *(Citrus spp)*, cauliflowers *(Brassica oleracea var botrytis)*, peach *(Prunus persica)*, spinach *(Tetragonia tetragonioides)*, strawberry *(Fragaria spp)*, beans *(Phaseolus vulgaris)*, lettuce *(Lactuca sativa)*, corn *(Zea mays)*, mango *(Manguifera indica)*, apple *(Malus domestica)*, apricot

(Prunus persica), melon *(Cucurnis melo)*, mustard *(Brassica nigra)*, potato *(Solanum tuberosum)*, pineaaple *(Ananas comosus)*, cabbage *(Brassica oleracea var capitata)*, watermelon *(Citrullus vulgaris)*, sorghum *(Sorghum bicolor)*, tobacco *(Nicotiana tabacum)*, tomato *(Licopersicon sculentum)*, carrot *(Daucus carota)*, flowers, sunflower *(Helianthus annuus)*, leather-leaf fern (*Rumohra adiantiformis)*, ornamental plants.

Registered Pests

Heliotis *(Heliothis sp)*, bollworms *(Spodoptera frugiperda)*, cucumber beetles *(Diabrotica spp)*, Stalk-worm *(Diaphania hyalinata)*, cabbage looper *(Trichoplusia ni)*, Granulate Cutworm *(Agrotis subterranea)*, coffee berry borer *(Hypothenemus hampei)*, Aphids *(Aphis sp)*, Cucumber Moth or Cotton Caterpillar *(Diaphania sp)*, silverleaf whitefly *(Bemisia tabaci)*, mites *(Steneotarsonemus ananas)*, aphids *(Myzus persicae)*, cyclamen mite *(Phytonemus pallidus)*, citrus thrips *(Sciothrips aurantii)*, lygus bug *(lygus spp)*, mites *(Stigmaeius floridanus)*, Cotton leafworm *(Alabama argillacea)*, thrips *(trips spp)*, Hairstreak Butterfly *(Thecla sp)*.

As supported below, endosulfan is a pesticide highly used for a broad variety of crops against many insects. It causes that it can be used basically in the whole country. Its use is distributed as follows approximately:

- Coffee: 70%
- Pineapple: 20%
- Vegetables: 10%

Moreover, the regional distribution list of the use of this product in the country is shown on Figure 4.

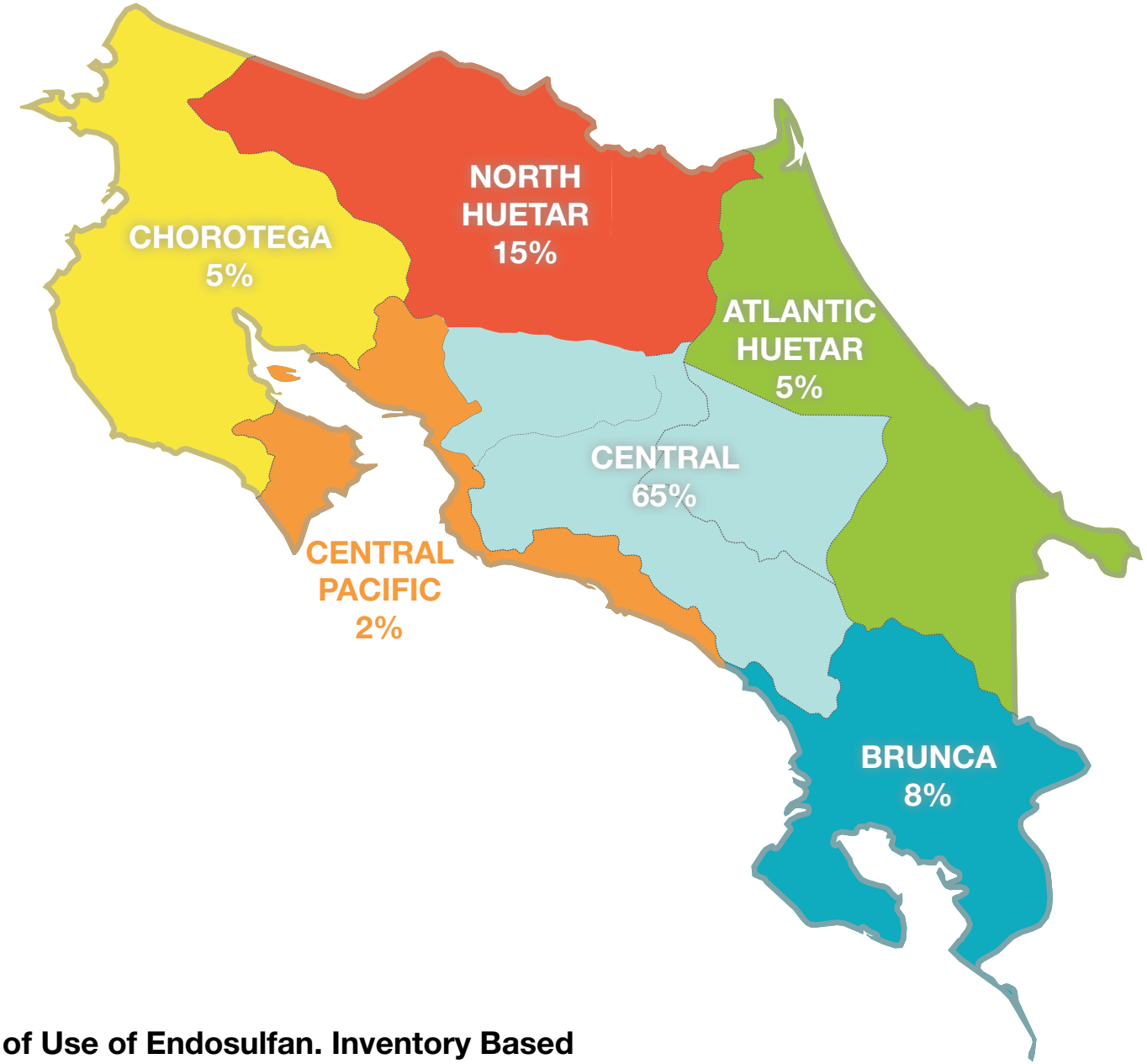


Figure 4.
Distribution of Use of Endosulfan. Inventory Based

Let us highlight, on Figure 4, that the Central region includes the most important areas of coffee cropping in the country (Los Santos, west area of Alajuela, Turrialba, Juan Viñas, and other.) Also, the North Huetar and Atlantic Huetar regions (Guacimo, Siquirres, Pococi) and the Brunca region have the most important pineapple producers.

C. Endosulfan Imports

Since 2008, the total records are 165 845 kg of active compound, from different brands and presentations, as shown on Figure 5. There are no changes on 2014 since, while collecting data, there were no new imports yet. Between 2009 and 2011, the imports increased significantly due to an increase of the coffee berry borer on the country during that period of time. Also, the increment on pineapple crops in the last years has an impact on the increasing use of this pesticide. The imports of this product have significantly decreased since 2012 and, according to importers, more restrictions and future prohibitions are foreseen which means that the consumption will continue decreasing by the end of 2014.

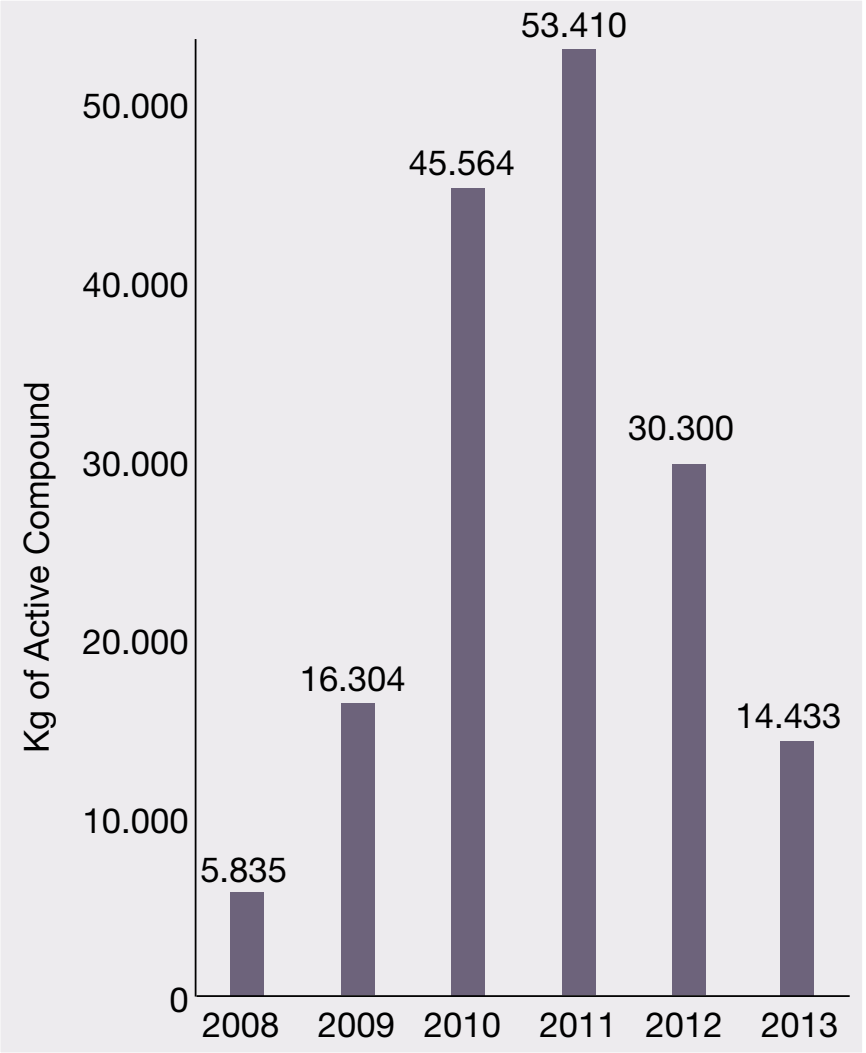


Figure 5.
Endosulfan Imports

It is important to highlight that, as per information from the Ministry of Environment and Energy, there is an executive decree written and signed by the Ministers of Agriculture and Livestock, Health, Ministry of Labor and Social Security, and Environment and Energy to prohibit the import, formulation, sales and exports of endosulfan. It is expected to have it published in a short term. In that way, its use will be allowed only for coffee crops, during a two-year period maximum. For all other crops, its use will be completely banned in a six-month period from publication of the decree.

D. Exports

The country produces formulated products of endosulfan. It also acts as international receiving and distribution center which generates exports mainly to other Central American countries. Since 2008 to date, the total amount of exports is 32 872 kg of active compound as shown on Figure 6.

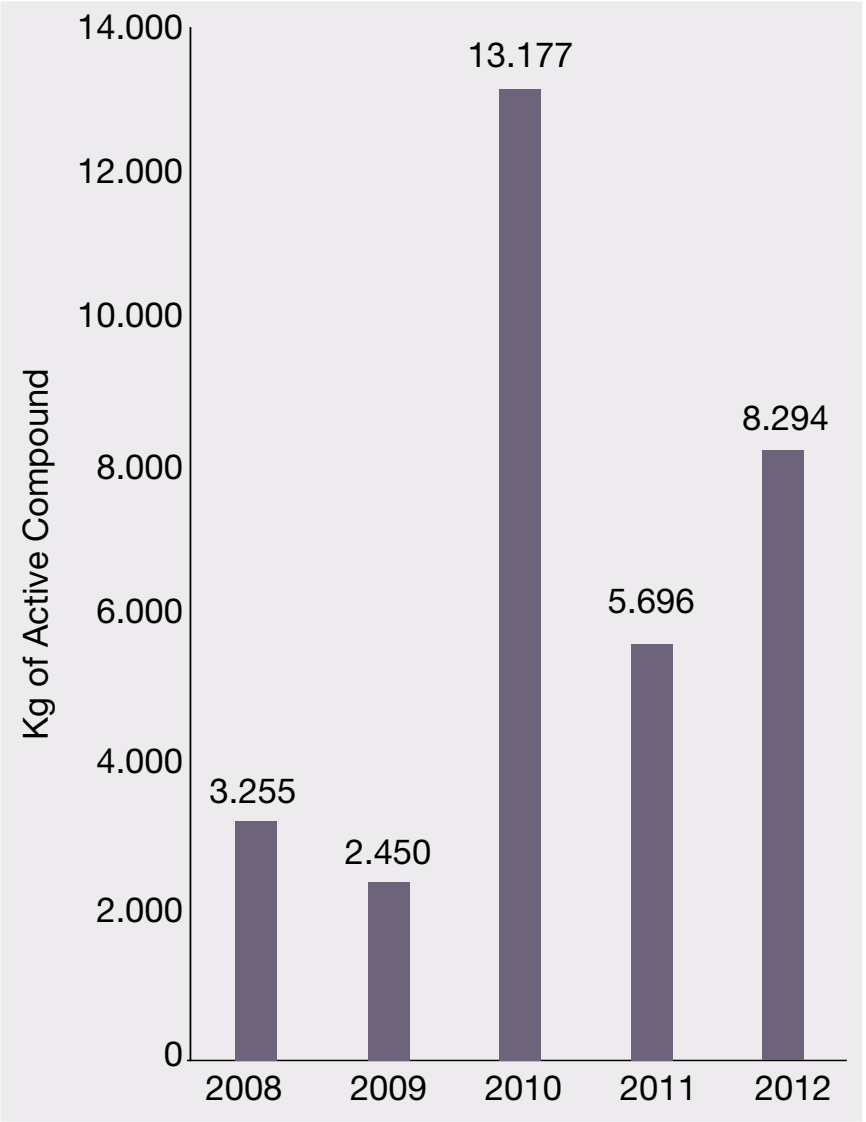


Figure 6.
Endosulfan Exports

As stated on Figure 6, the exports vary. However, since 2010, there is an important increase, which means that that year presented the most significant variation. That is linked to the increase of coffee berry borer in the Central American region.

Nonetheless, there are no movements reported on 2013 as well as 2014. It is expected that 2014 will end up with a significant decrease of exports compared to previous years.

E. Distribution of Endosulfan Inventory

The information on previous sections evidence that 165 845 kg has been received in the country since 2008 with exports of 32 872 kg. Therefore, for national consumption, 80% of the imports would be used which is near 132 973 kg of active compound that are equivalent to 379 922 L of formulated products of endosulfan.

It is also estimated that, on that same period of time, 356 573 L of formulated products of endosulfan have been commercialized in the country from different brands and presentations, keeping warehouse inventory of 29 thousand liters of formulated products of endosulfan approximately.

On the other hand, taken into account information from about geographical distribution of endosulfan use (Figure 4), the consumption of this product in all different brands and presentations by regions since 2013 can be estimated as stated on Table 20.

Table 20. Commercialized Endosulfan per Region since 2012

Region	Quantity (L)
Central	37 158
North Huetar	8 575
Brunca	4 573
Chorotega	2 858
Atlantic Huetar	2 858
Central Pacific	1 143

F. Sulfluramid Inventory

The sulfluramid is an ant pesticide against leaf cutter ants *(Atta spp and Acromyrmex spp)*, and domestic insects such as cockroaches *(Blatta orientalis)*.

Only two formulated products with this active compound are registered in the country: Mirex-S 0,3 GB and Blattanex Gel.

G. Imports and Exports

Approximately, 50 kg of Blattanex Gel as finished good are imported each year, which is equivalent to a 100 grams of active compound annually. There are no exports registered.

The imports data of Mirex-S 0,3 GB, since 2008, is presented as follows:

Table 21. Imports of Sulfluramid (Mirex-S)

Date	Record	Commercial Name	Amount of Active Compound (kg)
18/11/2008	3762	Mirex-S 0.3 GB	45
01/06/2009	3762	Mirex-S 0.3 GB	90
06/05/2010	3762	Mirex-S 0.3 GB	101
05/01/2011	3762	Mirex-S 0.3 GB	135
25/04/2012	3762	Mirex-S 0.3 GB	98
29/01/2013	3762	Mirex -S 0.3 GB	154
Total			**623**

In total, the country has imported 623 kg of active compound of sulfluramid since 2008. That is equivalent to 207 533 kg of Mirex-S 0,3 GB as finished good approximately.

As shown on Figure 7, there is an increase pattern on imports. The highest record was on 2013, with an import of 154 kg of active compound present in Mirex-S 0,3 GB. A similar pattern of demand of the product is expected in the following years.

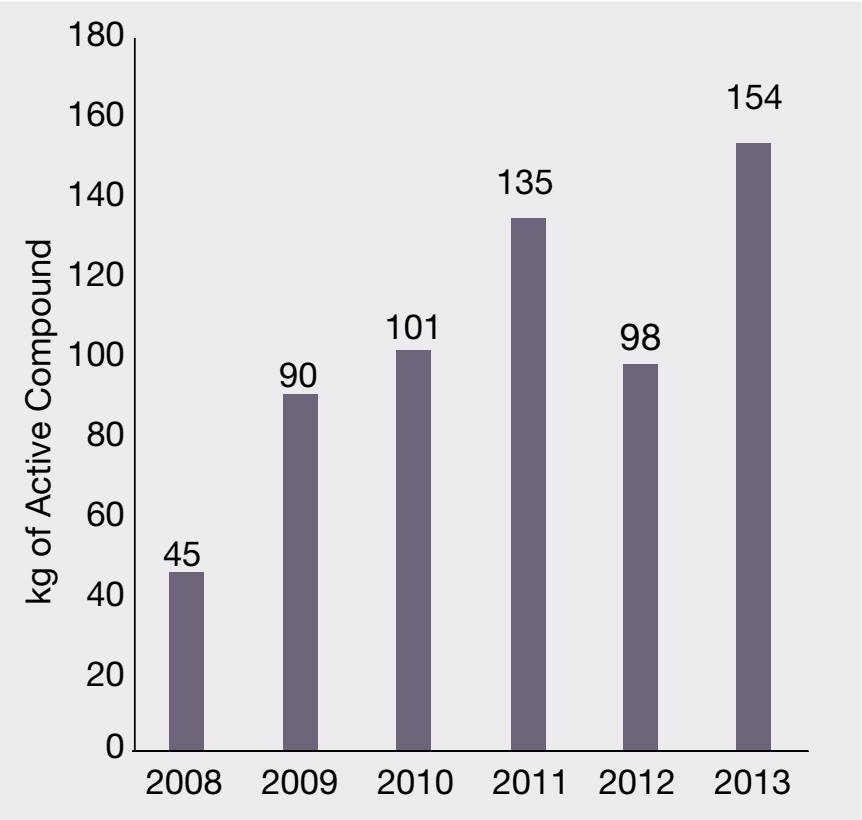


Figure 7. Imports of Sulfluramid

This product does not have the same movements regarding exports. It is important to highlight that Mirex-S 0,3 GB is produced by Atta Kill and gets in the country as finished good for national consumption.

H. Distribution of Sulfluramid Inventory

Even though the amount of sulfluramid derived from Blattanex Gel is really low (100 grams i.a./ year), it can be mentioned that this product is used mainly on the Central Valley and Caribbean region, without distribution to the rest of the country.

Mirex-S 0,3 GB is used in the whole country. According to distributors, its inventory in the country is distributed approximately as shown on Figure 8.

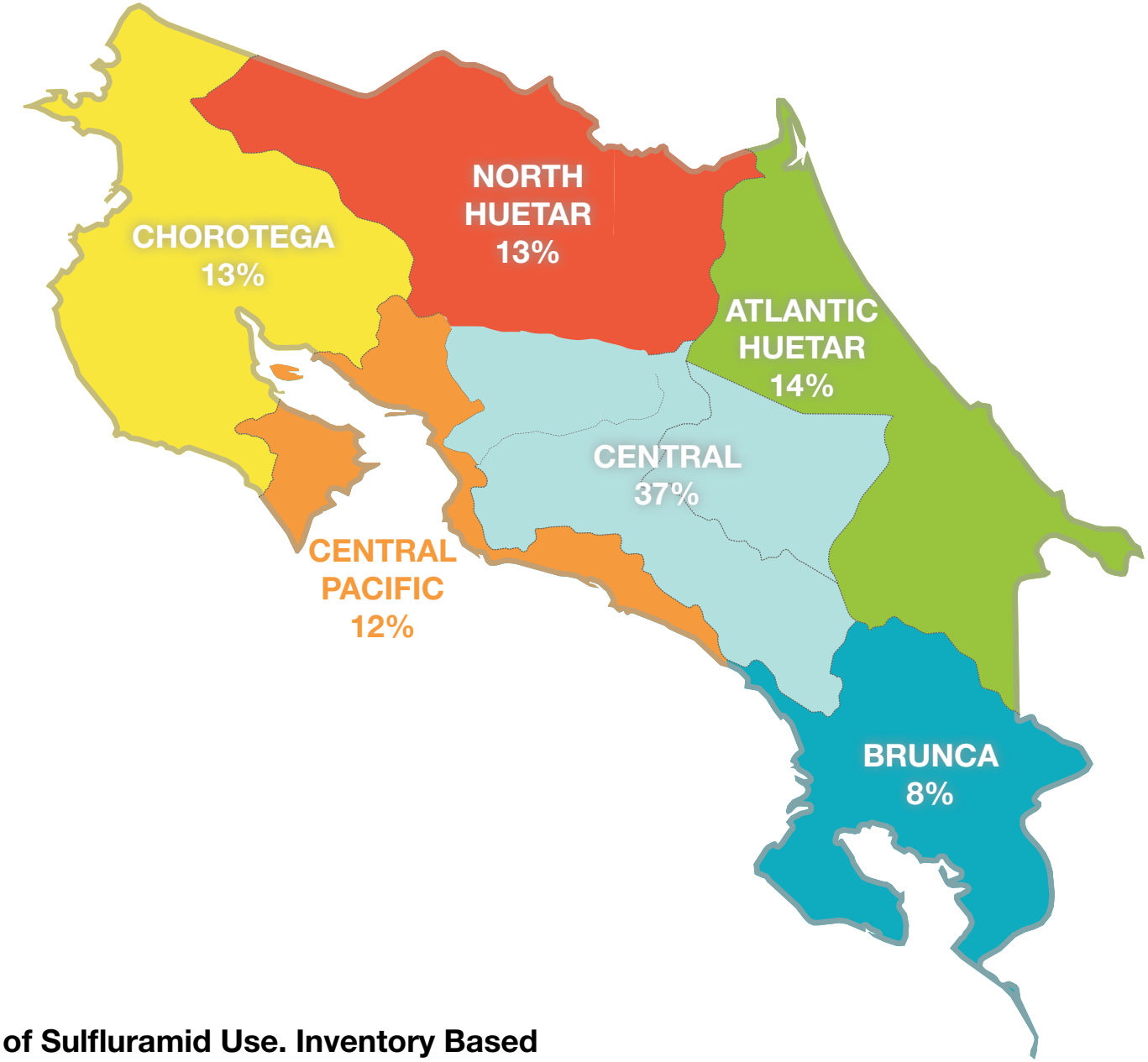


Figure 8.
Distribution of Sulfluramid Use. Inventory Based

As shown on Figure 8, the area in which sulfluramid is used the most is the Central region, 37%. All other regions have similar consumption percentages among them, between 11% and 14%.

4.4. Conclusions and Recommendations

From the investigations results, the following conclusions were obtained:

- Sometimes, pesticides users do not have protocols that reflect proper handling, control and management and final product disposition of obsolete or banned products technical criteria.
- Even though interviewees on field work claim that there is lack of clarity from government authorities regarding support on pesticides handling, mainly on usage, management, and final disposition, the country has several instances in charge of those functions such as the Ministry of Agriculture and Livestock.
- There was no traceability on pesticides management and residues or obsolete products treatment.
- Only formulated products that contain DDT, Aldrin, Dieldrin, Toxaphene, Chlordane and Heptachlor (heading 3808501200) have a technical note of explicit prohibition of entrance to the country. All other POPs require compliance to entrance requirements which means that actually the restriction of entrance is based on regulations from the Ministry of Agriculture regarding product registration, specifically by the SFE, as per regulations cited on Table 12.
- In a short term, a decree will be published to prohibit endosulfan which will allow its use for up to two years maximum for coffee crops.
- No prohibition or control regulations apply to pentachlorobenzene and Perfluorooctanesulfonic acid, including sulfluramid, in the country.
- There are registered products of endosulfan, sulfluramid and lindane. However, only the first two have cross-bordering movements and internal demand.
- Endosulfan is used basically in the whole country, having 88% among the Central region (65%), North Huetar (15%), and Brunca (8%) for coffee crops mainly (70%), pineapple crops (20%) and vegetables crops (10%).
- Since 2008, 80% of the imports have remain in the country for internal use which means that near 132 973 kg of active compound, which is equivalent to 379 922 L of formulated products.
- Two products with sulfluramid were found, Blattanex Gel (record 3201-P-519) and Mirex-S 0,3 GB (record 3762) of which 100 g and 154 kg

of active compound respectively were imported on 2013.

Moreover, the recommendations are the following:

- Coordinate actions to compensate technical gaps regarding disposition and elimination of POP pesticides and obsolete products with the Ministry of Agriculture and Livestock, Ministry of Health, and Ministry of Environment and Energy.
- Organize with the Plant Health Government Service (SFE-MAG in Spanish), training programs that allow technological advances and support for usage and management of pesticides residues of POP pesticides and obsolete products.
- Generate an information system for traceability of pesticides from entrance in the country, formulation, distribution and usage as well as residues management and obsolete products.
- Work with the General Customs Administration to include technical note 073 to import missing POP pesticides so that the entrance of those products will be prohibited in the country.
- Request that the Ministry of Agriculture and Livestock issues a regulation of prohibition of registration, formulation, manufacturing, imports, exports, transit, deposit, warehousing, sale and use of pentachlorobenzene and perfluorooctanesulfonic acid and its salts. This could be process through the Inter-ministerial Commission for Registration of Pesticides in which the MAG, the MINAE and the Ministry of Health are included.

4.5. Action Plan for POP Pesticides

Table 22. POP Pesticides – Action Plan

Direct Effects	Indicators	Base Line	Goals	Activities	Term	Responsible
Improve control of national inventory of endosulfan	Updated import, export, distribution and uses data of endosulfan in the country.	Only endosulfan is sold. On 2013, 14 432 kg of active compound were imported. The decree is on signatures approval step from the government authorities.	For 2017, it should have 100% of the national inventory of endosulfan.	Follow up on the established proposal of the decree of prohibition of endosulfan.	Short	MAG MINAE
		SFE has a pesticides registration system. However, it does not have online access.	For 2016, create the obligation to report usage, management and sale of endosulfan digitally.	Develop and implement an information system to control usage and management of pesticides.	Short	SFE

Direct Effects	Indicators	Base Line	Goals	Activities	Term	Responsible
Improve control of national inventory of endosulfan	Updated import, export, distribution and uses data of endosulfan in the country.	Since 2008, near 80% of the imports of endosulfan have remain in the country. Since 2012 to date, no exports were registered.	To have the database by 2017.	Create a database with information about endosulfan movements on the distributors' sites.	Short	SFE
Improve national management of POP Pesticides and obsolete products	Import, export, distribution and uses data of POP pesticides in the country.	Except for endosulfan, there are no imports or exports reported of any of the other POP pesticides.	To get a 100% updated digital database by 2016.	Adequate regulatory instruments to generate the use of the POP pesticides database.	Short	SFE MINAE

Direct Effects	Indicators	Base Line	Goals	Activities	Term	Responsible
Improve national management of POP Pesticides and obsolete products	Training Material developed for POP.	SFE collects a tax equivalent to 1,5% of the pesticides imports. That fund provides financing to the Good Agricultural Practices (GAP) program that the Ministry of Agriculture and Livestock is in charge of.	To have training material on POPs and obsolete products within the GAP program by 2015.	Adequate technical material of the GAP training courses to include POPs and obsolete products.	Short	SFE MINAE
	Record of protocols of POP inventory management and general obsolete pesticides.	Even though governmental institutions have programs about pesticides, there are weaknesses regarding scientific knowledge for elimination of POPs and obsolete products.	To have a reference protocol about POP management and other pesticides by 2016.	Define elimination mechanisms for obsolete pesticides through the Inter-ministerial commission.	Short	MINSALUD MINAE MAG

Direct Effects	Indicators	Base Line	Goals	Activities	Term	Responsible
Improve national management of POP Pesticides and obsolete products	Specific actions taken for the strengthening of audit and control of pesticides.	Technical limitations and inconsistencies in the warehousing, control, management and final disposition.	To have a strengthen audit and control process by 2018.	To strengthen audit and control process of pesticides.	medium	SFE
	Number of destroyed DDT tons.	The Ministry of Health has 8 600 kg of DDT in warehouses.	To eliminate all existences of DDT by 2018.	To identify means of international cooperation to obtain financing and eliminate POP and obsolete pesticides.	medium	MINSALUD MINAE MAG

Direct Effects	Indicators	Base Line	Goals	Activities	Term	Responsible
Improve national management of POP Pesticides and obsolete products	Finished draft of decree.	Obsolete pesticides have been found on public institutions and private companies.	To have a completed draft of the decree on 2017.	Elaborate a draft of the decree to report elimination of POP and obsolete pesticides.	Short	MINSALUD MINAE MAG
	Roadmaps of actions to facilitate traceability of POP management.	Lack of protocols for management.	To have 30% of the beneficiaries of the training program of the SFE already trained on 2018.	Include the coordination, usage, management, disposition and final treatments of the pesticides topics through the inter-institutional commission.	Medium	SFE MINAE

Direct Effects	Indicators	Base Line	Goals	Activities	Term	Responsible
Improve management of empty bottles or packages	Increase the amount of recovered and treated bottles or packages.	Since 2013, 725 tons of pesticides' empty bottles or packages have been generated. 30% have been recycled, 24% have been burn, 19% have been buried and 27% have received other treatments. Since 2012, the FLNC has collected 314 tons of plastic (bottles or packages and "common" plastic).	To increase by 40% the amount of collected bottles or packages by 2016.	Implement the regulation of special residues of the GIR Law so that the distributor is responsible of collecting and managing the bottles or packages.	Short	SFE MINSALUD
			To execute at least two bottles or packages' collecting campaigns by 2018.	Implement campaigns to collect bottles or packages.	Medium	MINSALUD MINAE Local Governments SFE

Direct Effects	Indicators	Base Line	Goals	Activities	Term	Responsible
Improve the regulations systems for POP control	Regulation for pentachlorobenzene and perfluorooctanesulfonic acid (PFOS).	An authorization register is required prior to imports of pentachlorobenzene and perfluorooctanesulfonic acid. But, no regulations govern their uses.	To have a decree to prohibit imports by 2017.	Create a draft of the decree to prohibit imports of products that contain pentachlorobenzene and perfluorooctanesulfonic acid.	Short	MINAE MINSALUD MAG
Improve customs control for entrance of new POPs to the country	Technical notes to prohibit entrance to the country.	There is no technical note to prohibit entrance of new POP pesticides to the country.	To apply technical notes to prohibit all POP pesticides on 2014.	Request to the MINAE, General Customs Administration, the application of technical note of prohibition of imports (073) for products that contain POPS.	Short	SFE MINAE

5. UNINTENTIONAL POPs INVENTORY

5. UNINTENTIONAL POPs INVENTORY

This section corresponds to the 2013 national inventory of dioxins and furans, applying the estimation tool provided by UNEP in its revised 2013 version (UNEP, 2013). It is the second inventory of unintentional POP emissions carried out on a national level as the baseline or first inventory was conducted in 2005.

Unlike the sections on pesticide POPs or industrial POPs, this section provides a distribution based on groups, categories, and types that utilizes the version-2013 evaluation tool. The results, conclusions, and recommendations are provided for each group.

5.1. Methodology

The present national inventory for dioxins (PCDD) and furans (PCDF) was conducted utilizing the UNEP-updated version-2013 tool. The data correspond to 2013 as the reference year. The information on the production rates for each one of the groups and categories was obtained by direct consultation (interviews, emails, telephone conversations) of issuing entities or by indirect estimation using a literature-based correlated datum. In other cases, sector information available in national associations, institutions, or chambers was used. The data obtained were validated by means of a workshop with the aforementioned stakeholders.

5.2. Results

5.3. Group 1: Waste incineration

The incineration group corresponds to technological incineration furnaces. It is sub-divided in 7 categories according to the matrix of the material being incinerated. The main release routes are: air, through direct release and contained in airborne ash, waste, particularly bottom ash, and, depending on the air pollution control system technology, water may be also included if gas scrubbers are taken into account. In Costa Rica, there is only one company that incinerates hazardous waste from residual agrochemicals resulting from formulation and packaging, due to which it is included in category b, hazardous waste. Moreover, two companies that offer pet cremation services were found. The results are shown in Table 23.

Table 23. Release of dioxins and furans: Waste incineration

Source categories	Production rate t/a	Annual releases		
		g TEQ/a	g TEQ/a	g TEQ/a
		Air	Fly ash	Bottom ash
Municipal solid waste incineration	**0**	**0,000**	**0,000**	**0,000**
Hazardous waste incineration	**114**	**0,040**	**0,103**	**0,000**
Low technol. combustion, no APCS		0,000	0,000	0,000
Controlled combustion, minimal APCS	114	0,040	0,103	0,000
Controlled combustion, good APCS		0,000	0,000	0,000
High tech. combustion, sophisticated APCS	0	0,0000	0,000	0,000
Medical waste incineration	**0**	**0,000**	**0,000**	**0,000**
Light-fraction shredder waste incineration	**0**	**0,000**	**0,000**	**0,000**
Sewage sludge	**0**	**0,000**	**0,000**	**0,000**
Waste wood and waste biomass incineration	**0**	**0,000**	**0,000**	**0,000**
Animal carcasses incineration	**2**	**0,001**	**0,000**	**0,000**
Old furnaces, batch, no/little APCS	2	0,001	0,000	0,000
Waste incineration **Subtotal**		0,041	0,103	0,000
Total		**0,144**		

A. Comparison of results with 2005 baseline

The emission of dioxins and furans in this group corresponds to the same emission source. The magnitude of the emission decreased by 40% because the amount of material to be incinerated has been decreasing. Figure 9 shows a comparison of emissions from 2005 to 2013. The emissions in this group remained incipient during the 2005-2013 period, and they corresponded to 0,04% of total national emissions.

B. Specific recommendations

The country must make an effort to evaluate incineration technologies and establish allowed limits on air emissions and deposit of fly ash and bottom ash.

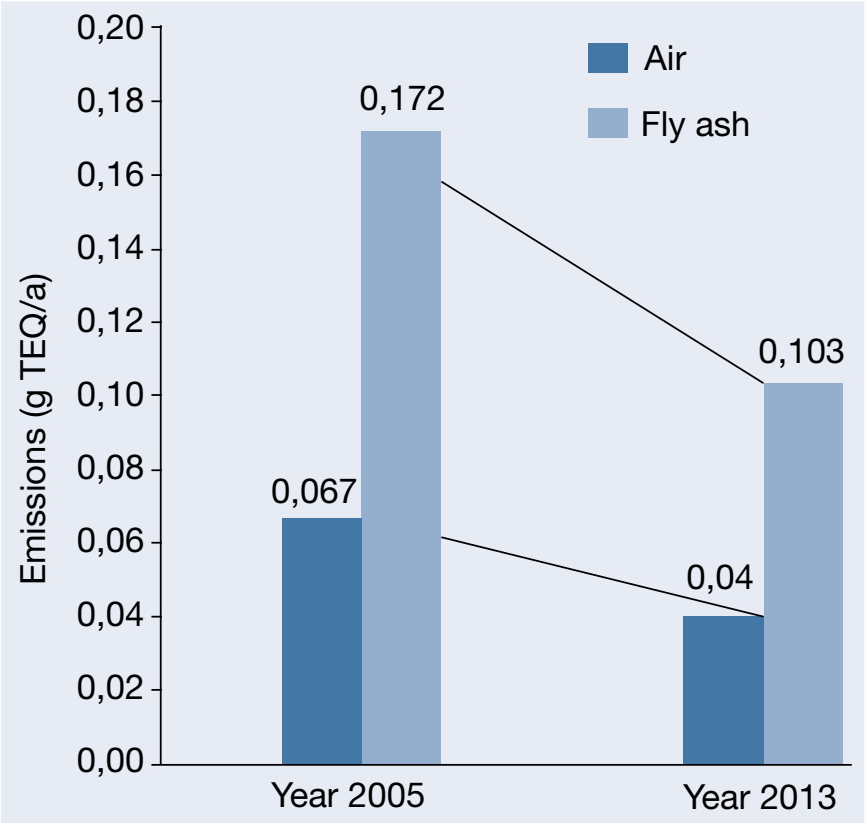


Figure 9.
Emissions of dioxins and furans in 2005 and 2013: Waste incineration

5.3.1. Action Plan - Group 1: Waste incineration

Table 24. Unintentional POPs - Group 1: Waste incineration

Direct effects	Indicators	Base line	Goals	Activity
Regulate the development of projects utilizing incineration or co-incineration technologies	Final draft regulation to be submitted for signature by government authorities.	The issue raised in this revision is the ban on waste incineration, allowing co-incineration only, in which the energy produced is utilized under strict regulations and procedures to keep emissions of dioxins and furans at a technically permissible level, according to international standards.	By 2016, have the final draft of *Regulation on operating conditions and emission control of facilities for ordinary solid waste incineration ready for signature*.	Provide scientific, technical, and environmental criteria, from the standpoint of dioxins and furans in air and ash, in the discussions made for the revision of Regulation.
Term				**Responsible**
Short				MINAE MINSALUD

Direct effects	Indicators	Base line	Goals	Activity
Regulate the development of projects utilizing incineration or co-incineration technologies	Number of regulations or guidelines updated and created to monitor activities or technologies not included in the *Regulation on operating conditions and emission control of facilities for ordinary solid waste incineration*.	Moratorium on municipal solid waste incineration.	By 2018, have technical criteria regarding the evaluation of thermal transformation projects.	Evaluate and develop regulations for the generation of ash and air emissions, needed to evaluate thermal transformation projects to settle in Costa Rica.
Term				**Responsible**
Medium				MINAE MINSALUD SETENA

Direct effects	Indicators	Base line	Goals	Activity
Regulate the development of projects utilizing incineration or co-incineration technologies	Number of draft regulations prepared.	The contribution of this category to total emissions represents less than 1% (0,04%) of total emissions.	By 2018, have a draft regulation on other types of incinerated waste.	Propose regulations on incineration of other types of waste, e.g. animal carcasses.
Term				**Responsible**
Medium				MINAE MINSALUD

Direct effects	Indicators	Base line	Goals	Activity
Regulate the development of projects utilizing incineration or co-incineration technologies	Number of enhanced laboratories.	The supply of analysis of dioxins and furans is limited in the country.	By 2018, have an enhanced capacity for chemical analysis of POPs.	Enhance the capacity for analysis of dioxins and furans, including training and *accreditation of samplers*.
Term				**Responsible**
Medium				MINAE

5.4. Group 2: Ferrous and non-ferrous metal production

This category includes a number of processes such as the production of various metals such as iron, copper, aluminum, zinc, and others. It also includes galvanizing processes, iron and steel casting, aluminum scrap processing, bronze and brass casting, as well as open cable burning, etc. (ICRC, 2014).

The search results are presented in Table 25:

Table 25. Release of dioxins and furans: Ferrous and non-ferrous metal production

Source categories	Production	Annual release(g TEQ/a)				
	t/a	Air	Water	Land	Product	Residue
Iron ore sintering	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Coke production	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Foundries	**720,000**	**0,007**	**0,000**	**0,000**	**0,000**	**0,0**
Cold-air cupola, or hot-air cupola, or rotary drum, no APCS	720,000	0,007	0,000	0,000	0,000	
Hot-dip galvanizing plants	**20 000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,0**
Facilities with degreasing step, good APCS	20 000	0,000	0,000	0,000	0,000	0,020
Copper production	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Aluminum production	**300**	**0,030**	**0,000**	**0,000**	**0,000**	**0,060**
Processing Al scrap, minimal treatment of inputs, simple dust removal	300	0,030	0,000	0,000	0,000	0,060
Lead production	**100**	**0,008**	**0,000**	**0,000**	**0,000**	**0,000**
Pb production from scrap containing PVC	100	0,008	0,000	0,000	0,000	
Zinc production	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Brass and bronze production	100	0,000	0,000	0,000	0,000	0,000
Thermal de-oiling of turnings	100	0,000	0,000	0,000	0,000	

Source categories	Production	Annual release(g TEQ/a)				
	t/a	Air	Water	Land	Product	Residue
Magnesium production	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Thermal non-ferrous metal production (e.g.Ni)	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Shredders	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Thermal wire reclamation and electrical and electronic waste recycling	**83**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Open burning of cable	83	0,999	0,000	0,000	0,000	0,000
Production of Ferrous and Non-Ferrous Metals - **Subtotal**	--------	1,042	0,000	0,000	0,000	0,091
Total	**1,133**					

A. Comparison of results with 2005 base line

The emissions from air and waste reservoirs decreased in 2013; however, this decline may be due to a decrease in production for this year.

B. Specific recommendations

Policies must be created in order to make companies report their production data, using tools such as the Pollutant Release and Transfer Register (PRTR), and prevent illegal trade of copper cables and open burning.

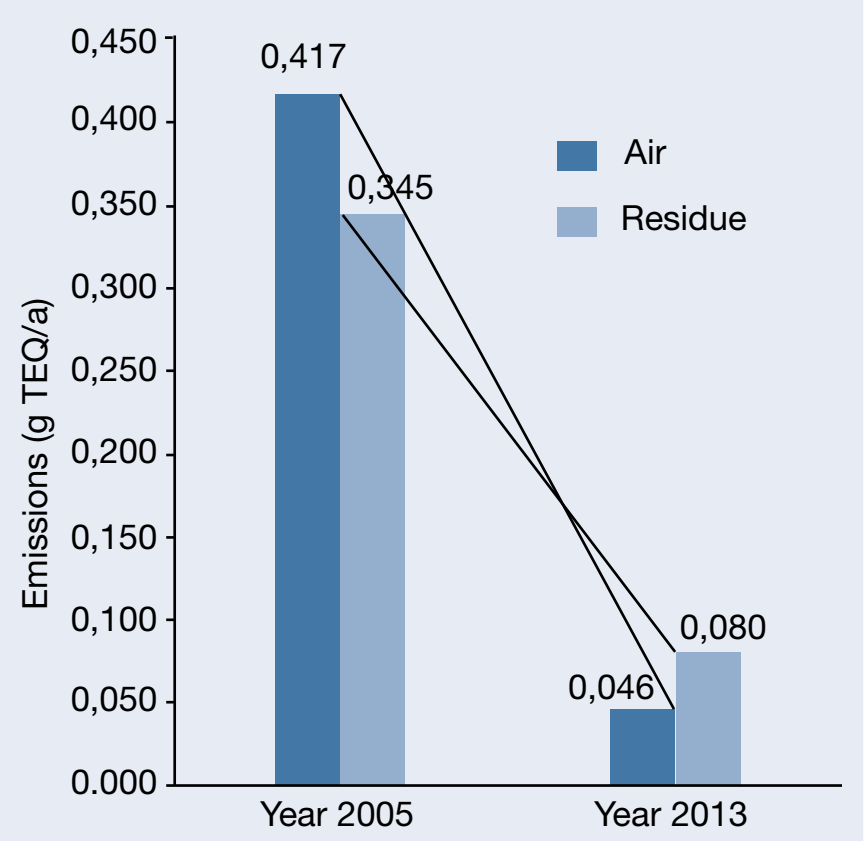


Figure 10. Emissions of dioxins and furans in 2005 and 2013: Ferrous and non-ferrous metal production

5.4.1. Action Plan - Group 2: Ferrous and non-ferrous metal production

Table 26. Unintentional POPs - Group 2: Ferrous and non-ferrous metal production

Direct effects	Indicators	Base line	Goals	Activity
Systematic collection of information for inventory	Information management system installed.	The contribution of this category to total emissions represents less than 1% (0,06%) of total emissions.	By 2018, have a system to manage the information on control of scrap amount as reported by managers.	Systematize the management of the information on control of scrap amount as reported by managers.
Term				**Responsible**
Medium				MINAE MINSALUD

Direct effects	Indicators	Base line	Goals	Activity
Improvement of regulation on scrap metal waste	Plan for solid waste management.	The management of used parts is included in the plans on a voluntary basis only.	By 2020, have a plan for solid waste management including the management of used parts and metal parts.	Compulsorily include the management of used parts waste in the plan for solid waste management submitted to the Ministry of Health.
Term				**Responsible**
Long				MINAE MINSALUD

Direct effects	Indicators	Base line	Goals	Activity
Improvement of regulation on scrap metal waste	Number of campaigns run.	The practice of burning scrap and metal parts takes place in the informal sector that handles this type of waste, so there is no control in this regard.	By 2018, have completed at least two awareness campaigns in order to avoid scrap and wire burning.	Awareness campaigns to avoid burning as part of the cleaning process of metal parts.
Term				**Responsible**
Medium				MINAE MINSALUD

5.5. Group 3: Heat and power generation

Group 3 applies to all combustion processes conducted to generate heat and power, except for thermal processes specifically included in other groups. Thus, thermal power plants and all kinds of industrial boilers run on both fossil fuels and biomass are part of this group. In 2013, fuel consumption of ICE's thermal plants accounted for 201 390 475,23 kg bunker and 62 468 178,90 kg diesel (ICE-furnished report on fuel consumed by thermal power plants in 2013). Bunker-powered industrial boilers consume 112 279 672,18 kg, equivalent to 4 678,3 TJ, which emitted 0,012 g TEQ into the air, and diesel-powered industrial boilers consumed 892 628 908 kg, equivalent to 42 580,9 TJ, which emitted 0,021 g TEQ. The specific data on industry-used biomass were limited to four major crops in Costa Rica: coffee (skins and firewood) (M. Araya, personal communication, 2014), rice (husk) (CONARROZ, 2014), sugarcane (bagasse) (LAICA, 2014), and oil palm (kernel and empty fruit bunch) (PELTEC, 2014).

Table 27. Release of dioxins and furans: Heat and power generation

Source categories	Production TJ/a	Annual release (g TEQ/a)				
		Air	Water	Land	Product	Residue
Fossil fuel power plants	**69 346**	**0,061**	**0,000**	**0,000**	**0,000**	**0,000**
Heavy fuel fired power boilers	13 094	0,033	0,000	0,000	0,000	0,000
Light fuel oil/natural gas fired power boilers	56 252	0,028	0,000	0,000	0,000	0,000
Biomass power plants	**19 713**	**0,986**	**0,000**	**0,000**	**0,000**	**0,900**
Clean wood fired power boilers	1 285	0,064	0,000	0,000	0,000	0,019
Boilers fired with bagasse, rice husks, etc.	18 427	0,921	0,000	0,000	0,000	0,921
Landfill biogas combustion	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Household heating and cooking – Biomass	**6 666**	**0,667**	**0,000**	**0,000**	**0,000**	**0,000**
Wood/virgin biomass fired stoves	6 666	0,667	0,000	0,000	0,000	0,047

Source categories	Production TJ/a	Annual release (g TEQ/a)				
		Air	Water	Land	Product	Residue
Domestic heating – Fossil fuels	**7 082**	**0,011**	**0,000**	**0,000**	**0,000**	**0,000**
Natural gas/LPG fired stoves	**7 082**	**0,011**	**0,000**	**0,000**	**0,000**	**0,000**
Heat and power generation **Subtotal**		1,724	0,000	0,000	0,000	0,988
Total		**2,712**				

A. Comparison of results with 2005 baseline

Comparing the emissions results from group 3 in 2013 with the emissions from the group in 2005, an increase of 59% (Figure 11) is observed in the group of heat and power generation. This increase is multifactorial, though data availability changed, and some variations in trends were also noted.

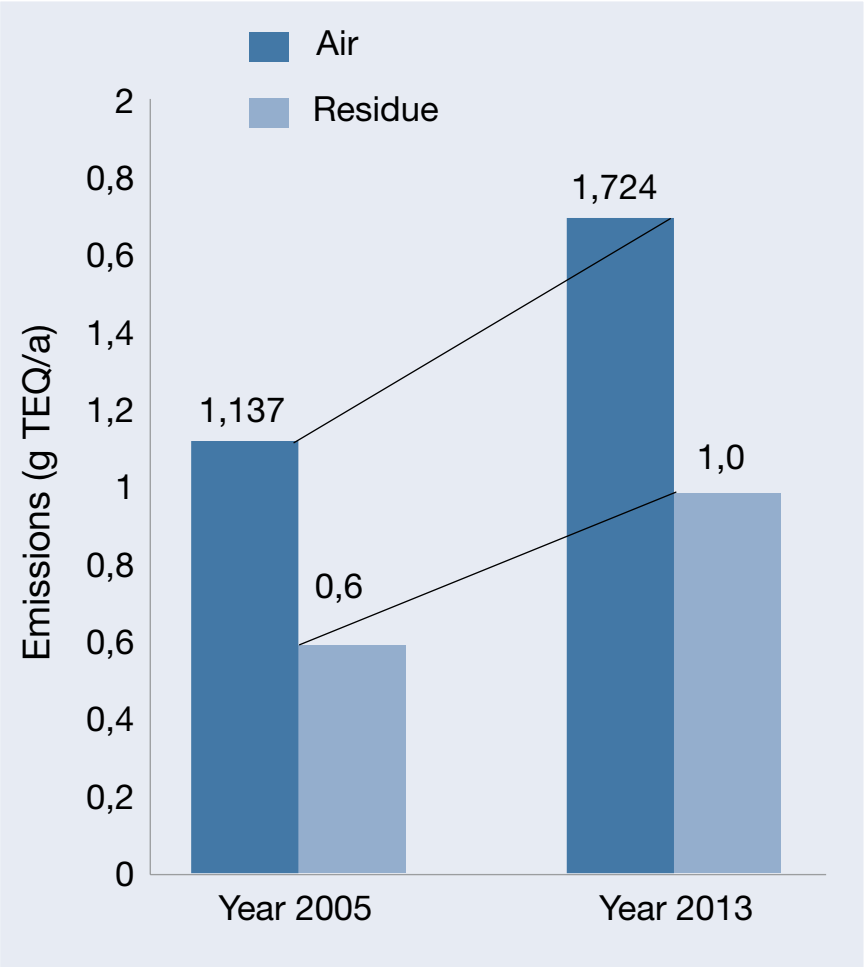


Figure 11. Emissions of dioxins and furans in 2005 and 2013: Heat and power generation

B. Specific recommendations

In Costa Rica, regulation Nº.36551-S-S-MINAET-MTSS (MINAET-MTSS, 2012) is applicable to biomass-fired boilers and furnaces. It sets the parameters for regular pollutants like PM_{10}, NO_x, and SO_2. However, a parameter on maximum allowable concentration of dioxins and furans (ng TEQ/m^3) must be included in said regulation. Furthermore, it is essential to require more efficient air pollution control systems (chimneys) and review the legislation on these furnaces and boilers in order to ensure the protection of the environment. Finally, although the operational reports are submitted to the Costa Rican Ministry of Labor, a specialized unit charged with processing and monitoring follow-up actions, such as site inspections and improvements in systems and sanctions, must be created.

5.5.1. Action plan – Group 3: Heat and power generation

Table 28. Unintentional POPs - Group 3: Heat and power generation

Direct effects	Indicators	Base line	Goals	Activity
Systematic collection of information for inventory	Digital information management system implemented.	No information system in place.	No information system in place.	Develop an information management system that allows for centralization and systematization of boiler activity reports, including the quantity and type of fuel used.
Term				**Responsible**
Medium				MINSALUD

Direct effects	Indicators	Base line	Goals	Activity
Improvement of regulations on air emissions and boilers	Draft decree on boilers' mandatory annual reporting on biomass consumption by business sector.	Industrial biomass utilized in heat generation in agribusiness corresponds to 45% of this group's releases.	By 2020, review of air emissions regulations in boilers, including ash maintenance and treatment.	Review and revision of existing regulations for boilers in order to request the information on the type and amount of fuel used during the year.
Term				**Responsible**
Long				MINSALUD

5.6. Group 4: Mineral Products

Productive activities in this group are mainly conformed by large cement companies, except for brick companies and limestone quarries, which fall into the category of small businesses. The country has two cement companies, both of which reported a 9,6% decrease in production between 2005 and 2013. This can be justified by the economic crisis that hit the construction sector (Vindas, 2014c), generating lower production rates. With regard to limestone quarries, their mining activity is mainly limited to limestone extraction to produce cement or veneers for building or house facades. Limestone for making cement has not been taken into account as heat treatment was included in the previous category. The country has 2 small companies engaged in the production of bricks and clay roof tiles: One employs burnt oil and wood, while the other, locally available mango wood. There are also a glass-making company and two ceramic factories. The rate of asphalt production is based on RECOPE's sales report. (RECOPE is a state-owned oil products company).

Table 29. Release of dioxins and furans: Mineral Products

Source categories	Production t/a	Annual release g TEQ/a		
		Air	Residue	Water/land/product
Cement kilns	**1 260 000**	**0,063**	**0,000**	**0,000**
Wet kilns, ESP/FF temperature <200°C and all types of dry kilns with preheater/precalciner, T<200 ° C	1 260 000	0,063	0,000	0,000
Lime	**3 500**	**0,035**	**0,000**	**0,000**
Cyclone/no dust control, contaminated or poor fuels	3 500	0,035		0,000
Bricks	**6 000**	**0,001**	**0,000**	**0,000**
No emission abatement in place and using contaminated fuels	6 000	0,001	0,000	0,000
Glass	**132 442**	**0,002**	**0,000**	**0,000**
Good dust abatement	132 442	0,002	0,000	0,000
Ceramics	**0**	**0,000**	**0,000**	**0,000**
Asphalt mixing	**66 955**	**0,005**	**0,000**	**0,000**
Mixing plants with no gas cleaning	66 955	0,005		0,000
Oil shale processing	**0**	**0,000**	**0,000**	**0,000**
Production of mineral products - **Subtotal**		0,106	0,000	0,000
Total			**0,106**	

A. Comparison of results with 2005 baseline

Figure 12 shows the results of the mineral products group. This group generated a total air emission of 0,106 g TEQ in 2013, which, compared to 0,154 g TEQ in 2005, represents a 31% decrease. This may be traced back to lower production rates in the cement, lime, and brick sectors.

B. Specific recommendations

The ceramics, glass, and cement industries employ advanced technologies with controlled temperatures and fossil fuels that are relatively clean in terms of dioxin and furan emissions; by contrast, the lime and brick factories run on biomass and burnt oil under almost artisanal and poorly controlled conditions. Although these production activities have shown a decline, it would be important to advise these sectors on the risk of using biomass and other alternative fuels, such as burnt oil, and on the efficiency of the technology being employed and feasibility studies for cleaner technologies.

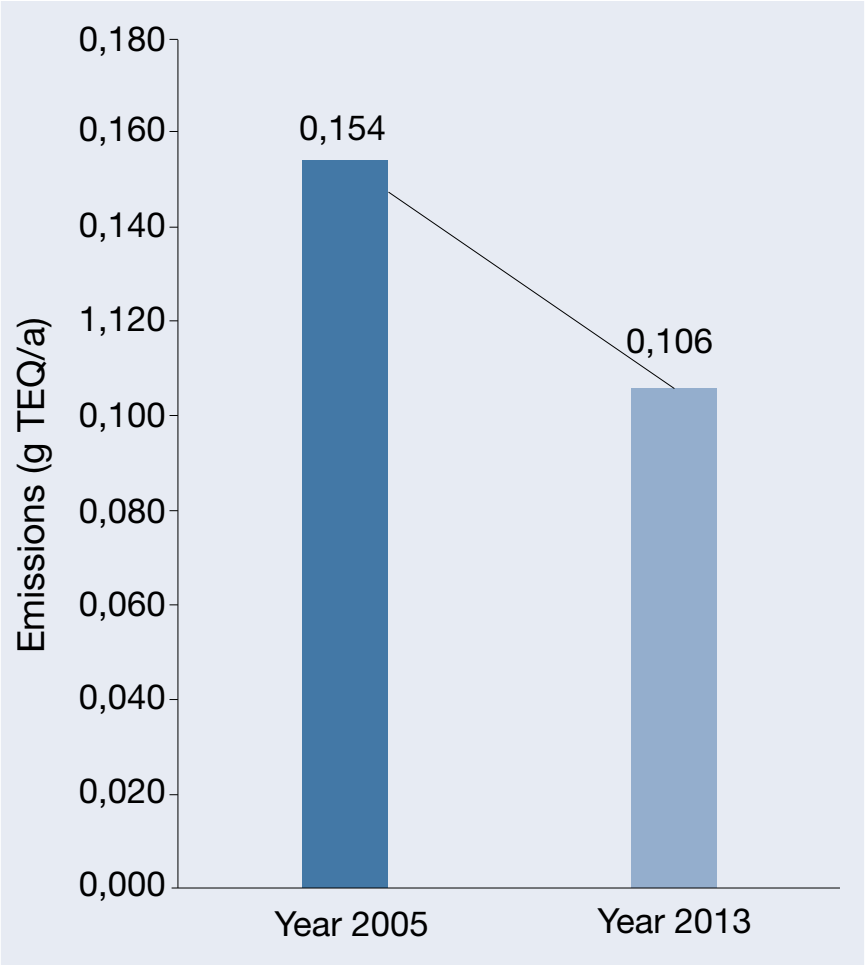


Figure 12. Emissions of dioxins and furans in 2005 and 2013: Mineral products

5.6.1. Action Plan - Group 4: Mineral Products

Tabla 30. Unintentional POPs - Group 4: Mineral Products

Direct effects	Indicators	Base line	Goals	Activity
Systematic collection of information for inventory	Digital information system.	The contribution of this category to total emissions represents less than 0,03% of total emissions.	By 2018, have a digital information system.	Develop an information management system to identify types of furnaces as well as the type and amount of fuel used on a yearly basis.
Term				**Responsible**
Medium				MINSALUD MINAE

Direct effects	Indicators	Base line	Goals	Activity
Systematic collection of information for inventory	Draft decree made.	This sector does not have a requirement to report fuel consumption. In 2013 inventory, some companies voluntarily provided information.	By 2018, have a draft decree to ensure reporting.	Review regulatory control of this sector in order to require companies to report the type and amount of fuel used during the year.
Term				**Responsible**
Medium				MINSALUD MINAE

5.7. Group 5: Transport

PCDD/PCDF emissions from the transport sector result from incomplete combustion of fuels in different types of engines. These emissions depend on various factors, such as: type of engine, presence or absence of catalyst, type of fuel to be used, presence of fuel additives, type of fuel used, and vehicle maintenance. Given that many factors, the Standardized Emissions Calculation Tool focuses on the two main ones only (UNEP, 2013): type of engine (two-stroke and four-stroke) and type of fuel (diesel, gasoline, and biodiesel).

The information required to estimate dioxin and furan emissions in Group 5, regarding transport, was obtained from fuel sales data provided by RECOPE, biodiesel sales, and the data on the vehicle fleet for 1974-2013 models provided by the Costa Rican Public Registry.

Table 31. Release of dioxins and furans: Transport

Source categories	Consumption t/a	Annual release (g TEQ/a)				
		Air	Water	Land	Product	Residue
Four-stroke engines	**1 485 021**	**0,079**	**0,000**	**0,000**	**0,000**	**0,000**
Unleaded gasoline without catalyst	787 061	0,079	0,000	0,000	0,000	0,000
Unleaded gasoline with catalyst	697 960	0,001	0,000	0,000	0,000	0,000
Two-stroke engines	**67 853**	**0,170**	**0,000**	**0,000**	**0,000**	**0,000**
Unleaded gasoline	67 853	0,170	0,000	0,000	0,000	0,000
Diesel engines	**1 804 570**	**0,180**	**0,000**	**0,000**	**0,000**	**0,000**
Regular diesel	1 800 082	0,180	0,000	0,000	0,000	0,000
Biodiesel	4488	0,000	0,000	0,000	0,000	0,000
Heavy-oil-fired engines	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Transport - **Subtotal**		0,429	0,000	0,000	0,000	0,000
Total		**0,429**				

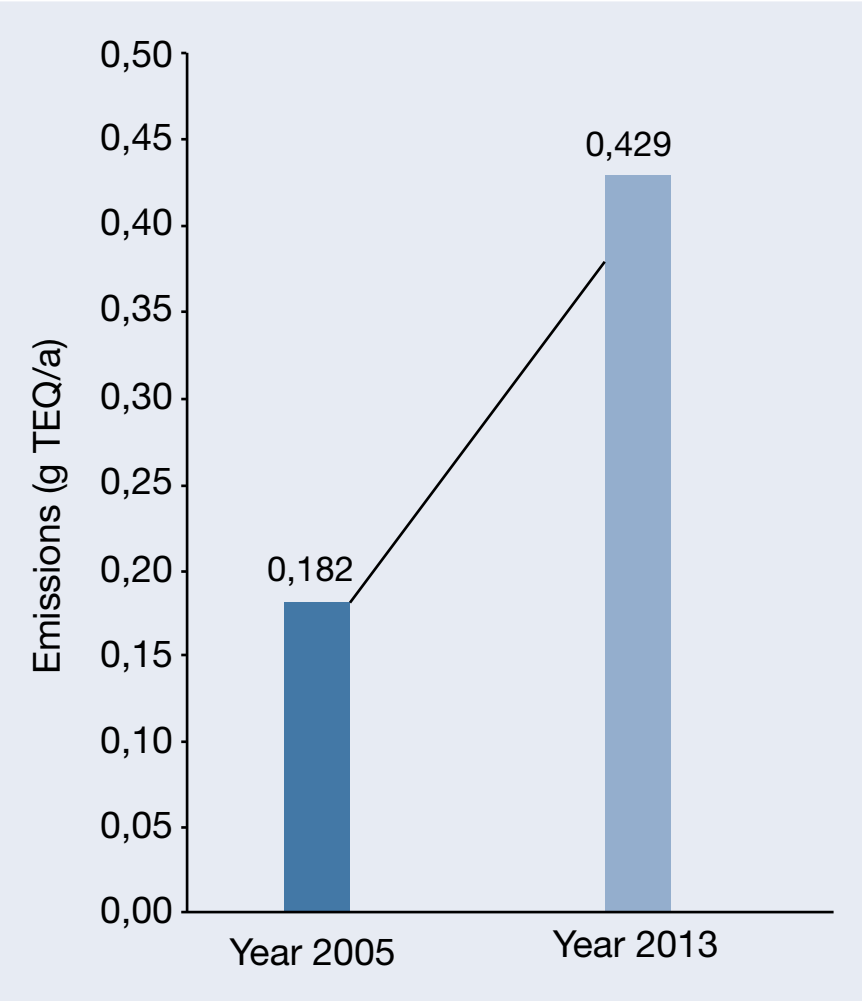


Figure 13. Emissions of dioxins and furans in 2005 and 2013: Transport

A. Comparison of results with 2005 baseline

The emissions in 2013 rose by 136% due to the increase of the vehicle fleet and, most likely, an increment in fuel consumption by vehicles of low efficiency and high emission (pre-1994 models). Figure 13 shows the difference in dioxin and furan emissions from 2005 to 2013.

B. Specific recommendations

To reduce emissions in this category, it is advisable to take action to regulate or prohibit the import of vehicles made before 1994 and of two-stroke vehicles (higher import duties, road taxes, or air charges).

With reliable, accessible databases, decision makers should be monitored regarding changes in the vehicle fleet, so that they take direct action to optimize efficiency in fuel consumption. It is important to promote improvements in public transport and the road network, both of which are directly related to greater efficiency in fuel consumption in this sector.

5.7.1. Action plan – Group 5: Transport

Table 32. Unintentional POPs - Group 5: Transport

Direct effects	Indicators	Base line	Goals	Activity
Systematic collection of information for inventory	Information system implemented.	There is no system to ensure traceability of burnt oil residues and catalysts for dioxins and furans.	By 2018, have a traceability information management system for burnt oil residues and catalysts.	Develop an information management system for verification in the waste management plans on the disposal of burnt oil and catalysts.
Term				**Responsible**
Medium				MINAE

Direct effects	Indicators	Base line	Goals	Activity
Systematic collection of information for inventory	Updated, accessible information from RTV.	Vehicle fleet information is difficult to access.	By 2016, governmental authorities have access to information from the company responsible for performing vehicle technical inspections.	Coordinate with the company responsible for performing vehicle technical inspections (RTV) to promote access to statistics by government entities.
Term				**Responsible**
Short				MINAE MINSALUD MOPT

Direct effects	Indicators	Base line	Goals	Activity
Improvement of regulations regarding vehicles	Final draft regulation.	There are no regulations to control the quality of petroleum products, so that dioxin and furan emissions are decreased.	By 2016, have the updated vehicle emission regulation draft.	Review the regulations related to petroleum products, spark-ignition and diesel engine fuel, so that the emission of dioxins and furans during combustion decreases.
Term				**Responsible**
Short				MINAE MINSALUD RTV MOPT

Direct effects	Indicators	Base line	Goals	Activity
Improvement of regulations regarding vehicles	Draft legislation banning vehicles over 10 years old and two-stroke motorcycles.	Persisting use of vehicle models prior to 1995 without catalyst and motorcycles with 2-stroke engines.	By 2018, have the legislation banning import of vehicles over 10 years old and two-stroke motorcycles.	Amend the regulation to ban the import of 2-stroke motorcycles using mixtures of oil and fuel in their engines.
Term				**Responsible**
Medium				MINAE MOPT

Direct effects	Indicators	Base line	Goals	Activity
Improvement of regulations regarding vehicles	Statistics on use and production of biofuel.	Although there has been a National Biofuels Program since 2008, the proposed distribution of blends (10% ethanol and 10-20% of biofuels) has not been achieved. Current data on biodiesel production are difficult to access by these companies.	By 2018, have target goals on the use of biofuel in the transport sector.	Regulate the process of production and use of biodiesel.
Term				**Responsible**
Medium				MINAE National Biofuels Program

5.8. Group 6: Open burning processes

In Group 6, two categories of open burning are discussed: a. Biomass burning and b. Waste burning and accidental fires. In the first one, pre- and post-harvest burning of agricultural residue and the burning of virgin biomass, such as forest and scrub fires, among others, are included. The second category encompasses structural, vehicle, and household waste fires. Combustion processes in both categories occur under open, uncontrolled conditions, lacking a suitable container or specialized equipment (such as a furnace or incinerator) to carry it out, which causes the release routes to be air and land, not the residues or ashes (UNEP, 2013).

The Ministry of Agriculture and Livestock (MAG), through its Department of Sustainable Production, provided the information on the extension of burnt land, according to burning permits granted, which has a direct correlation with biomass data, depending on the type of crop. In burning these materials, unfavorable combustion conditions were found, such as the burning of large stacked amounts, wet material, and possible use of chlorinated pesticides on crops. Such is the case with pineapple, for which the chlorinated pesticide Paraquat is sometimes used before burning the waste in the field.

In the case of accidental fires in houses, factories, and vehicles, the information came from the Benémerito Cuerpo de Bomberos (distinguished fire brigade).

This category accounts for over 80% of all annual emissions due to the large amount of biomass burning of such crops as pineapple and sugarcane, among others, taking place in the country.

5.8.1. Comparison with the results of 2005 base line

An increase in the emissions of Group 6, which corresponds to open burning, is shown for both periods examined and for releases to air and land. Between the two years, the percentage increase was 28% and 71% of releases to air and land, respectively, due to increased agricultural burning.

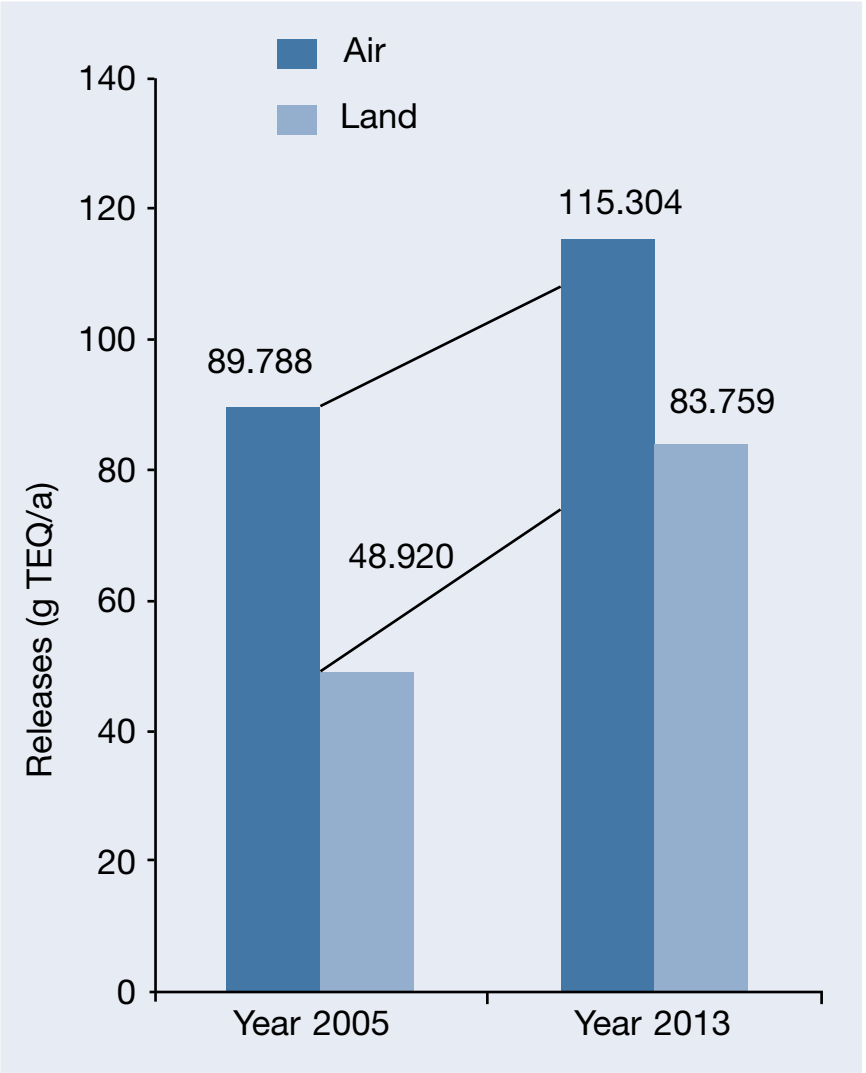


Figure 14. Comparison of dioxin and furan emissions for Group 6: Open burning processes in 2005 and 2013

Table 33. Release of dioxins and furans: Open burning processes

Source categories	Production t/a	Annual release (g TEQ/a)				
		Air	Water	Land	Product	Residue
Biomass burning	**1 607 763**	**22,177**	**0,000**	**7,039**	**0,000**	**0,000**
Agricultural residue burning in the field of cereals and other crops stubble, impacted, poor burning conditions	692 083	20,763	0,000	6,921	0,000	0,000
Sugarcane burning	193 459	0,774	0,000	0,010	0,000	0,000
Forest fires	559 853	0,560	0,000	0,084	0,000	0,000
Grassland and savannah fires	162 368	0,081	0,000	0,024	0,000	0,000
Waste burning and accidental fires	**286 657**	**93,127**	**0,000**	**76,720**	**0,000**	**0,000**
Fires at waste dumps (compacted, wet, high organic carbon content)	50 288	15,086	0,000	0,503	0,000	0,000

Source categories	Production t/a	Annual release (g TEQ/a)				
		Air	Water	Land	Product	Residue
Accidental fires in houses, factories	190 399	76,160	0,000	76,160	0,000	0,000
Open burning of domestic waste	45 274	1,811	0,000	0,045	0,000	0,000
Accidental fires in vehicles (per vehicle)	696	0,070	0,000	0,013	0,000	0,000
Open burning processes - **Subtotal**		115,304	0,000	83,759	0,000	0,000
Total	**199, 063**					

A. Specific recommendations

In connection with the burning of agricultural residue, it is advisable to establish an inspection process in areas where it is customary to engage in these practices, as it is likely that, in considering permit data only, the number of releases is underestimated. As for a possible reduction of dioxin and furan releases in this category, efforts should focus on promoting a ban on agricultural burning, mainly that of pineapple and sugarcane. Another aspect to consider is the reduction of fires at waste dumps, for which municipalities or bodies in charge should either train the staff in charge of waste disposal centers or deploy emergency teams to put out the fires.

5.8.2. Action Plan - Group 6: Open burning processes

Tabla 34. Unintentional POPs - Group 6: Open burning processes for year 2013

Direct Effects	Indicators	Base line	Goals	Activity
Collection of information for decision-making by government authorities in the process of banning open burning	Digital information management system implemented.	There is not an information system to manage open burning records.	By 2018, have a digital information system that centralizes the reports by MAG, SINAC, and Fire Brigades.	Regulate the process of production and use of biodiesel.
Term				**Responsible**
Medium				MINAE MAG

Direct Effects	Indicators	Base line	Goals	Activity
Improvement of legislation and practices related to open burning	Draft decree banning open burning.	Burning in agricultural activities is a common practice in some crops.	By 2017, have rolled out a plan to reduce agricultural burning.	Review the legislation on agricultural burning to define a legal mechanism that will gradually ban open burning.
Term				**Responsible**
Long				MINAE MINSALUD MAG

Direct effects	Indicators	Base line	Goals	Activity
Improvement of regulations and practices related to open burning	Number of GAP courses incorporating elimination of open burning in agricultural activities.	GAP courses do not include recommendations to reduce open burning.	By 2017, enhance MAG's GAP courses so that they promote the elimination of open burning practices.	Promote discussion forums among stakeholders in the agricultural sector to raise awareness about the need to eliminate open burning.
Term				**Responsible**
Short				MINAE MAG

Direct effects	Indicators	Base line	Goals	Activity
Improvement of regulations and practices related to open burning	Number of campaigns run per year.	Ordinary waste burning is prohibited. However, in rural areas, it is customary to burn ordinary waste.	By 2018, have completed at least two awareness campaigns.	Awareness campaigns to reinforce the proposed ban on open solid waste burning.
Term				**Responsible**
Medium				MINSALUD MINAE

Direct effects	Indicators	Base line	Goals	Activity
Improvement of regulations and practices related to open burning	Report on recommendations regarding national legislation prohibiting ordinary waste burning.	Implementing this legislation requires coordination among various departments of the institutions involved.	By 2018, have a review of the legislation.	Review national legislation prohibiting open ordinary waste burning (sanctions, follow-up, control, and breach reports).
Term				**Responsible**
Medium				MINSALUD MINAE

5.9. Group 7: Production and use of chemicals and consumer goods

In this group, emissions of chemicals and consumer goods associated with the release of dioxins and furans during production and/or use are quantified. The production of dioxins and furans is linked to processes in which some form of chlorine (elemental, organic, or inorganic) or some raw material contaminated with dioxins and furans (UNEP, 2013) is involved. This group includes 8 categories (a-h) with their respective classes. Table 35 shows only active categories and classes in the country, excluding inactive categories.

Table 35. Release of dioxins and furans: Production and use of chemicals and consumer goods

Source categories	Production t/a	Annual release g TEQ/a				
		Air	Water	Land	Product	Residue
Pulp and paper mills, boilers (per ton ADt pulp)	**85 065**	**0,016**	**0,000**	**0,000**	**0,000**	**0,156**
Power boilers fueled with sludge and/or biomass/bark	31 115	0,016	0,000	0,000	0,000	0,156
Paper recycling with contaminated waste paper	53 950	0,000	0,000	0,000	0,540	0,000
Chlorinated Inorganic Chemicals	**1 250**	**0,000**	**0,021**	**0,000**	**0,000**	**0,034**
Chlor-alkali production using titanium electrodes - Low-end technologies	1 250	0,000	0,021	0,000	0,000	0,034
Chlorinated aliphatic chemicals	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Chlorinated aromatic chemicals (per ton product)	**1 449,657**	**0,000**	**0,000**	**0,000**	**8,2**	**1,0**
Pentachloronitrobenzene (PCNB) – Low-end technologies	3,811	0,000	0,000	0,000	0,021	0.000
2,4-D and derivatives – Low-end technologies	1 433	0,000	0,000	0,000	8,150	0.000
Phthalocyanine dyes and pigments – Phthalocyanine copper	0,524	0,000	0,000	0,000	0,00004	0.000

Source categories	Production t/a	Annual release g TEQ/a				
		Air	Water	Land	Product	Residue
Dioxazine dyes and pigments- Violet 23 (Violet 23)	0,0045	0,000	0,000	0,000	0,000054	0.000
Triclosan – Low-end technologies	12,317	0,000	0,000	0,000	0,021	0.000
Other chlorinated and non-chlorinated chemicals	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Petroleum refining	**10,00**	**0,000003**	**0,000**	**0,000**	**0,000**	**0,000**
Flares (by TJ fuel burned)	10,00	0,000003	0,000	0,000	0,000	0,000
Textile plants	0	0,000	0,000	0,000	0,000	0,000
Leather plants	0	0,000	0,000	0,000	0,000	0,000
Chemicals and consumer goods- **Subtotal**		0,016	0,021	0,000	8,733	0,189
Total		**8,959**				

A. Comparison with the results of 2005 baseline

Based on the results in Table 35 and considering the 2005 inventory, the main release source in Group 7 corresponds to the import of 2,4-D and its derivatives, and, in general, the group has maintained the dioxin and furan emissions during the study period.

B. Specific recommendations

With regard to a possible reduction of emissions in Group 7, it would be advisable to review the national legislation in order to restrict the content of dioxins and furans as they are significant pollutants in the pesticide 2,4-D and its derivatives. The latter are generated in production processes.

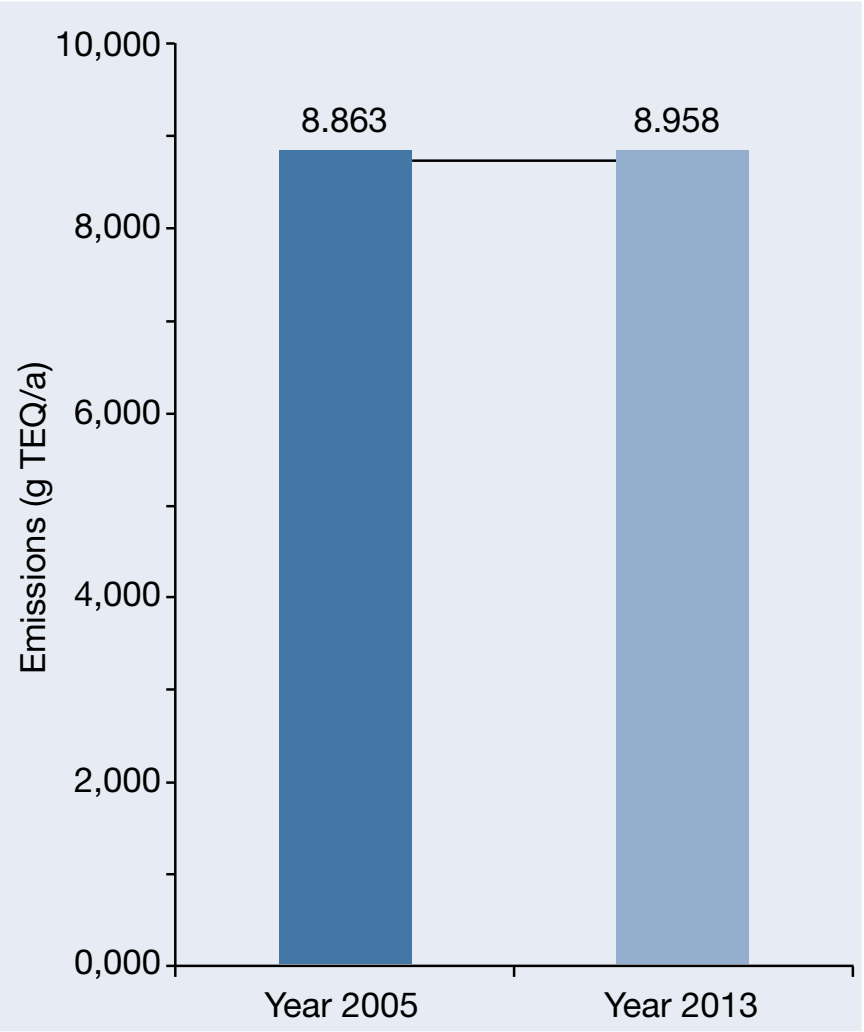


Figure 15. Emissions of dioxins and furans in 2005 and 2013: Production and use of chemicals and consumer goods

5.9.1. Action Plan - Group 7: Production and use of chemicals and consumer goods

Table 36. Unintentional POPs - Group 7: Production and use of chemicals and consumer goods for 2013

Direct effects	Indicators	Base line	Goals	Activity
Existence of PRTR which includes chlorinated compounds in commercial products	Number of category-7 substances included in PRTR within the next two years.	The contribution of this category to total emissions represents less than 2,8% of total emissions.	By 2016, have a strategy for implementation of PRTR.	Promote the adoption and implementation of PRTR.
Term				**Responsible**
Short				MINAE MINSALUD SFE

Direct effects	Indicators	Base line	Goals	Activity
Existence of a centralized digital information system that will maintain updated inventories of dioxins and furans	Percentage increase of chlorinated substances included in PRTR annually.	The information on these products is scattered in various institutions related to chemicals management.	By 2020, have at least 80% of substances containing chlorinated compounds included in PRTR.	Feed PRTR with chlorinated compounds.
Term				**Responsible**
Long				MINAE MINSALUD SFE

Direct effects	Indicators	Base line	Goals	Activity
Existence of legislation that restricts the import of products that make an impact on health and environment	Technical guide for monitoring identified precursor products.	The tariff headings used by Dirección General de Aduanas (General Directorate of Customs) have an overview of the product without specifying the chemical description of the parent compound.	By 2020, have the necessary resources to provide traceability to identified precursors.	Develop technical criteria to identify and monitor precursors of dioxins and furans.
Term				**Responsible**
Medium				MINAE MINSALUD MHacienda

Direct effects	Indicators	Base line	Goals	Activity
Existence of legislation that restricts the import of products that make an impact on health and environment	Technical guide for classifying commercial products containing 2,4-D according to the type of technology used in their production: high-end and low-end.	The import of 2,4-D and derivatives does not have import restrictions.	By 2017, have a product classification according to production technology.	Classify imported products containing 2,4-D and derivatives according to origin and production technology: high-end, medium-end, and low-end.
Term				**Responsible**
Short				MINAE MINSALUD SFE

Direct effects	Indicators	Base line	Goals	Activity
Existence of legislation that restricts the import of products that make an impact on health and environment	Draft regulation that restricts the import of products containing 2,4-D made with low-end technologies.	At a global level, commercial products containing 2,4-D and derivatives as active compounds have dioxins and furans which are considered unwanted pollutants. This is because their production processes generate dioxins and furans emissions. Depending on the technology used, the amount of resulting dioxins and furans can be high, medium, or low. The classification is based on the dioxin and furan emissions factor: low-end technology 5,688 µg TEQ/t, mid-range 170 µg TEQ/t, and high-end 0,1 µg TEQ/t.	By 2018, have a draft regulation that restricts the import of products containing 2,4-D and derivatives produced with low-end technology processes.	Conduct discussions among stakeholders to define a legal instrument banning the import of low-end technology products, incorporating the issue of enhanced monitoring (sampling and chemical analysis).
Term				**Responsible**
Medium				MINAE MINSALUD SFE

5.10. Group 8: Miscellaneous

In this category, the following five processes are listed: drying of biomass, crematoria (human), smokehouses, dry cleaning, and tobacco smoking. The results are shown in Table 37.

Table 37. Release of dioxins and furans: Miscellaneous

Source categories	Production t/a	Annual release (g TEQ/a)				
		Air	Water	Land	Product	Residue
Drying of biomass	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Crematoria	**540**	**0,049**	**0,000**	**0,000**	**0,000**	**0,000**
No control (per cremation)	540	0,049	0,000	0,000	0,000	0,000
Smokehouses	**Companies do not have data**	**0**	**0,000**	**0,000**	**0,000**	**0,000**
Dry cleaning	**Companies do not have data**	**0**	**0,000**	**0,000**	**0,000**	**0,000**
Tobacco smoking	**2 236**	**0,0002**		**0**	**0**	**0,00022**
Cigarette (per million units)	2 236	0,0002				0,00022
Miscellaneous - **Subtotal**		0,049	0,000	0,000	0,000	0,00022
Total	**0,049**					

A. Comparison with the results of 2005 base line

The emissions in Group 8 (miscellaneous) have little bearing on the overall results of emissions, amounting to 0,05%. The observed difference in emissions between 2005 and 2013 is mainly due to the availability of crematorium data in 2013, as opposed to 2005 when the information was non-existent.

B. Specific recommendations

The recommendations in this category are made based on the need to centralize and organize the information needed to quantify dioxins and furans because the current records on, for instance, cremations and dry-cleaning services, are not digitized.

5.10.1. Action Plan - Group 8: Miscellaneous

Table 38. Unintentional POPs - Group 8: Miscellaneous in 2013

Direct effects	Indicators	Base line	Goals	Activity
Improvement of regulations for this category	Final draft regulation.	The contribution of this category to total emissions represents less than 1%.	By 2016, have a strategy for implementation of PRTR.	Include annual reporting of number of cremations in legislation of funeral parlors.
Term				**Responsible**
Term				MINAE MINSALUD

Direct effects	Indicators	Base line	Goals	Actividad
Improvement of regulations for this category	Final draft of amended affidavit.	Cigarette distributors must submit an affidavit that discloses the compounds and emissions of tobacco products and by products. However, it does not indicate the number of cigarettes sold annually.	By 2016, have updated draft affidavit.	Modify the affidavit that cigarette distributors must submit to the Ministry of Health so that the annual marketed quantity is included.
Term				**Responsible**
Short				MINAE MINSALUD

Direct effects	Indicators	Base line	Goals	Activity
Database of operating crematoria	Database of operating crematoria.	Cremations data are scattered in different MINSALUD branches and are not digitized. On weekends, cremation permits are issued at MINSALUD headquarters.	By 2018, have an information management system on.	Develop a digital information management system that handles online cremation permit requests.
Term				**Responsible**
Medium				MINAE MINSALUD

Direct effects	Indicators	Base line	Goals	Activity
Database of operating crematoria	Technical inspection report that makes it possible to relate potential releases to the environment with current regulation.	Dry-cleaning companies must meet current regulations.	By 2016, have a review of emissions.	Inspect the activities of these companies with regard to air emissions and open water dumping of used solvents (Varsol, EXXON 40, and perchlorethylene).
Term				**Responsible**
Short				MINAE MINSALUD

5.11. Group 9: Disposal / Landfills

These processes, in most cases, are only release routes of dioxins and furans, not sources of their formation (UNEP, 2013). Dioxins and furans are found in waste being treated, and they gather or are released by the disposal systems in use (UNEP, 2013). The disposal systems discussed in this group are classified into 5 categories (a-e), with their respective classes. (See Table 39.)

A. Comparison with the results of 2005 base line

In the new version of the estimation tool, an emission factor of 50 µg TEQ/t is incorporated in category 9.a.1 Mixed wastes in Category 9.a, causing emissions to increase significantly with respect to 2005. However, in applying the 2013 estimation tool to the 2005 data and comparing them to those of 2013, a slight increase in emissions for this group is observed (Figure 16), which is mainly due to an increase in the national population, the parameter used in the calculations.

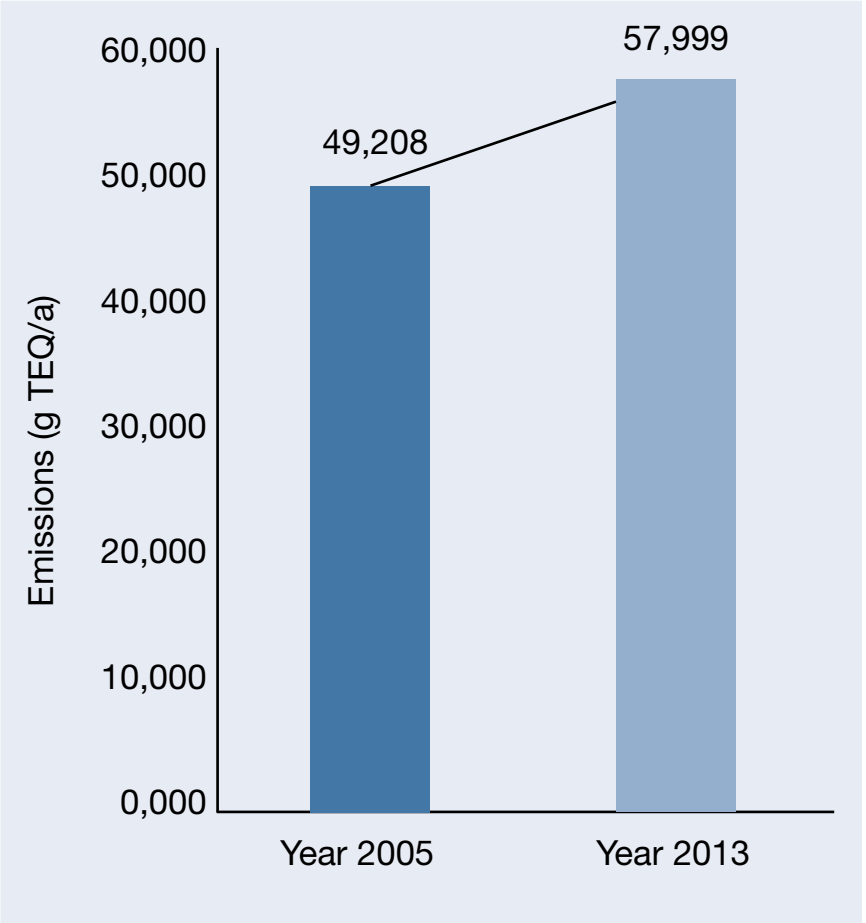


Figure 16. Emissions of dioxins and furans in 2005 and 2013: Disposal

Table 39. Release of dioxins and furans: Disposal

Source categories	Production t/a	Annual release g TEQ/a				
		Air	Water	Land	Product	Residue
Landfills, waste dumps, and landfill mining	**1 122 500**	**0,000**	**0,561**	**0,000**	**0,000**	**56,125**
Mixed wastes	1 122 500		0,561			56,125
Sewage and sewage treatment	**0**	**0,000**	**0,122**	**0,000**	**0,000**	**0,000**
Urban and industrial inputs with sludge removal	0	0,000	0,023	0,000	0,000	0,000
Domestic inputs with sludge removal	0		0,099	0	0	0,000
Open water dumping	**0**	**0,000**	**0,014**	**0,000**	**0,000**	**0,000**
Urban and peri-urban wastewater	0	0,000	0,014	0,000	0,000	0,000
Remote environments	0	0,000	0,001	0,000	0,000	0,000
Composting	**23 499**	**0,000**	**0,000**	**0,000**	**1,175**	**0,000**
Organic wastes separated from mixed wastes	23 499	0,000	0,000	0,000	1,175	0,000
Waste oil disposal	**0**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Disposal final - **Subtotal**		0,699	0,000	0,000	1,175	56,125
Total		**57,999**				

B. Specific recommendations

It is suggested to improve the data collection system of the industrial (wastewater) and agricultural (composting) sectors in order to generate reliable information to support decision-making in the field of waste disposal.

5.11.1 Action Plan - Group 9: Disposal / Landfills

Table 40. Unintentional POPs - Group 9: Disposal / Landfills

Direct effects	Indicators	Base line	Goals	Activity
Collection of information for decision-making by government authorities, seeking to improve waste disposal	Number of studies to determine dioxins and furans in landfills.	The contribution of this category to total emissions represents approximately 17,7% of total emissions.	By 2018, have research projects on determining dioxins and furans in landfills.	Conduct research on landfills to determine the presence and number of dioxins and furans.
Term				**Responsible**
Medium				MINSALUD

Direct effects	Indicators	Base line	Goals	Activity
Systematic collection of information for inventory	Annual reports on composting activities that provide relevant information for the calculation of unintentional POPs inventory.	The information on composting activities is scattered. There is not a body responsible for its monitoring and control.	By 2018, incorporate the amount of compost produced per year.	Enhance data collection on produced amount of compost in order to feed the calculation tool of dioxins and furans.
Term				**Responsible**
Medium				MINAE MAG

5.12. Group 10: Contaminated sites and hotspots

According to the PCDD and PCDF estimation tool, this category was created in order to develop strategies to identify potential sites contaminated with unintentional dioxins and furans. It is simply a checklist to identify activities that have historically taken place on these sites, evaluate the degree of exposure risk, and, if possible, conduct an analysis on the sites that require it.

Table 41. Release of dioxins and furans: Contaminated sites and hotspots

Source categories	Occurrence	g TEQ identified				
		Air	Water	Land	Product	Residue
		x means the need for specific onsite assessment				
Production sites of chlorine	**no**					
Chlor-alkali production	no		x	x		
Leblanc process and associated chlorine/bleach production	no			x		
Production sites of chlorinated organics	**no**					
Production sites of chlorophenol	no		x	x		
Former lindane production where HCH waste isomers have been recycled	no		x	x		
Former production sites of other chemicals suspected to contain PCDD/PCDF	no		x	x		

Source categories	Occurrence	g TEQ identified				
		Air	Water	Land	Product	Residue
		x means the need for specific onsite assessment				
Production sites of chlorinated solvents and other "HCB waste	no		x	x		
Former PCB and PCB-containing materials/ equipment production	no		x	x		
Application sites of PCDD/PCDF containing pesticides and chemicals	**No data**			**x**		
Timber manufacture and treatment sites	**No data**		**x**	**x**		
Textile and leather factories	**Yes**		**x**	**x**		
Use of PCB	**Yes**		**x**	**x**		
Use of chlorine for production of metals and inorganic chemicals	**no**		**x**	**x**		
Waste incinerators	**Yes**		**x**	**x**		
Metal Industries	**Yes**		**x**	**x**		
Fire accidents	**Yes**		**x**	**x**		
Dredging of sediments and contaminated floodplains	**Yes**		**x**	**x**		
Dumps of wastes/residues from groups 1-9	**Yes**		**x**	**x**		
Kaolin or ball clay sites	**no**					

5.13. Summary of results and conclusions on unintentional POPs

Emissions of dioxins and furans showed that, by 2013, Costa Rica emitted a total of 271 g TEQ per year, that is, 57,5 g TEQ/person. The most important groups in terms of emissions in 2013 were Group 6: Open burning processes (73,5%) and Group 9: Disposal (21,1%). Both amount to 95%, a figure similar to the 97% in 2005. (Table 41).

Table 42. Total releases of dioxins and furans in 2013 by group

Groups of sources		Annual release (g TEQ/a)						
Group		Air	Water	Land	Product	Residue	Total per group	%
1	Waste incineration	0,04	0,0	0,0	0,0	0,103	0,144	0,053
2	Ferrous and non-ferrous metal production	1,042	0,0	0,0	0,0	0,091	1,133	0,415
3	Heat and power generation	1,724	0,0	0,0	0,0	0,998	2,712	1,001
4	Production of mineral products	0,106	0,0	0,0	0,0	0,0	0,106	0,039
5	Transport	0,429	0,0	0,0	0,0	0,0	0,429	0,158
6	Open burning processes	115,304	0,0	83,759	0,0	0,0	199,063	73,480

Groups of sources		Annual release (g TEQ/a)						
Group		Air	Water	Land	Product	Residue	Total per group	%
7	Production and use of chemicals and consumer goods	0,016	0,021	0,0	8,733	0,189	8,959	3,679
8	Miscellaneous	0,049	0,0	0,0	0,0	0,0002	0,049	0,018
9	Disposal / Landfills	0,0	0,699	0,0	1,175	56,125	57,999	21,156
Total emissions per reservoir		**118,7**	**0,7**	**83,8**	**9,2**	**58,6**	**271,0**	
Total emissions		**271,0**						

The per-capita emissions for 2013 corresponded to 57,5 g TEQ/person, an increase of 25% if compared with the per-capita emissions in 2005 (45,9 g TEQ/person).

Table 43. Emissions of dioxins and furans by groups in 2005 and 2013

Group	Groups of sources	2005 (g TEQ/a)	2013 (g TEQ/a)
1	Waste incineration	0,2	0,1
2	Ferrous and non-ferrous metal production	0,8	0,1
3	Heat and power generation	5,5	2,7
4	Production of mineral products	0,1	0,1
5	Transport	0,2	0,4
6	Open burning processes	138,7	199,1
7	Production and use of chemicals and consumer goods	0,6	10,0
8	Miscellaneous	0,0	0,1
9	Disposal / Landfills	49,2	57,3
Total emissions		**196,2**	**271,0**

Table 44. Comparison of the ratio of PCDD and PCDF in 2005 and 2013 with the population, GDP, and territory

Year	Emission (gTEQ/ a)	Population (inhab)	Emission (µg TEQ/ capita)	GDP (US$/ capita)	Emission (mg TEQ /US$/ capita)	Emission per area (mg TEQ/km²)
2005	196	4 265 202	45,9	4 621	42,5	3,8
2013	271	4 713 168	57,5	10 185	26,6	5,3

5.14. Conclusions and general recommendations on unintentional POPs

The increase in per-capita emissions in the 2005-2013 study period is mainly due to factors such as consumption patterns and agricultural production involving open burning and waste disposal, which is consistent with weaknesses in waste management practices and implementation of nationally known regulations and standards.

On the other hand, it is concluded that capital generating investments in Costa Rica in 2013 generated fewer emissions than productive activities in 2005 (down 22%) due to the inclusion of high-tech industries in the biomedical and electronics sectors, among others; however, the country still has a strong track record of 90% in electricity generation from renewable and clean sources.

Some agricultural productive activities that use the land intensively (cultivation areas) have increased significantly and engage in highly PCDD and PCDF emitting practices, such as agricultural residue burning, which is reflected in an increase of 39% in the ratio of emissions per square kilometer.

As stated in the specific recommendations for each category, it is clear that appropriate regulations regarding air emissions, open burning, and ash management from combustion treatment have to be put in place, both in open areas and in the use of biomass and residue energy, especially in a scenario of gradual introduction of thermal treatment technologies.

In another context, the country must establish an environmental information system for centralized and robust collection and processing of data, enabling decision-making and enforcement of all related regulations. Such a system should create a unit for centralized information processing, with trained staff in the field of air emissions, so that individual, sectorial, and regional trends of PCDD and PCDF emission sources can be generated. This database, preferably with a high degree of automation, would be important to prioritize visual inspections and monitoring of sources that require a great deal of human and financial input.

In addition, it is recommended to take actions to improve the capacity of environmental monitoring and control, including trained human resources for sampling, infrastructure capacity, and instrumental capability to generate data on actual pollution levels. It is advisable to establish partnerships with state universities and international laboratories having reliable analysis capability.

The coordination of actions to reduce or eliminate PCDD and PCDF emissions should be led by the national focal point of the Stockholm Convention with political will, so that other bodies assist in the execution of the NIP. It is then essential that funds be managed in both the national budget and international organizations.

6. ANALYSIS OF THE INSTALLED ANALYTICAL ABILITY

6. ANALYSIS OF THE INSTALLED ANALYTICAL ABILITY

The support of the laboratories that offer physico chemical analysis services in POP is essential to provide support to productive activities in the private sector and to provide maintenance and control to the public sector. At a national level, the analysis of POP substances has been historically oriented to pesticides due to high agricultural production. However, some laboratories have implemented PCB methods of analysis due to the approval of the Stockholm Convention in August 2006, other national regulatory requirements, and research initiatives to analyze the impact of these compounds. The national universities research laboratories are in the stage of developing protocols of analysis for new POPs. In the private sector, there is a laboratory that offers services for the analysis of dioxins and furans, as well as new POPs (PBDE, PFOS).

6.1. Scope

This study includes laboratories that offer services for POP analysis in August 2004 and those laboratories that have the expertise to perform analysis (laboratories with the necessary equipment and qualified personnel), but they do not have the protocols of analysis accredited by the Costa Rican Accreditation Commission (ECA in its Spanish acronym).

The laboratories with the aforementioned certifications in accordance with the standard INTE-ISO/IEC 17025:2005, as of August 2005 according to the ECA.

6.1.1. Methodology

The methodology includes three phases:

1. Identify laboratories that offer POP analysis services.
2. Perform surveys to collect primary information.
3. Perform visits to laboratories.

A list of national laboratories of chemical analysts that perform POP analysis was collected. Four laboratories of the public sector (universities, ministries, institutes) and one laboratory of the private sector that offer chemical analysis of these compounds were included. To identify the laboratories, information of services offered was provided by the ministries and research centers of public universities. The private laboratories were chosen according to the information provided by

ECA about accredited laboratories. Subsequently, the laboratories supervisors were contacted to confirm if in fact the laboratory offered POP analysis. The laboratories to be included in this study were selected based on this initial review.

In order to obtain relevant information, a letter specifying the purpose of this study and a survey were sent to each laboratory. The requested information was formulated based on a tool proposed by PNUMA "Evaluation of the existent abilities and the needs for the creation of new abilities for the analysis of POP in developing countries" (PNUMA, 2014).

The visits to each laboratory allowed the verification of human resource and instruments that they had and it was also useful to expand the topic of the needs for training to enter in the services of new POP analysis.

In the visit phase, a meeting with the ECA Executive Directorate was held to evaluate the actions to be taken with the DIGECA-MINAE, as part of the project in progress for the PCB topic.

6.2. Results

6.2.1. General aspects

A. Offer of services for POP analysis

The offer of services for POP physico-chemical analysis focuses on pesticides and PCB. Only one private laboratory offer of services in the new POPs. Nevertheless, the laboratories at the public universities are in the process of developing protocols for the analysis of new POPs.

The analysis of POP contemplates the matrix and the type of compound to be analyzed, for which each laboratory has adapted their protocols depending on their technical and instrumental resources to respond to the demand of services. Table 45 shows the laboratory that offers services for each POP.

Table 45. Summary of the POP analysis services offer

POP	Emissions to air	Transformer oil	Abiotic Solid	Effluents, water	Biota (Vegetation, food)	Air	Blood
Aldrin, endrin, dieldrin			X[1]	X	X		Pub
Chlordane			X	X			
DDT			X	X	X		Pub
Heptachlor			X		X		Pub
Mirex			X				
Toxaphene							
HCB			X	X	X		
PCB: 7 congeners		X	X	X	X		X
dioxins and furans	Pri	Pri	Pri	Pri	Pri	Pri	
PFOS			Pri	Pri			
PBDES			Pri				

X: Public and private offer; Pub: public offer; Pri: private offer

B. Human Resource

All laboratories consulted claimed to employ qualified personnel to perform the POP pesticides analysis. The public universities research laboratories handle different chemical analysis needs for research projects, within the framework of the academy; therefore, it is important to highlight that its human resources includes professionals with degrees such as doctorates (PhD), masters (MSc.) in several fields of science.

The private laboratory has professionals with postgraduate and technical degrees. Nevertheless, there is only one laboratory that claims to have the experience and resources to analyze new POPs (PBDE, PFOS), dioxin and furans. It is unknown if this laboratory conducts training.

C. Main clients

Overall, the majority of clients are from private companies (approximately 80%), and only 20% are from public companies. The private laboratory states having services for foreign clients more often than local companies. In the case of research centers at public universities, the analysis performed are part of its research activities.

D. Systems for quality control

All the laboratories claim to have an established quality control system and a person responsible for quality assurance.

Taking into account that the POP pesticides analysis has had a great development, the laboratories indicate having participated in tests between laboratories for this category of compounds. In the case of new POP analysis, the laboratory has been recognized as part of the 17025 ISO accreditation with the ECA.

6.3. Method of Analysis

6.3.1. Methods for identification and quantification of POP, by matrix

The methods of analysis performed are different in all cases. Each laboratory has developed their own protocols based on international standards:

- EPA: Environmental Protection Agency.
- PAM: Pesticide Analytical Manual.
- ASTM: American Society for Testing Materials.

Tables 46 and 47 show a summary of the research centers at two state universities. The private laboratory has its own methods, which are regulated by the ECA accreditation.

Table 46. Methods used by public institutions to identify and quantify POP

POP	Transformer oil	Effluents, water	Biota (Vegetation, food)	Blood
Aldrin, endrin, dieldrin	PAM-302	EPA modified PAM-302	EPA modified	Hagmar et al. (2006)
Chlordane	PAM-302	EPA modified PAM-302		
DDT	PAM-302	EPA modified PAM-302	EPA modified	Hagmar et al. (2006)
Heptaclor	PAM-302	PAM-302	EPA modified	Hagmar et al. (2006)
Mirex	PAM-302	PAM-302		
Toxaphene				
HCB	PAM-302	EPA modified PAM-302	EPA modified	
PCB: 7 congeners	UNE-EN 61619:1997 own method	Own method	Own method	Hagmar et al. (2006)

6.4. Methods for POP extraction, by matrix

Each laboratory has adapted its method of extraction according to the analyzed matrixes. The information about the two university research centers is shown in table 47 and 48. The private laboratory stated that they use capillary column + LRMS, as well as HPLC-MSMS QTRAP as method of instrumental analysis for the majority of POP, including new POPs.

Table 47. Method of extraction and instrumental by matrix used by public institutions

POP	Transformer oil	Soils/ Sediments	Effluents	Vegetation	Water	Air	Biota	Human blood	Sólids
Aldrin		M2 M3 L2/ S2/ L3/ S3/L5/S5	L2/ S2/ L3/ S3/ L5/S5	M2 M3	F 3 L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/ S5	M2 M3	M2 M3
Chlordane		M2 M3 L2/ S2/ L3/ S3/L5/S5	L2/ S2/ L3/ S3/ L5/S5	M2 M3	F 3 L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/ S5	M2 M3	M2 M3
Dieldrin		M2 M3 L2/ S2/ L3/ S3/L5/S5	L2/ S2/ L3/ S3/ L5/S5	M2 M3	F 3 L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/ S5	M2 M3	M2 M3

POP	Transformer oil	Soils/ Sediments	Effluents	Vegetation	Water	Air	Biota	Human blood	Sólids
DDT		M2 M3 L2/ S2/ L3/ S3/L5/S5	L2/ S2/ L3/ S3/ L5/S5	M2 M3	F 3 L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/ S5	M2 M3	M2 M3
Endrin		M2 M3 L2/ S2/ L3/ S3/L5/S5	L2/ S2/ L3/ S3/ L5/S5	M2 M3	F 3 L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/ S5	M2 M3	M2 M3
Heptachlor		M2 M3 L2/ S2/ L3/ S3/L5/S5	L2/ S2/ L3/ S3/ L5/S5	M2 M3	F 3 L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/ S5	M2 M3	M2 M3

POP	Transformer oil	Soils/ Sediments	Effluents	Vegetation	Water	Air	Biota	Human blood	Sólids
Mirex	L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/ S5	M2 M3	M2 M3
Toxaphene					F 3				
HCB	L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/S5	M2 M3	F 3 L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/ S5	M2 M3	M2 M3
PCB: 7 congeners	D2 D3 L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/S5	M2 M3	F 3 L2/ S2/ L3/ S3/ L5/S5	M2 M3	L2/ S2/ L3/ S3/ L5/ S5	M2 M3	M2 M3

Nomenclature

Equipment	Acronyms	Extraction method abbreviations for POP analyzed in the laboratory according to matrix
1) HPLC (packed column) + ECD	**ECD:** An electron capture detector	**C:** Critical fluid level
2) GC (capillary column) + ECD	**GC**: Gas chromatography	**D:** Dilution
3) GC (capillary column) + LRMS	**LRMS:** Low resolution mass spectrometer	**F:** Solid/phase
4) GC (capillary column) + HRMS	**HRMS:** High resolution mass spectrometer	**L:** Liquid/Liquid
5) GC (capillary column) + MS/MS	**MS:** Mass spectrometer	**M:** Microvawe
6) HPLC-MSMS + QTRAP	**FID:** Flame ionization detector	**P:** Pressurized fluid
	HPLC: High performance liquid chromatography	**S:** Soxhlet
	QTRAP: Quadrupole ion trap	**U:** Ultrasound

6.5. Conclusions and recommendations

In Costa Rica, the private and public sectors perform physico-chemical analysis in POP. The most common service is POP in pesticides, especially to private companies that need to present certificates of analysis as part of the controls established by law for those who commercialize or use agrochemicals. Currently, only one private laboratory offers services of new POP analysis. However, the laboratories at public institutions stated having qualified personnel and the equipment needed to implement methods of analysis for new POP.

The main matrixes for pesticides sampling are by descending order:

- water and effluents,
- food,
- soils and sediments,
- solid waste.

There is more services of analysis in the case of the PCB. The methods of analysis are varied; some of them have been adapted by the laboratories according to the conditions and technics available. Oil transformers make up the majority of the matrix. There have been analysis in water, soils, sediments and animal tissues in smaller amounts.

Only two laboratories have been certified for the analysis of PCB in soils and sediments (one of the least analyzed matrix).

The analysis of dioxins and furans is more critical. Only the private laboratory has effectively performed tests on stack emissions, since it is the only one that has this test certified with the ECA.

The main concern of the laboratories consulted focuses on describing the complexity of the sampling and the need for special infrastructure conditions and laboratory equipment to perform the dioxins and furans analysis in an appropriate manner.

Overall, the POP analysis performed in air, fish, marine mammals, human blood and breast milk are very scarce. There is a variety of extraction methods and instrumental analysis employed.

On the other hand, it is evident that the research centers located in state universities have great potential for skill development for the analysis of new POP. Although there is this potential for analysis, the State does not have centralized information about the services that these laboratories offer nor information about the protocols for analysis nor prices, etc.

Recommendations

- Promote tests between laboratories in POP analysis through the coordination of ECA.
- Develop an outreach program about the need to strengthen the national laboratory capacity regarding POP.
- Promote the coordination of private and public laboratories to homogenize the methods of analysis and the quality of the services offered due to the complexity of the POP analysis regarding matrixes, methods and instruments.
- Promote the development of sampling technics that facilitate the accreditation of laboratories in the case of dioxins and furans.

7. FINAL CONSIDERATIONS

7. FINAL CONSIDERATIONS

The results from the inventory, the study on the legal frame in POPs and the proposed actions in this NIP, set out major challenges for the country to achieve an integrated management of these compounds, especially for the Ministry of Environment and Energy, which, having the focal point in the Stockholm Convention, is responsible for looking after the following challenges:

- To improve institutional coordination with the main Ministries involved in chemical substances management.
- To modify the existing legislation significantly to achieve an integrated management of POPs and chemical substances in general.
- To promote institutional information systems that allow access to the required information to future POPs inventories, and follow-up and control of the chemical substances.
- To raise awareness in government sectors and institutions on management of POPs and chemical substances.

To improve institutional coordination, government institutions such as MINAE, MAG and MINSALUD, which are the most involved in POPs and chemical substances, need to incorporate the actions provided in the NIP, through their institutional operating plans. They will have to adopt a firm and permanent commitment in this aspect to create the best conditions for the required interinstitutional and intersectorial coordination.

The Technical Secretariat for the Coordinating of the Chemical Substance Management, which is an interinstitutional and intersectorial institution and a platform for the synergies among the Stockholm, Basel and Rotterdam conventions, could also collaborate. However, its functions must be strengthened to facilitate the decision making and the implementation of actions related to each convention

In the private sector, several groups (enterprises, non-profit organizations, universities) are interested and involved in the different stages of the life cycle of products and productive processes containing POPs. They can also help in the search of technical options

to minimize the amount of residues and improve disposal and elimination of POPs. For this reason, to widen and strengthen all kind of intersectorial mechanism is a need.

Other possible intersectorial actions that must be developed are technical assistance programs with follow-up and control actions, especially those related to disposal and elimination of residues, since both public and private sectors are interested in that aspect. Definitely, to achieve the NIP objectives, the alliances between the public and private sectors and a clear coordination among the involved government entities will be a fundamental axis.

In regard to modifications and new proposals in regulation, the work must be focused on regulate more aspects related to POPs. In Costa Rica there are laws on the different stages POPs life cycle, especially related to pest-control substances and industrial chemicals. Since the 2009 National Implementation Plan, the legal development is focused on the handling of hazardous wastes.

Regarding unintentional emissions, there is a regulation that requires improvement in some aspects. Some tools that could be useful are: the setting up of a Pollutant Release and Transfer Register (PRTR) and the strengthening of the National Air Pollution Monitoring Network.

Industrial POPs (PBDE, PFOS) are of recent preoccupation for the country; for that reason, the identified gaps must be taken into account. In relation to control and follow-up of EEE and WEEE, there is a regulation but it does not includes vehicles. Laws and legislation needs to be modified to regulate, especially, the import and the processing of waste from vehicles manufactured between 1975 and 2004, which represents 72% of the fleet of vehicles. During the indicated period, vehicles containing hazardous substances were manufactured.

On PFOS, the NIP proposes actions to prohibit register, import and sale of products which contain them. Also, the MINSALUD product registration need to be revised since the presence of these substances is not indicated. The singularity with PFOS is that its detection is diffuse due to the technical difficulty to identify imported products that contain them, and industrial processes that used them.

On national legislation, the NIP prioritizes in the gaps and weaknesses that can be solved or straightened by legal reforms or adoption of new legislation. Some of those standards have to be addressed in a legal way, which implies writing the regulation and raising awareness in the people in charge of national policies decision-making, so those can be approved.

In this frame, the proposed reforms to the current regulations or new executive decrees require a collaboration between the ministries and the private sectors that are not regulated yet, for a suitable implementation of the proposals.

The other major challenge that the NIP proposes to the country are the requirements related to information system management. The process involve to develop a digital platform that allows to collect data of products with POPs, and gather information on residues of products that contain it, which will be very useful.

From integrated information it is possible to get input to strengthen the current technical assistance programs on management, use and disposal of products containing POPs. The private sector that uses these products count on technical specialists (professionals in manufacturing processes or consultants in production, sale, distribution and use of products containing POPs and other hazardous substances) who follow-up, control and provide technical recommendations that government entities can use. When reporting the actions to the appropriate government entities, through an information system management, decision-makers could access a current and relevant data to optimize the NIP actions and, consequently, substance management.

In the case of industrial and unintentional POPs, inventories evidence that the information required to estimate quantities is scattered and, in some cases, in print form.

As a consequence, it is complicated to keep updated the necessary inventories to make decisions on the NIP proposed actions.

Finally, from environmental and heath perspectives, reporting and communication are fundamental challenges due to the commitment to inform and educate citizens. For this, since 2009, actions on POPs management reporting and awareness were proposed to government sectors and institutions as well as the general public. Besides the efforts, reporting activities are visualized. To achieve it, to involve other society participants is necessary to design together campaigns with different objectives on POPs management.

Challenges in each POPs category:

All NIP actions are important; however, according to MINAE, some of them required special attention. The crosscutting challenges of these actions are: to improve interinstitutional and intersectorial coordinations, to promote reforms to regulation, to establish information systems and to generate effective reporting and communication processes.

In POPs pesticides, the major challenges to solve in the next years are the prohibition of import and use of endosulfan and the elimination of DDT stockpiles.

In the case of endosulfan, an executive decree, expected to be published, sets up the prohibition to import it and use it as of 2017. Currently, its use is permitted in the country under the guidelines established in the 34782- S-MAG.MINAET decree. This regulation points out that endosulfan can be sold only if it is prescribed in the official forms by a professional member of the Costa Rican Association of Agronomists.

The NIP indicates three goals related to endosulfan:

1. To complete the 100% of the national inventory as of 2017.
2. To make mandatory to digitally report the use, handling and sale of pesticides as of 2016.
3. To have a database as of 2017.

The elimination of DDT reservoirs contemplates coordination between international entities. The purpose will be to identify the best form of eliminating it in those places where technology allows it eradication, under controlled conditions and without harm for human health and environment.

The NIP sets up a goal for DDT: to eliminate all DDT stock (8,600 kg) as of 2018.

Related to industrial POPs, identifying and controlling PBDE and PFOS in imported products is a challenge with improvements to make in the General Directorate of Customs. Besides, it is evident the need to have follow-up and control mechanisms for the processes that use PBDE and PFOS. Actions on industrial POPs pretends to eliminate the entry of PBDE in EEE and vehicles components, as well as to reduce PBDE content in waste stream of vehicle parts and WEEE.

The NIP indicates three goals to eliminate the entry of EEE containing octabromodiphenyl ether:

1. By 2017, to prohibit the import of used EEE.
2. To regulate the entry and use of EEE with PBDE as of 2018.
3. To have a technical guideline as of 2018.

The NIP establishes six goals to reduce the amount of octabromodiphenyl ether entering in the waste stream:

1. To assure that for 2015, all EEE importers be registered in a compliance department.
2. To assure that for 2016, only the importers registered in the compliance department can do EEE clearance.
3. To have information in an historical WEEE inventory from government institutions as of 2016.
4. To have inventory information from private companies as of 2016.
5. To improve the procedure for registering agents, to do not duplicate procedures in the processes of sanitary permit and register of authorized agent as of 2018.
6. To carry out two WEEE collecting campaigns as of 2018.

The NIP establishes three goals to eliminate the entry of vehicles containing pentabromodiphenyl ether:

1. By 2018, to restrict the import of vehicles that were manufactured between 1975 and 2004, with a possibly staggered restriction.
2. To modify or create tariff headings for those imported cars that were manufactured between 1975 and 2004 as of 2017.
3. To decrease to 50% the percentage of imported vehicles containing POPs (if prohibition is staggered) as of 2018.

The NIP establishes four goals to reduce the amount of pentabromodiphenyl ether entering in the waste stream:

1. By 2020, to have the 5% of vehicles unsubscribed that enter to the integrated waste stream management.
2. To have a vehicle and vehicle's parts recycling model as of 2018.
3. To have a proposed model that formalizes vehicle's parts recycling as of 2016.
4. By 2020, to have the "vehicle recycling" regulation – Reglamento de Residuos de Manejo Especial.

Industrial POPs looks to identify PFOS in import products and industrial processes that use them. NIP establishes four goals in the identification of products containing PFOS:

1. By 2017, to have a list of products that required to be registered in the health registration department, by its use.
2. To set up the prohibition to register products containing PFOS according to the list from point 1 as of 2019.
3. To set up requirements for label inscription as of 2018.
4. To publish the list of restricted products as of 2018.

NIP establishes two goals in the identification of industrial processes that uses PFOS:

1. By 2018, to have a list of the industrial processes that require control in the use of PFOS.
2. To establish as a requirement that a professional in Chemistry or Chemical Engineering supervise the processes that could contain PFOS as of 2020.

In unintentional POPs, the major challenges are open burning prohibition in agriculture and technical capacity strengthening in thermal conversion processes. In open burning processes, the information must be systematized for government authorities to make decisions and for updating the inventory. NIP establishes five goals in this respect:

1. By 2018, to have a digital information system that centralizes the reports from MAG, SINAC, and Costa Rica Fire Department.
2. By 2020, to have the outline of a decree that prohibits open burning, or that proposes a staggered change.
3. By 2017, to strengthen those MAG's BPA training courses that contemplate to eliminate open burning practices.
4. By 2018, to have done at least two campaign to raise awareness.
5. By 2018, to have a revision of the legislation.

Unintentional POPs evidences the need to strengthen technical capacity in thermal conversion processes. The regulation that controls those processes is being revised, and the concept of residues burning to obtain electrical energy is being discussed by the policy decision-makers. Cogeneration processes are also being analyzed; for that reason, it is relevant to promote technical discussions about the need of new technologies that allow an efficient transformation, without releasing dioxins and furans to the environment. Therefore, it is a need to strengthen the human resource to count on specialists in the area who, in a short term, can contribute to the development of thermal conversion processes.

MINAE, as a competent national authority, responsible for coordinating the actions derived from the Stockholm Convention implementation, accepts the commitment to gradually attend the challenges resultant from the NIP. Through cooperation and agreement between public and private participants, it is expected to carry out most of the initiatives and projects that will allow to the country to step forward in chemical substances management, particularly in POPs.

BIBLIOGRAPHIC REFERENCES

BCCR. (2013, December). *Banco Central de Costa Rica*. Evolución del PIB Real y la Balanza de Pagos de Costa Rica. Retrieved from http://www.bccr.i.cr/publicaciones/politica_monetaria_inlacion/Evol_pib_real_y_sector_externo_III_trim_2013.pdf

BCCR. (2015, February 16). *Banco Central de Costa Rica*. Indicadores Económicos. Retrieved from http://www.bccr.i.cr/indicadores_economicos

BCIE. (2014, September 17). *Banco Centroamericano de Integración Económica*. Ficha Estadística de Costa Rica. Retrieved from http://www.bcie.org/uploaded/content/article/271417695.pdf

CICR. (2014, November 2). *Distribución por sector de actividad*. Retrieved from http://www.cicr.com/Galeria/index/18/Distribuci%C3%B3n-por-sector-de-actividad

CONARROZ. (2014, August 26). *Inteligencia de Mercado*. Retrieved from http://www.conarroz.com/index.php?option=com_content&view=article&id=70&Itemid=98

EPI. (2014). *Environmental Performance Index Full Report*. Connecticut: Yale Center for Environmental Law and Policy.

INBIO. (2015, February 2). *Instituto Nacional de Biodiversidad*. Retrieved from http://www.inbio.ac.cr/conservacion.html

INEC. (2011, February 4). *Instituto Nacional de Estadística y Censo*. Población y Demografía - Población - Evaluación Censo 2011. Retrieved from http://www.inec.go.cr/Web/Home/GeneradorPagina.aspx

INEC. (2014, February 4). *Instituto Nacional de Estadística y Censo*. Retrieved from http://datos.inec.go.cr/dashboards/5341/poblacion/

LAICA. (2014, August 26). *La Liga Agrícola Industrial de la Caña de Azúcar*. Resultados agroindustriales finales de la zafra 2012-2013, Conexión, (7). Retrieved from http://www.laica.co.cr/media/docs/estadisticas/Zafra2012-2013.pdf

MAG; MINSALUD; MINAE; MEIC. (2006). Reglamento sobre Registro, Uso y Control de Plaguicidas Sintéticos Formulados, Ingrediente Activo Grado Técnico, Coadyuvantes y Sustancias Afines de Uso Agrícola. *Executive Decree Nº. 33495 of 31 October 2006 and its reforms*, Art. 3.55.

MIDEPLAN. (2010). *Ministerio de Planificación Nacional. II Informe País 2010: Objetivo de Desarrollo del Milenio*. San José: MIDEPLAN.

MIDEPLAN. (2014). *Plan Nacional de Desarrollo 2015-2018: Alberto Cañas Escalante*. San José, Costa Rica: MIDEPLAN.

MINAE. (2012). Registro de Plaguicidas de Uso Agrícola, Coadyuvantes y Sustancias Afines. *Executive Decree Nº. 36549-MAG-S-MEIC-MINAET of April 28 2012*.

MINAE. (2013). Reglamento General para la Clasificación y Manejo de Residuos Peligrosos. *Executive Decree Nº. 37788-S-MINAE of 15 February 2013,* Art. 3,5.

MINAE. (2013). Reglamento General para la Clasificación y Manejo de Residuos Peligrosos. *Executive Decree Nº. 37788-S-MINAE of 15 February 2013,* Art. 14.3.

MINAE. (2013). Reglamento General para la Clasificación y Manejo de Residuos Peligrosos . *Executive Decree Nº. 37788-S-MINAE of 15 February 15 2013,* Art. 13.

MINAE. (2013, February 15). Reglamento General para la Clasificación y Manejo de Residuos Peligros. *Decree Nº. 37788-S-MINAE of 13 February 2013,* Art. 13.

MINAET-MTSS. (2012). *Regulation on Emisión de Contaminantes Atmosféricos Provenientes de Calderas y Hornos de Tipo Indirecto.* San José, COSTA RICA. Published at La Gaceta Nº.140 of 20 July 2012.

Ministerio de Hacienda. (2014, August 12). *Servicio Nacional de Aduanas: Plan Estratégico 2012-2017.* Retrieved from http://www.hacienda.go.cr/docs/51c35a2d55478_PLANESTRATEGICOSERVICIONACIONALDEADUANAS20122017.pdf

Obregon, R. (1995, August 12). *El Poder Legislativo en Costa Rica.* San José, COSTA RICA: Impresión Comercial S.A. Retrieved from http://www.costaricaweb.com/gene-ral/nuestrademocracia.htm#contitucion

PELTEC. (2014, May 26). *Programa de Energía Limpias del Instituto Tecnológico de Costa Rica*. Informe de Capacidad de Energías Limpias Disponibles en Costa Rica. Retrieved from http://www.fesamericacentral.org/iles/fes-america-central/actividades/costa_rica/Actividades_cr/131210%20mesa%20energia%202021/INFORME%20DE%20ENERGI%CC%81AS%20RENOVABLES%20DISPONIBLES%20EN%20COSTA%20RICA%202012.pdf

Roa, F. (2009). Sistema de Manejo Sostenible para Residuos Electrónicos en Costa Rica. *Tecnología en Marcha*, Vol. 22, N° 2, 3-10.

Sibaja, A. G. (1949). *Actualización de la Costitución de la República de Costa Rica*. San José, COSTA RICA: EDITEC.

UNEP. (2013). *Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs.*

UNEP. (2014, June 21). *United Nations Environment Program*. Evaluación de las capacidades existentes y necesidades de creación de capacidades para el análisis de COP en países en desarrollo. Retrieved from http://www.chem.unep.ch/Pops/laboratory/Lab_Quest_sp.pdf

UNIDO; UNITAR; UNEP; Stockholm Convention. (2012). *Guidance for the inventory of perluorooctane sulfonic acid (PFOS) and related chemicals listed under the Stockholm Convention on Persistent Organic Pollutants*.

UNIDO; UNITAR; UNEP; Stockholm Convention. (2012). *Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants*.

Vindas, L. (2014, September 15). *El Financiero*. Sector de minas y canteras de Costa Rica arrastra lucro de decrecimiento. Retrieved from http://www.elinancierocr.com/negocios/mineria-canteras-PIB_0_536946303.html.

LIST OF ACRONYMS

ABS	Acrylonitrile-butadiene-styrene
ASTM	American Society for Testing and Materi*als*
CATIE	*Centro Agronómico Tropical de Investigación y Enseñanza (Tropical Agricultural Research and Training Center)*
CCSS	*Caja Costarricense de Seguro Social (Costa Rican Department of Social Security)*
CEGIRE	*Comité Ejecutivo para la Gestión Integral de los Residuos Electrónicos (Executive Committee for Integral E-waste Management)*
CNFL	*Compañía Nacional de Fuerza y Luz (National Power and Lighting Company)*
CONARE	*Consejo Nacional de Rectores (National Council of Rectors)*
CRT	Cathode Ray Tube
CSO	*Consejo de Salud Ocupacional (Occupational Safety Council)*
DDT	Dichlorodiphenyltrichloroethane
DIGECA	*Dirección de Gestión de Calidad Ambiental del MINAE (Environmental Quality Management Direction of MINAE)*
ECA	Ente Costarricense de Acreditación *(the Costa Rican standards certifying organization)*
EEE	Electrical and Electronic Equipment
EFSA	European Food Safety Authority
EPA	Environmental Protection Agency

ESPH	Empresa de Servicios Públicos de Heredia *(Heredia Public Services Company)*
FLNC	*Fundación Limpiemos Nuestros Campos (Clean Fields Foundation)*
GDP	Gross Domestic Product
GEF	Global Environment Fund
ICD	Instituto Costarricense sobre Drogas *(Costa Rican Narcotics Institute)*
INEC	Instituto Nacional de Estadísticas y Censos *(National Institute of Statistics and Census)*
INS	Instituto Nacional de Seguros *(National Insurance Institute)*
INTA	Instituto Nacional de Innovación y Transferencia de Tecnología Agropecuaria *(National Institute of Agricultural Innovation and Technology Transfer)*
IWM	Integrated Waste Management
JASEC	Junta Administrativa de Servicios Eléctricos de Cartago *(Administrative Board of Electricity Services in Cartago)*
MAG	Ministerio de Agricultura y Ganadería *(Ministry of Agriculture and Livestock)*
MEIC	Ministerio de Economía, Industria y Comercio *(Ministry of Economy, Industry, and Commerce)*
MEP	Ministerio de Educación Pública *(Ministry of Public Education)*
MHacienda	Ministerio de Hacienda-Dirección de Aduanas *(Ministry of Finance-General Directorate of Customs)*
MICIT	Ministerio de Ciencia y Tecnología *(Ministry of Science and Technology)*

MIDEPLAN	Ministerio de Planificación Nacional y Política Económica *(Ministry of National Planning and Economic Policy)*
MINAE	Ministerio de Ambiente y Energía *(Ministry of Environment and Energy)*
MINSALUD	Ministerio de Salud *(Ministry of Health)*
MOPT	Ministerio de Obras Públicas y Transporte *(Ministry of Transport and Public Works)*
MSDS	Material Safety Data Sheet
MTSS	Ministerio de Trabajo y Seguridad Social *(Ministry of Labor and Social Security)*
NIP	National Implementation Plan
octaBDE	Octabromodiphenyl ether
OECD	Organization for Economic Cooperation and Development
PAM	Pesticide Analytical Manual
PBDE	Polybrominated diphenyl ether
PCB	Polychlorinated Biphenyls
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
PentaBDE	Pentabromodiphenyl ether
PFOS	Perfluorooctane Sulfonate
PFOSF	Perfluorooctanesulfonyl fluoride
PGAI	Programa de Gestión Ambiental Institucional *(Institutional Environmental Management Program)*

POPs	Persistent Organic Pollutants
PROCOMER	Promotora de Comercio Exterior de Costa Rica *(Costa Rican Foreign Trade Promotion Office)*
PRTR	Pollutant Release and Transfer Register
RECOPE	Refinadora Costarricense de Petróleo *(Costa Rican Petroleum Refinery)*
RTV	Revisión Técnica Vehicular *(Vehicle Technical Inspection)*
SAD	Single Administrative Document
SETENA	Secretaría Técnica Nacional Ambiental *(National Environmental Technical Secretariat)*
SFE	Servicio Fitosanitario del Estado del MAG *(MAG's Phytosanitary Government Service)*
SME	Small and Medium-Sized Enterprises
UCCAEP	Unión Costarricense de Cámaras y Asociaciones de la Empresa Privada *(Costa Rican Union of Private-Sector Chambers and Associations)*
UNA	Universidad Nacional (National University)
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
WEEE	Waste Electrical and Electronic Equipment

MINISTRY OF ENVIRONMENT AND ENERGY

ENVIRONMENTAL QUALITY MANAGEMENT DIRECTION

PHONE: (506) 2257-1839 / (506) 2258-3272

FAX. (506) 2258-2820

WWW.DIGECA.GO.CR