National Training for Colombia on Decommissioning Oil & Gas Infrastructure

17-20 September 2024

Fairfield Hotel
Bogotá, Colombia

TRAINING SUMMARY AND DOCUMENTATION

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Acknowledgements

The successful organization and delivery of this workshop was made possible by the support of many individuals. We would like to extend our gratitude for the outstanding guest presentations, which greatly enriched the workshop's learning outcomes. These contributions were delivered by several individuals, namely Julián Gonzalez (EcoPetrol), Ximena Rodriguez (GeoPark), Andrea López (CorpOrinoquia), Leonardo Donado (National University of Colombia), Diego Corredor (Bogotá District Secretary of Environment), and Jesús Sepulveda and Ernesto Romero (Ministry of Environment and Sustainable Development). We extend our thanks to the Diego Corredor for also facilitating the visit to the Petrobras facility, which added an invaluable practical learning experience. Special appreciation goes to both Dr. Matthew Richmond for developing and delivering the core course modules and activities, and to Paula Solarte for her tireless support in handling a range of logistical, coordination, and language interpretation needs to ensure smooth planning for the training team and a comfortable experience for participants. We also extend heartfelt thanks to Karen López and Ernesto Romero at the Ministry of Environment and Sustainable Development, who provided oversight and guidance throughout the organizing process. Finally, we are deeply grateful to all the participants for their enthusiastic engagement and willingness to learn, which made the event truly successful.

Background

The United Nations Environment Programme (UNEP) and the Government of Norway's Oil for Development (OfD) Programme undertook an eight-year collaboration (2016-2024) to enhance institutional capacities for improved environmental management in the oil and gas sector. Under the OfD Programme, UNEP developed a training course tailored for relevant government institutions tasked with overseeing the decommissioning of retired oil and gas infrastructure. Colombia's Ministry of Environment and Sustainability requested this course from UNEP in 2024 to train national and state-level regulators on how to address this issue.

This request stems from UNEP's institutional Capacity Needs Assessment (CNA), conducted as a rapid assessment, on behalf of the Government of Colombia to enhance environmental management in the oil and gas sector. The CNA aimed to identify the capacity needs of key government ministries, departments, and agencies in this regard. Finalized in 2022, the findings contribute to a national "roadmap" that outlines the strategic capacity needs of government institutions to improve environmental management in the sector.

The CNA explored the broad challenges and opportunities faced by government institutions in managing the environmental impacts of upstream oil and gas activities over the long term as well as other related topics that emerged through the study. It assessed the roles of various government institutions in environmental management within the sector and the specific challenges each institution encounters. One of the key concerns identified in this assessment was the emerging need to address the environmental and social risks associated with decommissioning the country's aging oil and gas wells and pipeline infrastructure, which the Ministry of Environment and Sustainability subsequently prioritized as a top issue.

In this context, UNEP delivered a four-day, in-person course to help Colombia's designated regulatory staff understand the environmental considerations, legal frameworks, and planning approaches needed to effectively manage the risks associated with the country's continental oil and gas infrastructure earmarked for decommissioning.

Key learning objectives of the course

The four-day training course was designed to strengthen national capacity to decommission Colombia's aging hydrocarbon infrastructure and facilities in an environmentally-responsible manner.

As a result of the course, participants were able to:

1. Develop basic knowledge of the oil and gas value chain and the associated infrastructure that exists in Colombia, focused on the continental ("onshore" or terrestrial) environment.
2. Understand the role of decommissioning in the oil and gas value chain in Colombia, including timelines for planning and implementing decommissioning activities.
3. Understand the general risks, as well as the costs, technological challenges and opportunities related to continental decommissioning.

4. Appreciate environmental issues/concerns associated with decommissioning of oil and gas installations in Colombia.
5. Understand Colombia's environmental regulatory and legal frameworks applicable to decommissioning of oil and gas infrastructure, and the institutions associated with the permitting and monitoring, including institutional and corporate roles and responsibilities, financing and constraints.
6. Develop an understanding through theoretical and practical exercises of the work involved in preparing the main elements and tasks required for a *Decommissioning and Abandonment Plan* as per Colombia legislation.

Overview of learning topics and activities

The workshop provided thorough coverage of the decommissioning process for onshore (terrestrial) oil and gas infrastructure, with focus on the regulatory framework and case study examples in Colombia. Decommissioning involves the safe dismantling of oil and gas facilities that have reached the end of their productive life, aiming to restore the surrounding environment as much as possible. In many countries, including Colombia, early oil and gas projects did not often account for decommissioning, but it has since become a key part of the project lifecycle. Several presentations emphasized the importance of careful planning and involving local communities, environmental organizations, and regulators to ensure the process is undertaken in an environmentally and socially responsible manner.

A notable example of decommissioning complexities was the Brent Spar, a redundant oil storage installation in the North Sea. Initially, the operator (Shell) intended to sink the structure, but public opposition, led by Greenpeace, forced the company to dismantle it onshore. This mid-1990s case underscored the environmental, social, and financial challenges decommissioning projects can face, which have led to companies and countries creating more robust guidelines to manage the

process responsibly. These lessons are especially relevant for Colombia, where aging oil infrastructure poses similar risks.

In Colombia, the oil and gas sector is vital to the economy, with significant infrastructure located in sensitive regions such as the Andes and the Amazon. Many of the country's wells and oil field infrastructure, particularly those operated by EcoPetrol (Colombia's nationalized petroleum company), are nearing the end of their operational life and will require decommissioning. Some components, such as pipelines, may remain in place to avoid unnecessary environmental disruption, while wells will be plugged and sealed to prevent fluid migration. Private and foreign companies are also involved in the sector, necessitating consistent standards for decommissioning practices in the country.

Another recurrent issue raised during the workshop was the environmental impact of illegal hydrocarbon activities in Colombia, driven in part by non-authorized third-party actors such as armed groups. These activities have caused many cases of oil spills and subsequent environmental damage, posing risks to adjacent ecosystems and the health of nearby residents. Under the country's regulatory framework, oil companies are required to address the damage caused by third-party actors and collaborate with environmental and law enforcement agencies to dismantle illegal hydrocarbon processing sites. Efforts include the development of protocols for mitigating environmental harm and restoring contaminated areas.

A key highlight of the workshop was the visit to the Petrobras oil storage and processing plant, where participants were taken on a guided tour of the facility and shown the types of assets and equipment that would need to be considered in the eventual decommissioning of the facility, as well as the relevant environment and social considerations involved in responsible decommissioning of such infrastructure.

The latter part of the workshop involved group activities where participants were tasked with applying the knowledge gained. One exercise involved developing and presenting an outline for an assigned chapter of a Decommissioning Plan, incorporating the lessons learned throughout the course. Grouped participants were evaluated by an expert panel, receiving grades and feedback on their presentations. The final activity allowed participants to identify priority areas for action, enabling them to begin coordinating the process of decommissioning oil and gas infrastructure under the mandates of their respective jurisdictions and agencies. These interactive activities reinforced the importance of strategic planning and cooperation in the decommissioning process.

See **Annex I** for detailed daily overviews of presentation topics.

All materials prepared for and used during the course (background documents and presentation slides) can be accessed on Google Drive via **this link**.

Format and timing

Technical staff from Colombia's relevant national agencies and certain state-level jurisdictions containing substantial oil and gas infrastructure joined the in-person workshop hosted from 17-20 September 2024 in Bogotá. The main working language was Spanish, but simultaneous interpretation in English was also provided.

See **Annex II** for the full workshop agenda.

Participant demographics

Twenty-one participants (14 women, 7 men) attended the workshop, with 20 (14 women, 6 men) completing the workshop from start to finish and receiving the course completion certificate. Half of the participants represented relevant agencies headquartered in Bogotá: Ministry of Environment and Sustainability (MinAmbiente), Ministry of Mines and Energy (MinEnergia), National Hydrocarbon Agency (ANH), National Environmental Licensing Authority (ANLA), Colombian Association of Petroleum and Gas (ACP), and Bogotá's District Secretary of Environment (SDA). The other half of the participants, who travelled in from outside Bogotá to attend the workshop, represented several of Colombia's autonomous state-level governments called "corporaciónes": Alto Magdalena, Boyacá, Cesar, Cundinamarca, Nariño, Orinoquia, Santander, and Tolima.

See **Annex III** for the full list of participants.

Key issues raised

Need for updating Colombian regulations on decommissioning

During the workshop, it was noted that Colombian law 2327 on environmental liabilities is currently under review by MinAmbiente. It was also noted that decree 1076 of 2015 is being updated to

address environmental licensing for decommissioning projects. MinAmbiente, in collaboration with MinEnergía, is actively working on adjustments to the environmental licensing framework for these regulations. It is recommended that additional key technical environmental authorities be engaged in this process, as they play a direct role in its implementation. The District Secretary of Environment in Bogotá presented their initiative to dismantle service stations in the city, noting that the licensing framework developed for this initiative could serve as a model across Colombia, with adaptations for the unique needs of other regions and municipalities.

Enhancing toxicology laboratories and developing national toxicological guide

Colombia has a limited number of accredited laboratories capable of assessing all toxic substances, highlighting a significant investment opportunity in science and technology. Strengthening existing laboratories and developing guidelines for calculating environmental risk indices for nationally regulated chemical compounds at contaminated sites would advance this capacity. The District Environment Secretariat in Bogotá has already made progress in designing guidelines for toxicology-based calculations at contaminated sites, as well as for dismantling commercial, industrial, and service facilities. These guidelines could be expanded nationwide to collaborate effectively with corporations, national entities, and local communities.

Independent initiation of workshops and knowledge exchange

The workshop highlighted the need for a more efficient communication protocol between regional autonomous corporations familiar with Colombia's territories, national ministries responsible for law-making, and national environmental authorities who conduct site visits and regulate environmental processes related to decommissioning. Convening subsequent workshops and creating systems for open dialogue was emphasized as a priority to collaboratively develop more effective decommissioning efforts nationwide.

Decommissioning in environmentally-sensitive and offshore settings

Colombia's rich biodiversity encompasses a wide array of ecosystems where hydrocarbon infrastructure exists or may be developed in the future. While Colombia currently has no significant offshore oil and gas infrastructure, except for several dozen exploratory and appraisal wells drilled in recent years, yet a significant portion of its territory is oceanic, making it essential to build national regulatory capacity to protect marine ecosystems. Future decommissioning regulations and guidelines should consider these marine environments. The workshop underscored the importance of addressing complex scenarios where hydrocarbon infrastructure is present or may be developed in sensitive areas such as swamps, coral reefs, or other fragile ecosystems. This calls for a collaborative effort among regional corporations, local communities, national ministries, and regulatory agencies to identify and map these sensitive ecosystems.

Identifying orphan wells and decommissioning refineries

The workshop highlighted that MinMinas is currently developing a nationwide inventory of orphan wells, which will aid in ranking and prioritizing wells for decommissioning. Another key topic discussed was the dismantling of refineries; Colombia has yet to establish a national protocol for this process, even as some refineries near the end of their operational lifecycle. Additionally, it

was noted that numerous oil storage tanks will require decommissioning, including those used for palm oil.

Utilizing existing soil remediation guidance

A Decommissioning Plan must include a soil remediation component to mitigate environmental impacts and prevent future damage, given the widespread soil contamination at various sites across the country. MinAmbiente has taken steps to regulate the management of contaminated soils under the Environmental Liabilities Law, which should be integrated into the final stages of decommissioning projects.

Establishing a protocol for decommissioning funds

A dedicated environmental impact study tailored to decommissioning activities is essential, along with a management plan that includes estimated costs. Colombian institutions need clear, coordinated guidelines to determine responsibilities for dismantling, financing mechanisms, and the government's role in overseeing these processes. Additionally, protocols must be established for situations where companies fail to fulfill their obligations, as well as for managing potential well leaks that may occur decades after decommissioning. Operators' contracts should specify decommissioning terms, and the impact of a decommissioning fund on government tax incentives must be assessed. The guidelines should also outline when the fund mechanism should begin, who will manage it, and how to address potential shortfalls.

Full compilation of questions/answers and discussion points are listed in **Annex VII**.

Knowledge assessment results

UNEP carried out baseline and final assessments using the same set of "exam" questions (29 in total), as one way of evaluating participants' improvements in knowledge from the training. The set of questions was based on the core technical presentations delivered during the training.

Responses were in multiple choice or true/false statement formats. It should be noted that this type of written assessment only provided a partial assessment of knowledge gained by individual participants, given that additional knowledge was developed through group work exercises and direct interactions with the experts. Hence, it is important to view knowledge assessment results in conjunction with participants' training evaluation results to determine the degree the training met participants' learning needs (discussed further below).

Nineteen out of 21 participants completed both the baseline and final knowledge assessments. The average score of the baseline assessment was 75% and the average score of the final assessment was 87%. Scores from 16 out of the 19 participants who completed all course requirements were improved from the baseline to final knowledge assessment, with an average relative percentage increase of 15% (12% absolute increase).

Participant's evaluation results

UNEP provided the opportunity for participants to voluntarily evaluate the training based on their own expectations and learning needs. Twenty-one participants evaluated the training. Most participants gave scores of 5/5 or 4/5 for the course meeting its learning objectives as outlined in the training program. Participants were also asked to rate the extent that each core course module (1 through 5) met their individual learning needs (score range of 5 = fully met to 1 = not met). Most participants likewise scored each session as 5/5 or 4/5. When asked to rate their overall satisfaction with the training course, 71% of participants rated the training as "excellent"; 24% as "highly satisfactory"; 5% as "satisfactory"; and none left ratings for "needs improvement" or "poor".

Participants also provided valuable qualitative feedback on aspects of the training they found useful, not useful, and could be improved upon. This feedback is synthesized below.

The following aspects were found to be **most useful** by participants:

- Inclusion of guest presentations showing different case studies, all relevant to Colombia.
- Interacting with other entities and authorities present in the workshop, allowing participants to identify gaps in inter-agency relationships.
- Learning about experiences from other countries and how this can relate to Colombia.
- Interactive group work exercises to practice the knowledge gained.
- Being able to discuss and publicize the needs in the regional territories with national authorities.
- Touring the oil processing facility to visualize the infrastructure to be decommissioned.

The following aspects were found to be **least useful** by participants:

- Theoretical presentations.
- Presentation content on the offshore decommissioning process, which is currently irrelevant for Colombia.

Participants indicated the following as **opportunities for improvement**:

- EcoPetrol could have been more involved throughout the workshop, in particular to be part of the discussions, and their presentation could have included challenges and mistakes made and what is being done to address these.
- Workshop content, either from UNEP or guest speakers, could go into more detail on the methodology used to decommission infrastructure.
- UNEP experts could have more experience with decommissioning and well abandonment in terrestrial settings.
- Presenters should not be reading off their slides.
- Include a site visit to a facility that is currently undergoing decommissioning.
- More presentations on successful decommissioning projects, such as the ones shown by GeoPark.
- Better moderated discussions, allowing discussions to remain focused and not span too many topics.
- All presenters should be given a professional template to follow when designing their presentations, enforcing use of viewer-friendly colors and text size.
- Additional presentations from academia could allow the participants (regulators) to understand and also support the tools and methods for decommissioning.

Refer to **Annex VI** for all graphically-displayed evaluation results.

Annex I: Daily proceedings and key takeaways

The course was based on five modules delivered by Dr. Matthew Richmond (UNEP senior consultant), interspersed with a diverse set of six Guest Presentations. Summaries of the modules and presentations are provided below.

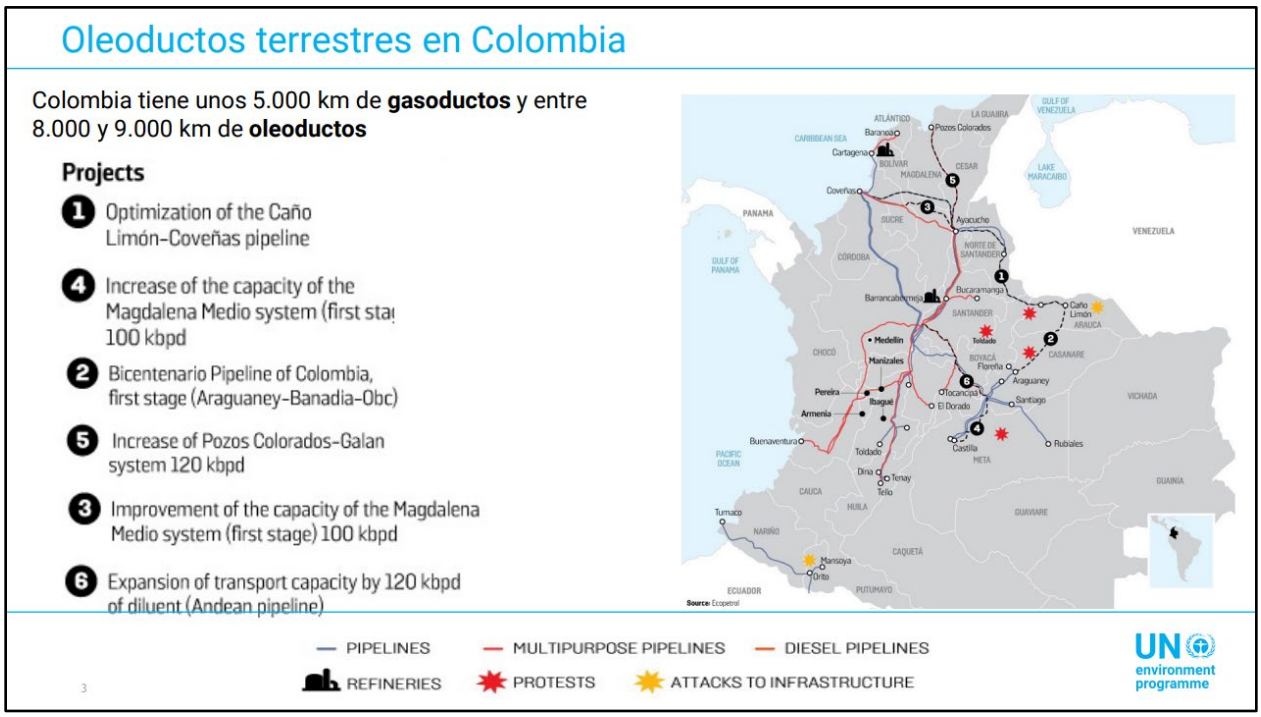
Day 1

Module 1: Overview of the decommissioning process for oil and gas infrastructure in Colombia

The module gives an introductory overview of the decommissioning process for onshore oil and gas infrastructure, with a focus on Colombia. Decommissioning refers to the process of safely dismantling oil and gas facilities that have reached the end of their productive life, ensuring that the environment is reclaimed as much as possible. The early phases of oil and gas projects rarely accounted for decommissioning, but it has now become an integral part of project life cycles. Components like flowlines and pipelines may be left in place to avoid disruption of biota, while wells are plugged and sealed to prevent fluid migration.

A notable case shown in the presentation is the Brent Spar oil storage structure decommissioning in the North Sea, which became a major environmental controversy in the 1990s. Shell initially planned to sink the structure, but after a Greenpeace-led campaign, the company was pressured to dismantle it onshore. This case illustrates the complexities involved in decommissioning, including environmental risks, public opposition, and cost considerations. Lessons learned from such cases have led to the development of guidelines to handle decommissioning more responsibly.

Presentation by Dr. Matthew Richmond – UNEP



Map displaying Colombia's terrestrial pipeline infrastructure distribution

In Colombia, the oil and gas industry plays a significant role in the economy, with much of the infrastructure concentrated in areas like the Andes foothills and the Amazonian jungle. Many of the country's oil fields, wells, and pipelines are decades old and will require decommissioning in the coming years. Ecopetrol, Colombia's national oil company, operates most of these assets, but private and foreign companies also have a presence. The presentation highlights the importance of involving various stakeholders, including local communities, environmental NGOs, and government regulators, to ensure that decommissioning is conducted in a way that minimizes harm to the environment and society.

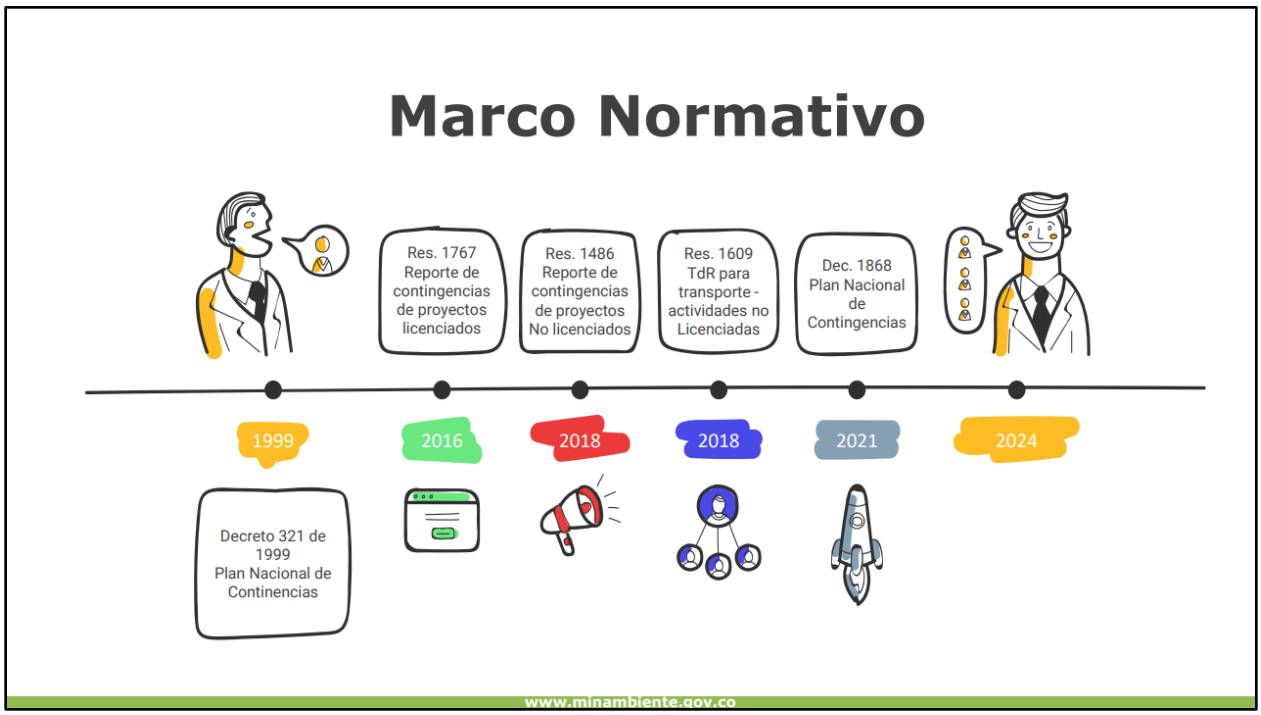
Guest presentation 1: Contingencies for impacted sites linked to third party actors in Colombia

MinAmbiente – Jesús Sepulveda and Ernesto Romero

The presentation addresses the increasing environmental challenges caused by illegal hydrocarbon activities in Colombia, primarily driven by third-party actors (actors other than the oil companies). Factors such as illegal hydrocarbon processing, heightened activity by armed groups, and hydrocarbon seizures have exacerbated the problem. These activities result in oil spills and environmental contamination, which pose significant risks to both human health and ecosystems. Under Decree 1868 of 2021, companies responsible for oil infrastructure are required to take action to mitigate environmental damage triggered by third-party incidents, regardless of the cause.

Protocols have been developed for dismantling illegal hydrocarbon processing sites, in collaboration with Colombia's law enforcement and environmental authorities. These guidelines aim to minimize environmental damage during dismantling operations through measures such as controlled burning, solidifiers, and enhanced natural remediation. Additionally, guidelines are currently being drafted to provide a systematic approach for managing sites contaminated by hydrocarbon spills, outlining methods to assess and prioritize areas based on environmental risks.

The presentation highlights the need for strong coordination between government agencies, such as the Ministry of Environment and the Ministry of Defense, to address environmental liabilities linked to illegal activities. The regulatory framework has been expanded with laws like Law 2327 of 2023, which offer technical and financial tools for managing contaminated areas. Regular reporting and oversight by environmental authorities seeks to ensure that appropriate contingency measures are implemented to minimize environmental damage.

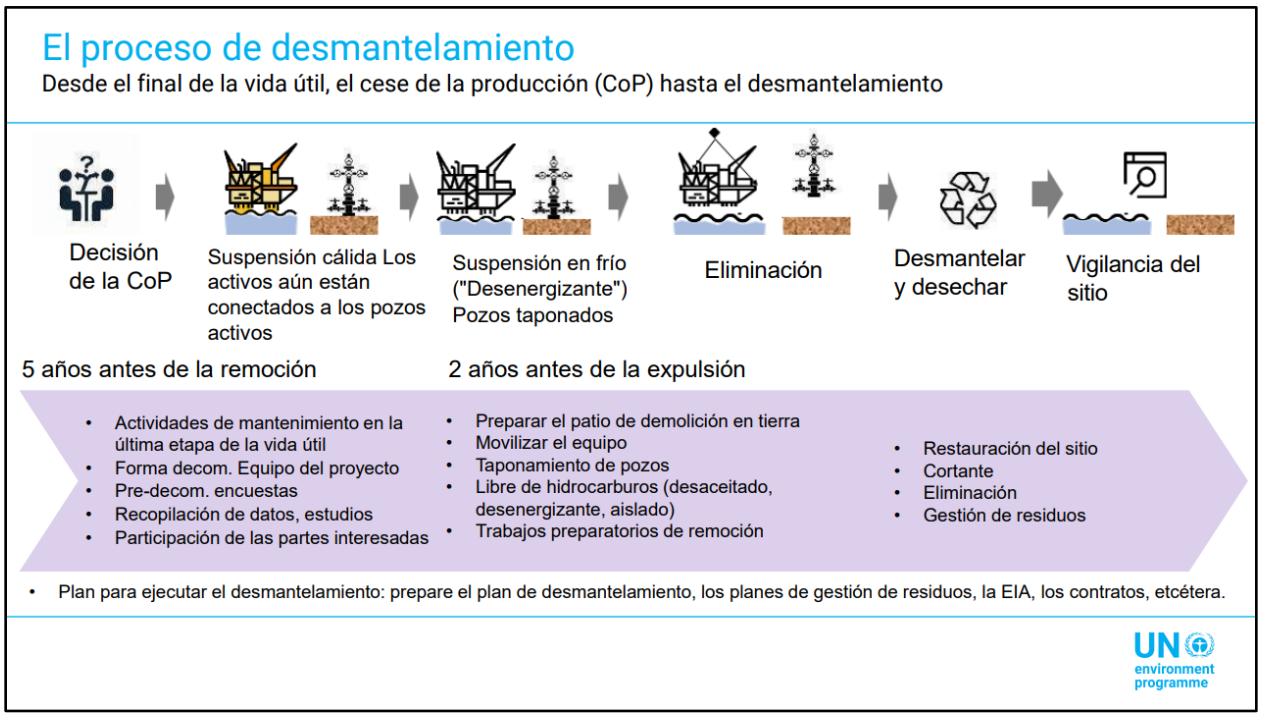


Colombia's key legislation related to handling oil spills caused by third party actors

Module 2: Decommissioning obligations, challenges, and main stages

The module outlines the decommissioning process for oil and gas infrastructure in more detail, including key stages, challenges, and regulatory obligations. Decommissioning involves the safe dismantling of oil and gas facilities that have reached the end of their productive life, with a focus on minimizing environmental impacts. It stresses the roles of governments and regulatory bodies in ensuring that operators follow environmental laws and best practices throughout the process. In Colombia, for example, operators are required to submit a decommissioning plan and secure financial guarantees to cover decommissioning costs. This process ensures that infrastructure is safely decommissioned, and that the adjacent environment is restored.

The decommissioning process follows nine stages, with the first five stages described in more detail: pre-decommissioning assessments, project planning, de-energizing plus secondary de-energizing, and addressing hazardous materials. As facilities transition from active production to decommissioning, operators must remove hydrocarbons, de-energize equipment, and safely dismantle infrastructure. Successful decommissioning involves stakeholder engagement, waste management, and the need for a thorough environmental impact assessment (EIA) before decommissioning activities commence. Best practices, such as using Multi-Criteria Decision Analysis (MCDA) and Comparative Assessment (CA), help balance environmental, safety, and economic considerations.



Overview of components involved in the decommissioning process

Funding and long-term management pose significant challenges in decommissioning projects. Operators are responsible for setting aside financial resources, often through decommissioning funds, to cover anticipated costs. The presentation highlights various international regulatory frameworks and the tax implications of decommissioning, drawing on cases in the UK and Kazakhstan. Governments and operators must ensure that proper financial and regulatory measures are in place to handle the complex nature of decommissioning, including site restoration and the safe disposal of hazardous materials.

Module 3: Onshore / terrestrial decommissioning

The module provides an overview of onshore (terrestrial) oil and gas infrastructure decommissioning. It describes stages 6 and 7, on dismantling and demolition. One critical aspect is the plug and abandonment (P&A) process for wells, where downhole equipment is removed, and the wellbore is filled with cement plugs to prevent fluid migration and contamination. Decommissioning also includes the dismantling of refineries and petrol stations, including associated pipeline infrastructure, which all must follow stringent safety and environmental standards.

A significant challenge with the onshore petroleum sector is the risks posed by abandoned or improperly decommissioned wells and pipelines. These neglected infrastructures, often spread across extensive areas, can pose environmental hazards, including greenhouse gas leaks and groundwater contamination. Properly sealed wells prevent fluid movement between geological

layers and to the surface. Pipeline decommissioning can involve leaving the pipeline in place or removing it, dependent on considerations for environmental and safety impacts as well as cost.

Diagram showing the casing of a well and surrounding subterranean matter

Additionally, the presentation highlights that decommissioning petroleum refineries is rare, as they are more often upgraded than dismantled. However, when decommissioning is necessary, it presents significant challenges due to the complex equipment and infrastructure typically involved. Included case studies from different countries emphasize the complexities and risks associated with decommissioning, as well as the importance of planning to mitigate long-term environmental damage.

Guest presentation 2: Decommissioning terrestrial exploratory wells in Colombia

EcoPetrol – Julian Gonzalez

The presentation discusses EcoPetrol's decommissioning process for its terrestrial wells in Colombia, primarily focusing on the environmental, legal, and technical aspects of abandonment. It outlines Colombia's regulatory framework that governs these activities, including decrees and resolutions related to environmental compliance. The decommissioning process involves several stages, such as well plugging, dismantling infrastructure, and waste management. The aim is to prevent cross-contamination between permeable formations and protect groundwater. Additionally, strategies for optimizing costs and reducing environmental impact, such as reusing materials and waste management, are emphasized.

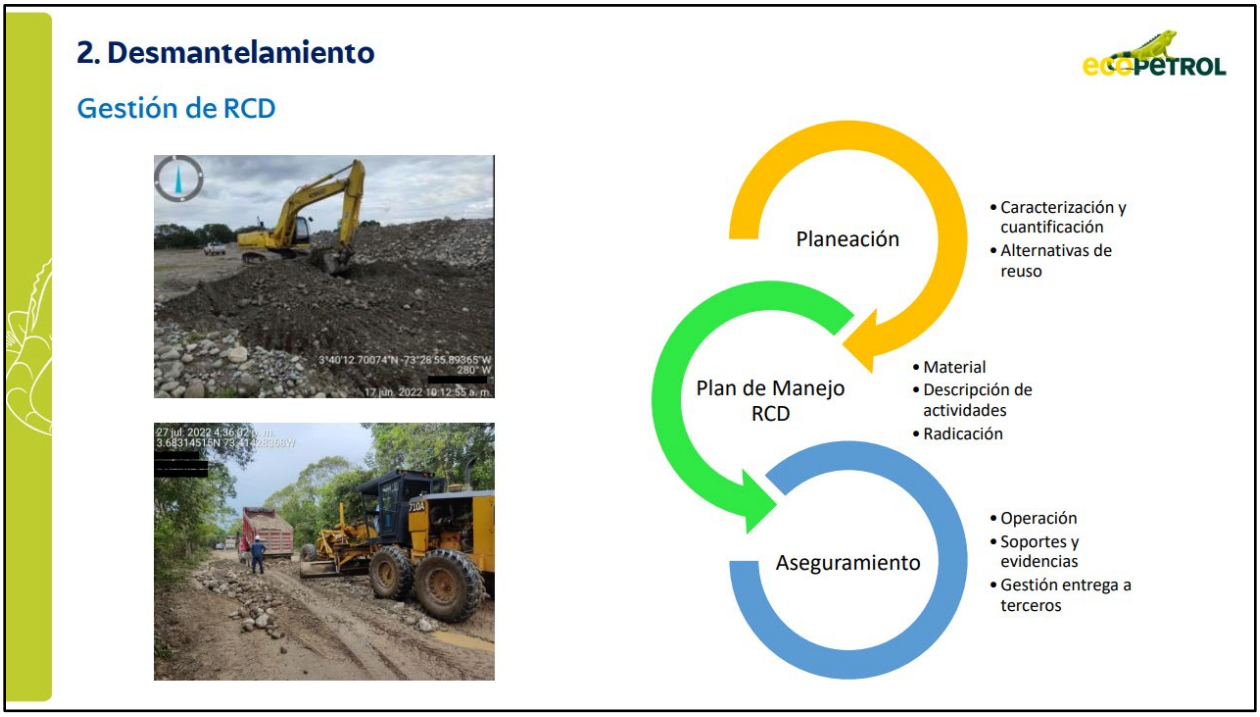


Diagram of the "Residuals of Construction and Demolition" (RCD) plan

EcoPetrol's approach to decommissioning follows a circular economy model. This includes efforts to reuse waste materials, reduce raw material demand, and manage residuals from the decommissioning process. The company highlights the environmental benefits of these practices, including carbon emissions reduction, traffic minimization, and positive impacts on local communities. Key civil works during decommissioning include the dismantling of platforms and concrete structures, as well as geotechnical and water control measures.

The presentation also outlines the environmental recovery phase, involving land reshaping, revegetation, and restoration to its original use, aiming to return the land to productive activities for its owners. EcoPetrol has successfully implemented several decommissioning projects in the country, achieving significant cost savings and environmental benefits. The company's strategy contributes to sustainable development while maintaining good relations with stakeholders and local communities. It was also emphasized that although EcoPetrol is the national oil company, there are other operators that own (and abandon) wells in the country.

Day 2

Module 4: Environmental and social considerations of decommissioning

The module outlines key environmental and social considerations involved in decommissioning. For environmental aspects, emphasis is placed on spill prevention and stormwater management to reduce the negative impacts of decommissioning. The process requires strategies for managing surface water runoff, reducing siltation in water bodies, and controlling erosion,

highlighting the importance these strategies play in preventing sediment from entering nearby rivers and reservoirs. Stage 8 describes effective scrap and waste management, essential during decommissioning, especially in the demolition phase, emphasizing recycling and reusing materials to reduce environmental impact and offset the costs of producing new materials.

Examples of methods to control siltation and erosion commonly caused by decommissioning projects

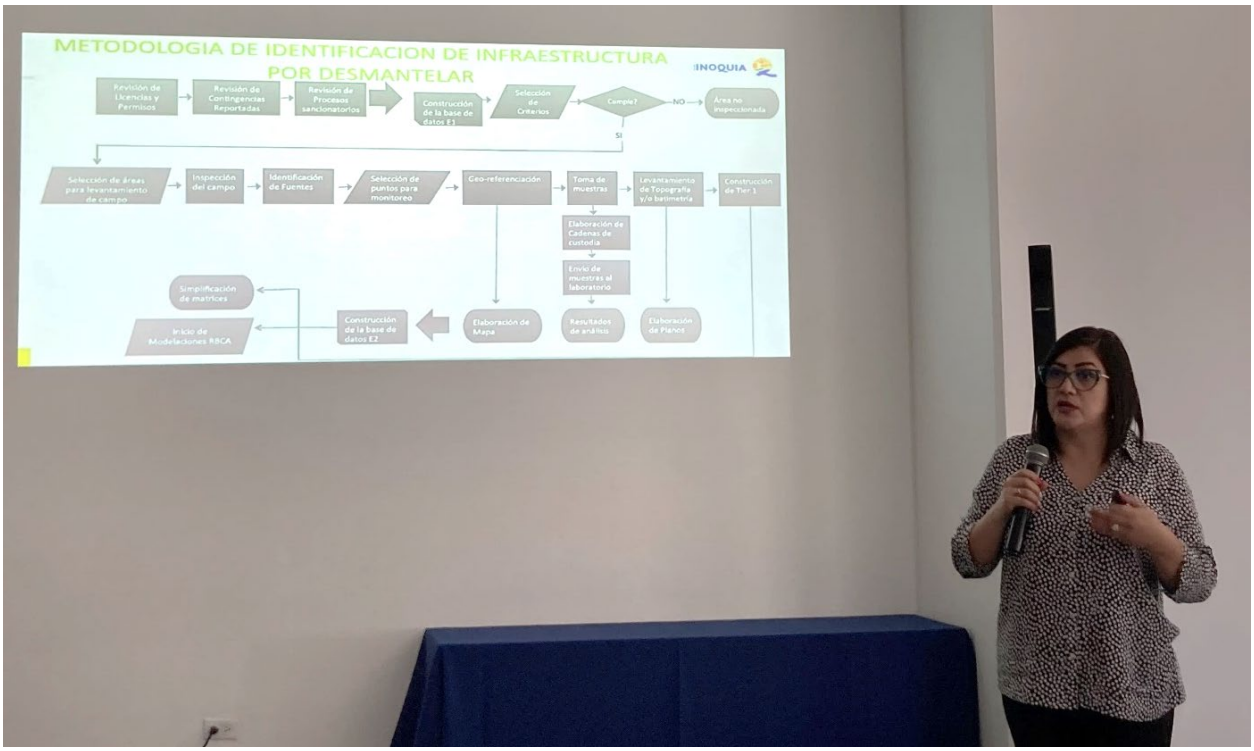
Sustainable decommissioning is driven by nine key principles, focusing on enhancing corporate social responsibility, minimizing environmental impacts, and maximizing material reclamation and recycling. Operators are encouraged to engage with communities and stakeholders throughout the decommissioning process to build trust and ensure social and environmental impacts are minimized. Proper removal of hazardous materials, thorough planning, and financial assurance are likewise crucial to ensuring that decommissioning activities are conducted responsibly and safely.

The module also highlights the common environmental and social impacts associated with decommissioning, such as air emissions, and discharges to sea and physical disturbances to the seabed (relevant for offshore settings as well as operations in freshwater environments). The importance of Environmental and Social Impact Assessments (ESIAs) to evaluate these impacts and guide decision-making is also stated. Colombia's regulatory authorities, the National Hydrocarbon Agency (ANH) and National Environmental Licensing Authority (ANLA), oversee the decommissioning process to ensure compliance with environmental and safety standards.

Guest presentation 3: Dismantling, abandonment, and restoration of petroleum infrastructure

CorpOrinoquia – Andrea Lopez

The presentation discusses the process and responsibilities related to the dismantling, abandonment, and restoration of petroleum infrastructure, particularly focusing on hazardous waste management. It emphasizes Colombia's legal framework governing these activities, such as Law 430 of 1998, which regulates hazardous waste and its safe disposal, and Decree 4741 of 2005, which outlines the obligations of waste generators. These regulations require companies to prevent environmental contamination and ensure that all hazardous waste is managed safely and appropriately, with measures in place to protect both human health and the environment.



Infrastructure that will need to undergo decommissioning in the CorpOrinoquia region

In addition, the presentation highlights specific infrastructure that requires dismantling and restoration in Colombia, mentioning ongoing decommissioning projects by operators like Perenco, Sierracol Energy, and EcoPetrol. It indicates identified areas and infrastructure, such as oil pipelines and wells, that are pending dismantling, including areas like the Lemon Covenas pipeline and various assets in Saravena. It also references successful restoration cases and ongoing efforts to seal seismic exploration sites to prevent further environmental damage.

Finally, the presentation outlines the importance of coordinating dismantling activities with environmental licenses and management plans to ensure compliance with the country's environmental regulations. It also discusses how improper handling of waste, such as poorly sealed detonations, can negatively impact water resources, particularly domestic water supplies, thus underscoring the need for meticulous planning and execution of infrastructure decommissioning and restoration efforts.

Guest presentation 4: Impacts of hydrocarbon leakage in soil and groundwater

UNAL – Leonardo Donado

This presentation discusses Light Non-Aqueous Phase Liquids (LNAPLs), such as petroleum, gasoline, or diesel fuel, which are groundwater contaminants that are less dense than water and not highly soluble in it. Due to their lower density, LNAPLs float above the water-saturated zone, persisting in aquifers for long periods despite their slight solubility in water. Although they are degradable, their persistence poses a significant pollution issue, especially as they are capable

of penetrating soil quickly due to their low viscosity and can easily enter small fractures due to their low surface tension. This creates long-term contamination challenges in affected groundwater systems.

The spread of LNAPLs in the environment is influenced by the heterogeneity of the subsurface. For example, LNAPLs can migrate in unexpected directions, even against groundwater flow, depending on the soil composition and structure. Common sources of LNAPL contamination include gasoline and diesel spills from leaking underground storage tanks, refineries, and pipelines. The contaminants commonly found in these fuels, such as Benzene, Toluene, Ethylbenzene, and Xylene (BTEX), can dissolve or vaporize, further contaminating the surrounding soil and water. Additionally, LNAPLs can migrate through the soil in both vertical and horizontal directions, driven by gravity and capillary forces.

The presentation highlights that remediation of LNAPL contamination requires addressing several factors, including dissolution, vaporization, and sorption behaviors. Heat treatment is one effective method to increase the mobility and vaporization rate of LNAPLs in the soil, aiding their removal. The behavior of LNAPLs in relation to water and gas (air) must also be considered, with water typically being more “wettable” than LNAPLs, affecting their spread in the environment. Understanding the spread and behavior of LNAPLs is crucial for developing effective remediation strategies and mitigating long-term environmental damage.

The presentation featured a visual demonstration illustrating how liquids infiltrate and flow through subsurface environments. This was achieved using a water tank, into which different colored dyes were introduced.

Diagram showing how Light Non-Aqueous Phase Liquids infiltrate soil

Guest presentation 5: Dismantling and abandonment of the Tardigrade and Cachalote platforms

GeoPark – Ximena Rodgriguez

The presentation outlines GeoPark's decommissioning and abandonment plan for the Tardígrada and Cachalote platforms in Colombia, which were used for exploratory drilling in the Andaquíes Block. The project began in 2011, with initial drilling activities completed between 2011 and 2012. The presentation provides a detailed timeline of the various phases of the project, including operational activities such as civil works, drilling, and environmental monitoring, as well as post-operational steps such as dismantling and area restoration. The plan is designed to meet regulatory requirements, ensuring the safe and environmentally responsible closure of the platforms.

A general diagnosis was conducted to evaluate the status of the project, including its environmental and social impacts. The presentation highlights the importance of monitoring water and soil conditions, managing waste, and maintaining communication with local communities and authorities throughout the decommissioning process. The presentation also discusses the legal framework governing the project, such as compliance with Decree 1076 of 2015, which outlines regulations for the abandonment and dismantling of oil and gas infrastructure. The presentation describes strategies for managing land use, terminating easements, and addressing property owner concerns.

Photos of sites where wells were abandoned and adjacent land restored

The dismantling and abandonment process involves a series of steps, including mobilizing machinery, cleaning surfaces, restoring the land, and abandoning wells. Environmental monitoring and social engagement are central components of the process to ensure that the surrounding environment and local communities are protected. The project will conclude with the formal closure of the case, following verification by environmental authorities that all regulatory obligations have been fulfilled. The final resolution occurred in August 2024, after which the platforms will be fully dismantled and restored.

Module 5: Assessment, restoration, site clean-up, and reporting

The module outlines the methods and best practices for decommissioning. It emphasizes the importance of Environmental and Social Impact Assessments (ESIAs) to identify potential environmental impacts and plan for site restoration and remediation. Decommissioning activities require thorough planning, including a specific ESIA, which should assess alternatives and ensure that a fund is available to cover decommissioning costs.

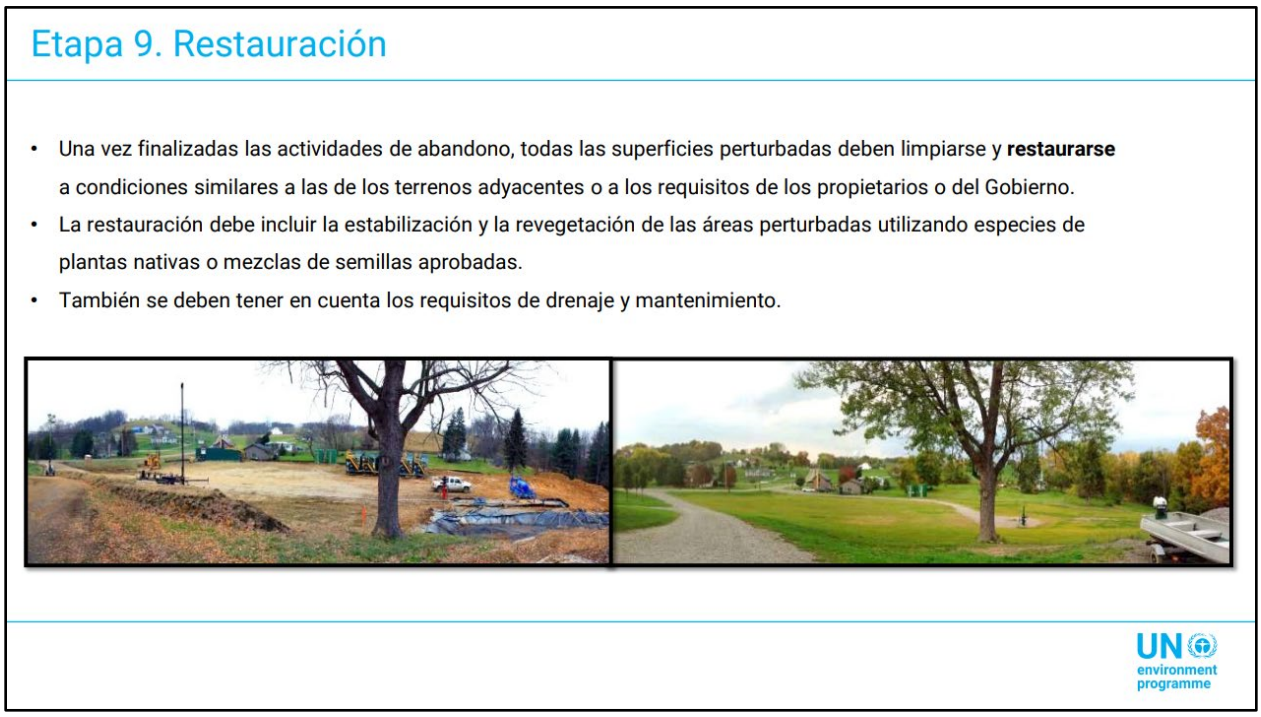


Photo showing "before and after" a site was restored

Stage 9 restoration activities involve returning the site to a condition similar to adjacent land, as required by landowners or the government. Restoration should stabilize disturbed areas, reintroduce native vegetation, and ensure proper drainage. Habitat restoration often starts before decommissioning to assess pre-existing conditions, while site remediation focuses on removing pollutants and contaminants from the land. Long-term monitoring and maintenance, such as managing re-vegetation and preventing weed invasion, are critical for successful restoration.

The final steps in the decommissioning process include marking remains, establishing safety zones, and submitting a closure report. Decommissioning projects require careful financial planning and compliance with regulatory frameworks to ensure the safety of local communities and the environment. Proper execution of the nine phases of decommissioning, from pre-assessment to restoration, ensures that sites are rehabilitated and can be safely reused or restored to their natural state.

Guest presentation 6: Decommissioning projects in Bogotá

SDA – Diego Corredor

The presentation focuses on the decommissioning and dismantling of hydrocarbon facilities in Bogotá, led by the District Secretariat of Environment (SDA). The process involves strict oversight of fuel storage and distribution sites, particularly service stations, to ensure that hazardous materials, such as used oils and chemicals, are safely managed. SDA's technical visits to service stations assess compliance with regulations for non-domestic wastewater management,

hazardous waste storage, and fuel handling. Fuel service stations are inspected for tank conditions, spill containment, and the functionality of leak detection systems, among other safety measures.

The presentation also covers the investigation of potentially contaminated sites, where past industrial activities involving hydrocarbons may have led to soil and groundwater pollution. The SDA's role includes evaluating environmental liabilities and ensuring the restoration and remediation of contaminated land. Sites that have been used for fuel storage and distribution must undergo environmental assessments before being repurposed for other uses. The process includes site investigations, risk assessments, and ensuring that restoration efforts meet legal and environmental standards before development can proceed.

Diagram and photos of subterranean gasoline tank in Bogotá

Case studies included in the presentation illustrate the decommissioning process for several service stations in Bogotá, highlighting challenges like soil contamination, incomplete site investigations, and the need for thorough environmental assessments. These case studies demonstrate the importance of accurate data collection, proper handling of hazardous waste, and compliance with safety protocols. The ultimate goal is to ensure that decommissioned sites are safe for future use, whether for residential, industrial, or public projects.

Day 3

Group presentations on Decommissioning Plan chapters

Participants were divided into five groups, each with a balanced mix of regional and national representatives, and tasked with outlining 1-2 assigned chapters typically included in a Decommissioning Plan. Each group was instructed to gather relevant information for their assigned chapters and present the main elements on a flipchart sheet. They were encouraged to consider key questions to discuss with managerial staff from two facilities—a petrol station and an oil processing plant—and were allowed to search online resources to enhance their flipchart presentations. The preparation phase lasted one hour, followed by group presentations, with each group given ten minutes to present.

Group presentations were assessed by a panel and given a score out of 40 points, graded according to four categories: 1) stayed within time limit, 2) ability to synthetically and schematically cover the topic, 3) team involvement, and 4) identify key stakeholders relevant to their chapter.

Group 1

Chapter: Political, Legal, and Institutional Framework

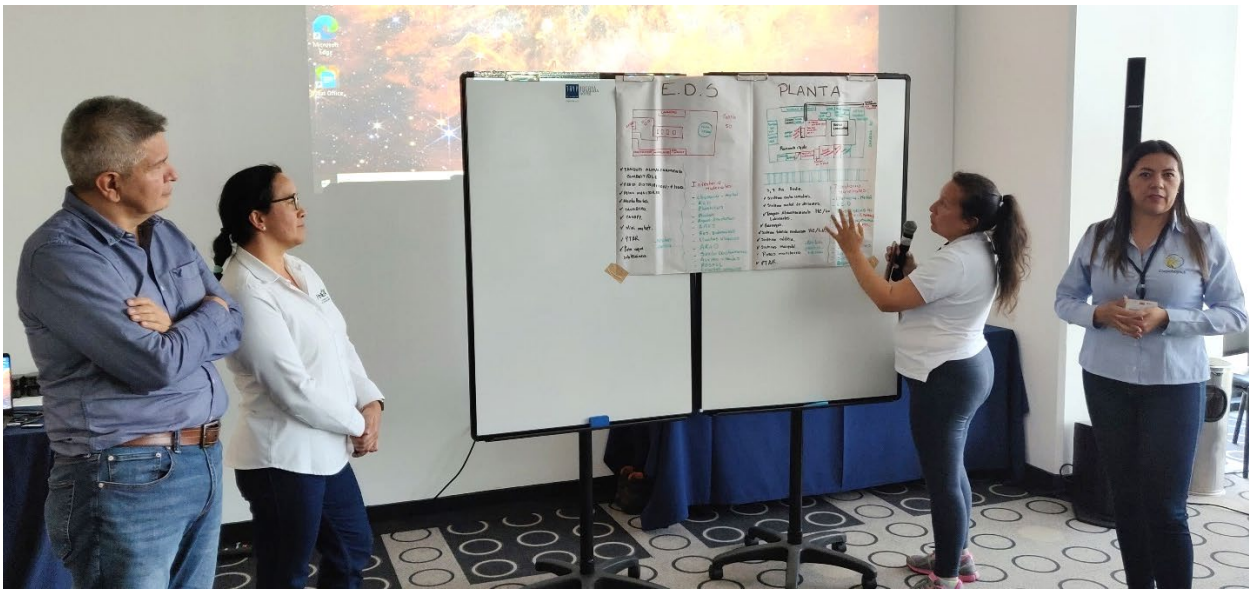
Group 1 members: Oscar Calvo (ANH), Erwin Cordoba (CorpoBoyacá), & Jorge Jimenez (CorpoCesar)

Group 1's presentation highlighted the need for a contingency plan to address specific requirements of both the oil processing plant and the petrol station. The plan highlighted that the petrol station operates on commercially designated land, while the oil processing plant is situated on industrial land, each requiring different types of licenses. It emphasized the necessity of conducting an Environmental Impact Assessment (EIA) before dismantling the facilities, in

accordance with Colombia's 1999 environmental guidance for decommissioning projects. Additionally, the presentation noted that, as of 2024, these facilities no longer require environmental licenses, although they did require such licenses during their construction years.

Group 2

Chapters: Description of the Elements to be Dismantled & Inventory of Materials



Group 2 members: Luisa Ramírez (ANLA), Amanda Herrera (CorpoBoyacá), Claudia Neisa (CAR), & Jesús Sepulveda (MinAmbiente)

Group 2's presentation provided a comprehensive outline of the primary assets and infrastructure to be dismantled at the petrol station and oil processing plant. Their poster featured detailed maps of both sites, and the group listed all equipment, infrastructure, materials, soil, water, and waste requiring decommissioning. They mentioned specific items and materials to be addressed, including different fuel types, on-site oil wells, parking areas, scrap yard materials, packaging, an empty warehouse, a maintenance shop, water storage facilities, and pavement. Contaminated soil present at both facilities was identified as an item for remediation.

Group 3

Chapters: Ready Removal and Disposal Options & Selected Removal and Disposal Options

Group 3's presentation featured a map of the oil processing plant and proposed an optimized reorganization of the infrastructure within the site or, if necessary, relocation to a new location. Their plan included leasing an adjacent, unused military building. The group preferred retaining the current site and optimizing its layout, with full decommissioning as a last resort. In the event of relocation, they proposed a cost-benefit analysis to account for construction time and costs, suggesting that building a new facility while the existing one continues operation would be more

efficient. Certain infrastructure, such as above-ground pipelines, could be easily dismantled and repurposed at the new location.

Group 3 members: Lilian Silva (ACP), María Bustamante (ANLA), Viviana Tafur (CorpOrinoquia), & Viviana Marcela (CorpoNariño)

Group 4

Chapters: Environmental and Socio-economic Assessment and Impact & Monitoring and Follow-up Details

Group 4's presentation featured a detailed diagram outlining the handling of various environmental and social impacts common to the decommissioning of both the oil processing plant and petrol station. They highlighted similar impacts on surface and groundwater at both sites and noted that decommissioning activities would generate noise, affecting nearby communities. Specific to the petrol station, road closures would disrupt local transit, creating immediate social impacts. For the oil plant, historical pesticide use on-site would require careful soil and water management, and initial environmental impacts on the landscape could later lead to positive outcomes. Socially, decommissioning both sites would create jobs, stimulate economic activity, and involve post-decommissioning site monitoring. The plan would include soil removal in compliance with national regulations, while Bogotá's air quality monitoring network could support air quality management efforts.

Group 4 members: Andrea López (CorpOrinoquia), Diana Triana (CAS), Sandra Cortes (MADS), & Roa Lozano (MinEnergía)

Group 5

Chapter: Definitions and Stakeholder Consultations

Group 5's presentation included a diagram highlighting the importance of communication in decommissioning projects, detailing the actors involved and their consultation requirements. They emphasized that the company should define decommissioning activities and submit the timeline to environmental authorities through formal channels like letters and board meetings. Their plan outlined specific communication strategies for both the oil processing plant and the petrol station. Vendors connected to both facilities would be informed about route changes for delivery trucks, while an advertising campaign would inform petrol station customers. Additionally, the communications plan would notify vendors of the location of the new oil processing facility, given its role in producing a specialized product in the country.

Group 5 members: Javier Reyes (CAM), Paula Rozzi (CorTolima), Jeniffer Rodriguez (MinEnergía), & Paola Caicedo (SDA)

Day 4

Group action planning

As a final exercise in the workshop, participants were tasked with developing action plans to translate their learning outcomes into concrete steps for implementation. Divided into four groups, participants created tables on large sheets of paper to address four key questions: 1) What are the challenges or priorities to be addressed? 2) What are the current efforts to tackle these challenges? 3) What needs to be done in the short term (1-3 years) to achieve progress? and 4) Who are the responsible entities to initiate the necessary actions? Each group then briefly presented their action plans to the rest of the workshop participants.

Refer to **Annex V** to view the action planning tables.

After the action planning activity, the lead trainer provided a summary of the learning content covered throughout the workshop. The workshop then concluded with group photos and the presentation of UNEP course certificates by the training team.

Annex II: Training program agenda

DAY ONE (Tuesday, 17th September)		
Title	*Speaker*	*Time (local)*
Registration and hotel security briefing	Hotel security staff	8:30 – 9:00
UNEP welcoming & government opening remarks	Marisol Estrella, UNEP & Ernesto Romero, MinAmbiente	9:00 – 9:15
Introductions of training team & participants, and course overview / schedule	Taylor Blair, UNEP & Paula Solarte, UNEP	9:15 – 10:00
Module 1: Overview of the decommissioning process and continental oil and gas infrastructure in Colombia	Matthew Richmond, UNEP	10:00 – 10:45
Morning coffee / tea		10:45 – 11:00
Guest presentation 1: Strengthening the management of environmental authorities in contingencies of the hydrocarbons industry	Jesús Sepulveda and Ernesto Romero, MinAmbiente	11:00 – 12:00
Module 2: Decommissioning main stages, challenges and obligations	Matthew Richmond	12:00 – 13:00
Lunch		13:00 – 14:00
Module 3: Continental / terrestrial decommissioning	Matthew Richmond	14:00 – 15:00
Guest presentation 2: Dismantling surface infrastructure and environmental restoration	Julian Gonzalez, EcoPetrol	15:00 – 15:45
Q&A / sticky notes activity	All trainers / participants	15:45 – 16:15
Afternoon coffee / tea		16:15 – 16:30
End of Day 1		16:30

DAY TWO (Wednesday, 18th September)		
Title	*Speaker*	*Time (local)*
Recap of Day 1	Taylor Blair & Paula Solarte	8:30 – 9:00
Module 4: Environmental and social considerations	Matthew Richmond	9:00 – 9:45
Guest presentation 3: Dismantling, abandonment, and restoration of oil infrastructure in the Casanare department	Andrea Lopez, CorpOrinoquia	9:45 – 10:30
Morning coffee / tea		10:30 – 10:45
Guest presentation 4: Impacts of hydrocarbon leakage in soil and groundwater	Leonardo Donado, Universidad Nacional de Colombia	10:45 – 11:30

Guest presentation 5: Decommissioning the Cachalote and Tardígrado platforms in the Andaquies block	Liza Ximena Rodríguez, GeoPark Colombia	11:30 – 12:15
Module 5: Assessments, site clean-up, restoration, and reporting	Matthew Richmond	12:15 – 13:00
Lunch		13:00 – 14:00
GROUP WORK ACTIVITY, PART 1 *Preparations for site visit*	Matthew Richmond / all trainers	14:00 – 15:00
Guest presentation 6: Overview of decommissioning projects in Bogotá	Diego Corredor, Bogotá city District Secretary of Environment (SDA)	15:00 – 15:45
Q&A / sticky notes activity	All trainers / participants	15:45 – 16:15
Afternoon coffee / tea		16:15 – 16:30
End of Day 2		16:30

DAY THREE (Thursday, 19th September)		
Title	*Speaker*	*Time (local)*
Recap of Day 2 / participants put on protective gear / headcount of participants	Taylor Blair & Paula Solarte	7:30 – 8:00
Bus departure at **8:00 sharp** for field visit	All trainers / participants	8:00 – 8:15
Field visit tour Part 1 at Petrobras plant (midstream)	Diego Corredor / Petrobras / Matthew Richmond	8:15 – 11:00
Bus departure to Petrobras La Palma gas station	All trainers / participants	11:00 – 11:20
Field visit tour Part 2 at La Palma gas station	Diego Corredor & Matthew Richmond	11:20 – 12:15
Bus departure back to hotel	All trainers / participants	12:15 – 12:45
Lunch		13:00 – 14:00
GROUP WORK ACTIVITY, PART 2 *Prepare and present review of site visit*	Matthew Richmond / all trainers	14:00 – 16:00
Discussion / Q&A	All trainers / participants	16:00 – 16:15
Afternoon coffee / tea		16:15 – 16:30
End of Day 3		16:30

DAY FOUR (Friday, 20th September)		
Title	*Speaker*	*Time (local)*
Recap of Day 3	Matthew Richmond / SDA / ANLA	8:30 – 9:15

Group action planning	All trainers / participants	9:15 – 10:15
Summary of the course	Matthew Richmond	10:15 – 10:30
Morning coffee / tea		10:30 – 10:45
Survey questionnaires: final knowledge exam and course evaluation	Taylor Blair & Paula Solarte	10:45 – 11:30
Presentation of certificates and group photos	All trainers / MinAmbiente	11:30 – 12:15
Closing remarks	Matthew Richmond & Marisol Estrella	12:15 – 12:30
Lunch		12:30 – 13:30
End of course – participants check out and travel home		13:30

Annex III: Workshop participants & training team roster

Participants

	Name	Gender	Institution	National or Regional government (N/R)	Email
1	Oscar Andres Calvo Montoya	M	Agencia Nacional de Hidrocarburos (ANH)	N	
2	Lilian Silva Mantilla	F	Asociación Colombiana del Petróleo y Gas (ACP)	N	
3	Luisa Fernanda Ramírez Leguizamón	F	Autoridad Nacional de Licencias Ambientales (ANLA)	N	
4	María Catalina Bustamante Martínez	F			
5	Erwin Ferney Cordoba Veloza	M	Corporación Autónoma Regional de Boyacá (CorpoBoyacá)	R	
6	Amanda Yanneth Herrera Hernandez	F			
7	Jorge Humberto Jimenez Duran	M	Corporación Autónoma Regional de Cesar (CorpoCesar)	R	
8	Claudia Maritza Neisa Guerra	F	Corporación Autónoma Regional de Cundinamarca (CAR)	R	
9	Viviana Patricia Tafur Silva	F	Corporación Autónoma Regional de la Orinoquia (CorpOrinoquia)	R	
10	Andrea Consuelo López Niño	F			
11	Viviana Marcela	F	Corporación Autónoma Regional de Nariño (CorpoNariño)	R	
12	Diana Carolina Triana Ardila	F	Corporación Autónoma Regional de Santander (CAS)	R	
13	Javier Alirio Reyes Camacho	M	Corporación Autónoma Regional del Alto Magdalena (CAM)	R	
14	Paula Tatiana Rozzi Sandoval	F	Corporación Autónoma Regional del Tolima (CorTolima)	R	
15	Ernesto Romero Tobón	M	Ministerio de Ambiente y Desarrollo Sostenible (MADS)	N	
16	Jesús Miguel Sepulveda E.	M			

17	Sandra Pilar Cortes Sanchez	F			
18	Sofia Roa Lozano	F	Ministerio de Minas y Energía (MinEnergía)	N	
19	Jeniffer Eliana Rodriguez Salamanca	F			
20	Héctor Diego Felipe Corredor Forero	M	Secretaria Distrital de Ambiente de Bogotá (SDA)	R	
21	Paola Yazmin Caicedo Pulido	F			

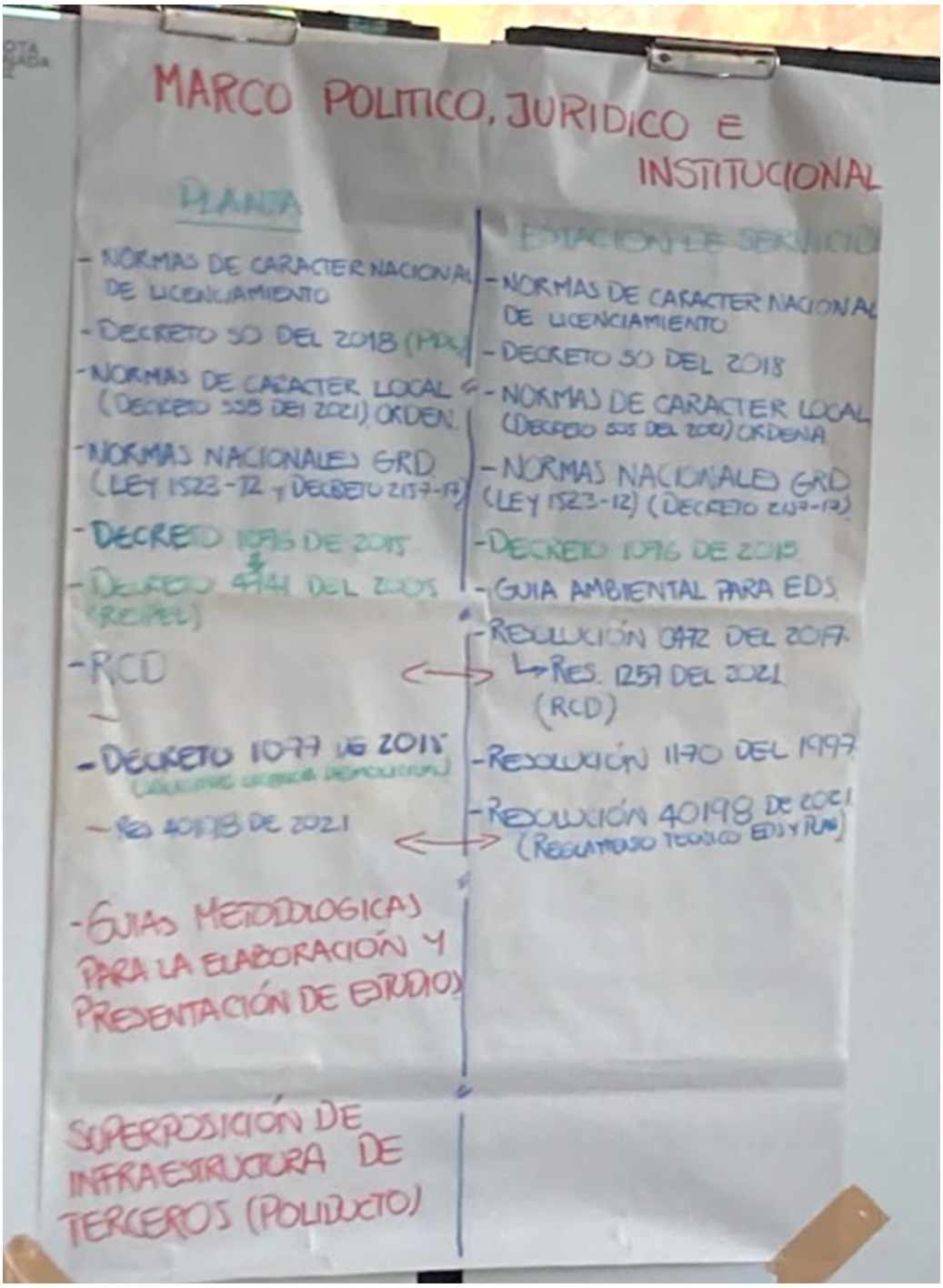
Guest presenters

Name	Institution	Email
Mr. Ernesto Romero	MinAmbiente	
Mr. Jesús Sepulveda	MinAmbiente	
Mr. Julian Gonzalez	EcoPetrol	
Mr. Leonardo Donado	UNAL	
Mrs. Liza Ximena Rodríguez	GeoPark	
Mrs. Andrea Lopez	CorpOrinoquia	
Mr. Diego Corredor	Bogotá SDA	

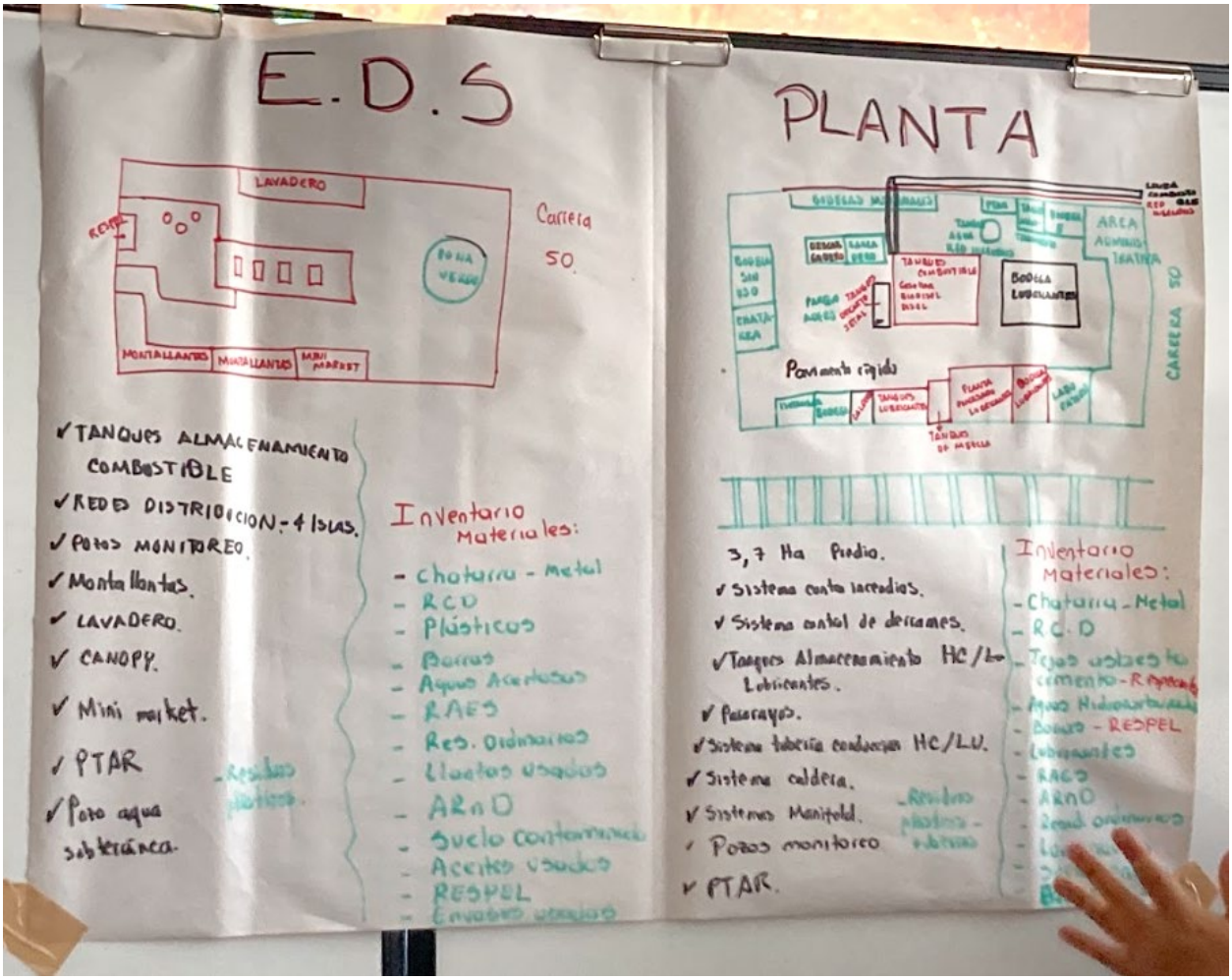
Training team

Name	Position & affiliation	Email
Mr. Matthew Richmond	Course Lead Expert, UNEP Disasters & Conflicts Branch	
Ms. Paula Solarte-Blandon	Field Coordinator, UNEP Disasters & Conflicts Branch	
Mr. Taylor Blair	Research Associate, UNEP Disasters & Conflicts Branch	
Ms. Marisol Estrella	Program Coordinator, UNEP Disasters & Conflicts Branch	

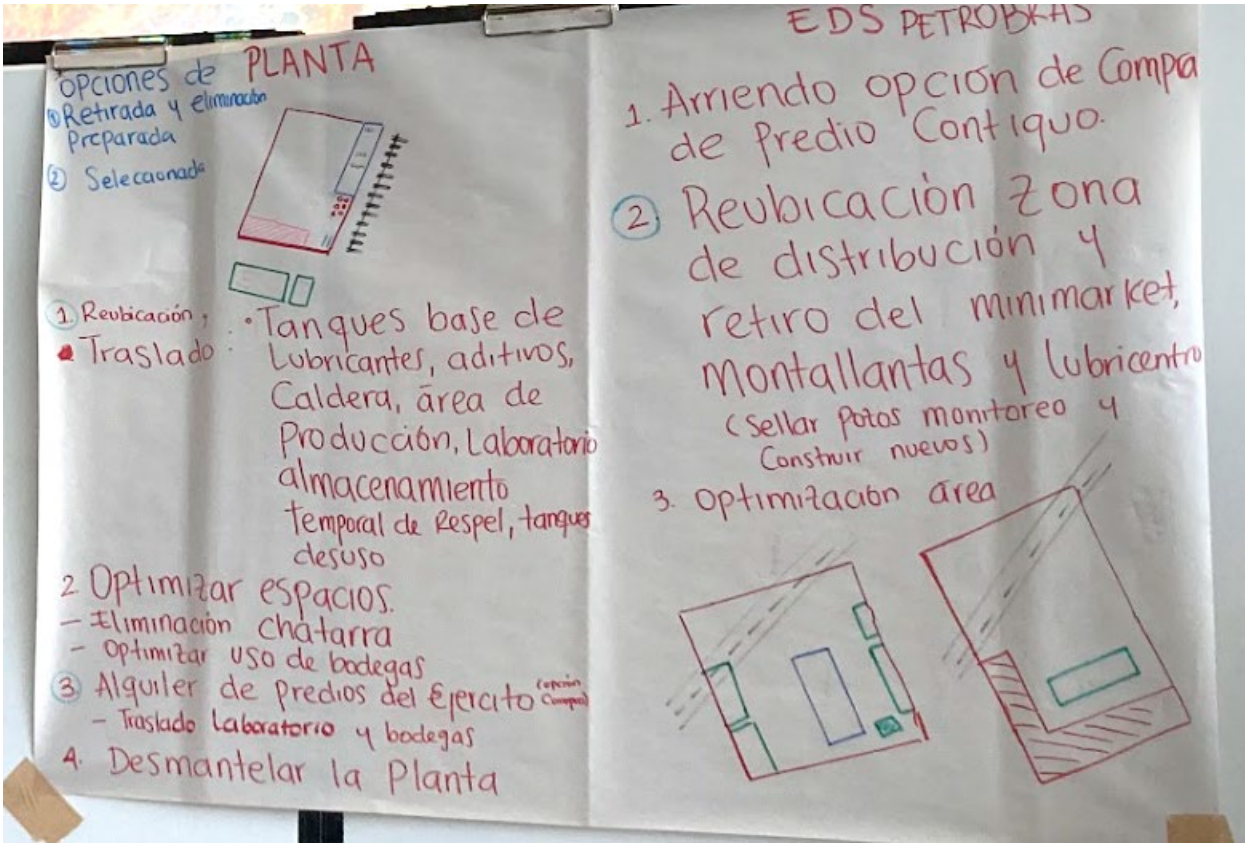
Annex IV: Developing decommissioning report chapter outlines



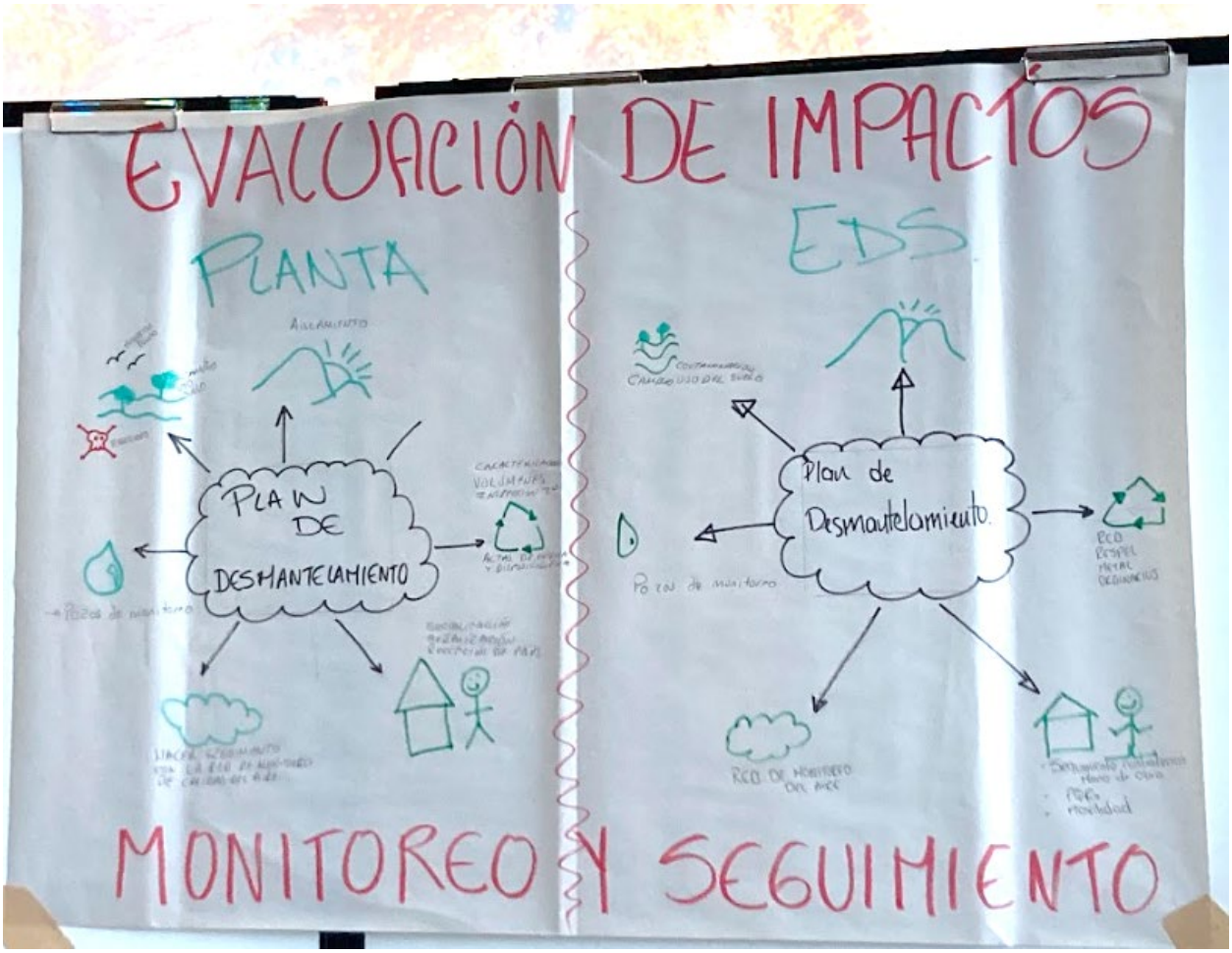
Group 1 - Political, Legal, and Institutional Framework



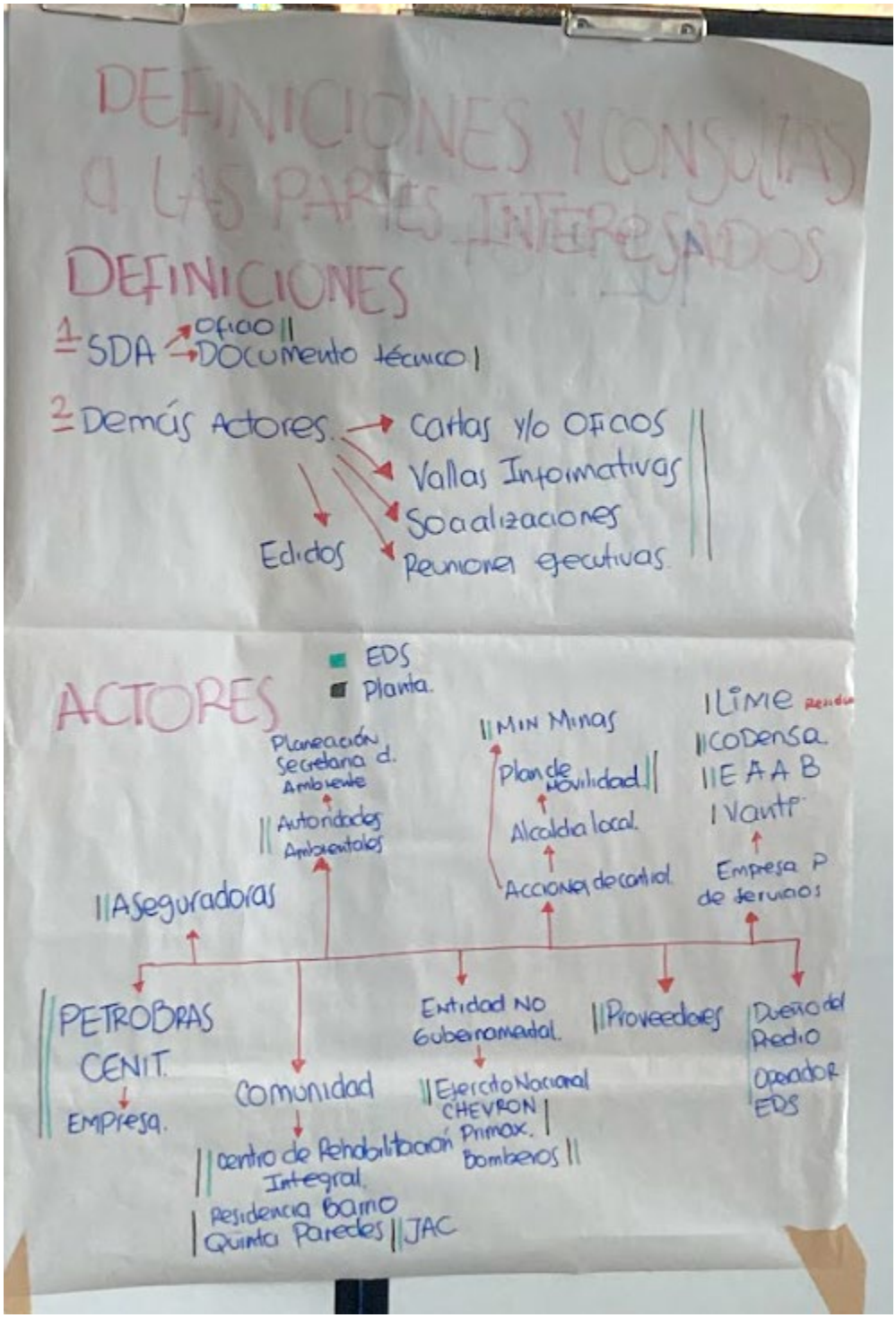
Group 2 - Description of the Elements to be Dismantled & Inventory of Materials



Group 3 - Ready Removal and Disposal Options & Selected Removal and Disposal Options



Group 4 - Environmental and Socio-economic Assessment and Impact & Monitoring and Follow-up Details



Group 5 - Definitions and Stakeholder Consultations

Annex V: Developing action plans

Group 1

Challenge/priority	Current efforts to address this challenge	What to do in the short term (1-3 years)	Entity responsible for making this happen
Preparation of a guide for the calculation of environmental risk indices of compounds of interest in sites affected by chemical substances. (Regulated) A procedure must be in place for implementation by the Environmental Authority of the guide in its environmental control exercise. Tools to define site-specific compliance limits that are useful and mandatory for use by regional corporations (calculators).	In the District of Bogotá, there are advances in the design of guides for calculations based on toxicology in contaminated sites and guides for the dismantling of industrial, commercial and service facilities that can be extrapolated country wide. The Ministry of Environment has made efforts to regulate the management of contaminated soils, within the framework of the Law on Environmental Liabilities. The participation of the community through the exercise of rights (guardianship, popular actions and others), has generated mandates from the courts and the council of state that motivate the generation of norms associated with contaminated soils by Colombian institutions.	Carry out studies and proposals for guidelines at the national level for the application of autonomous corporations. Develop the necessary legal framework to implement these guidelines with the legal force of mandate (environmental instrumentalization, environmental control requirements, impositions of a punitive nature, etc.) Develop permanent working groups so that ALL regions actively participate in the development, review and configuration of the guide that allows all national problems to be addressed. (Review participation of private sectors)	Congress of the Republic, Ministry of Environment, Ministry of Health Regional and National Environmental Authorities Trade associations and NGOs

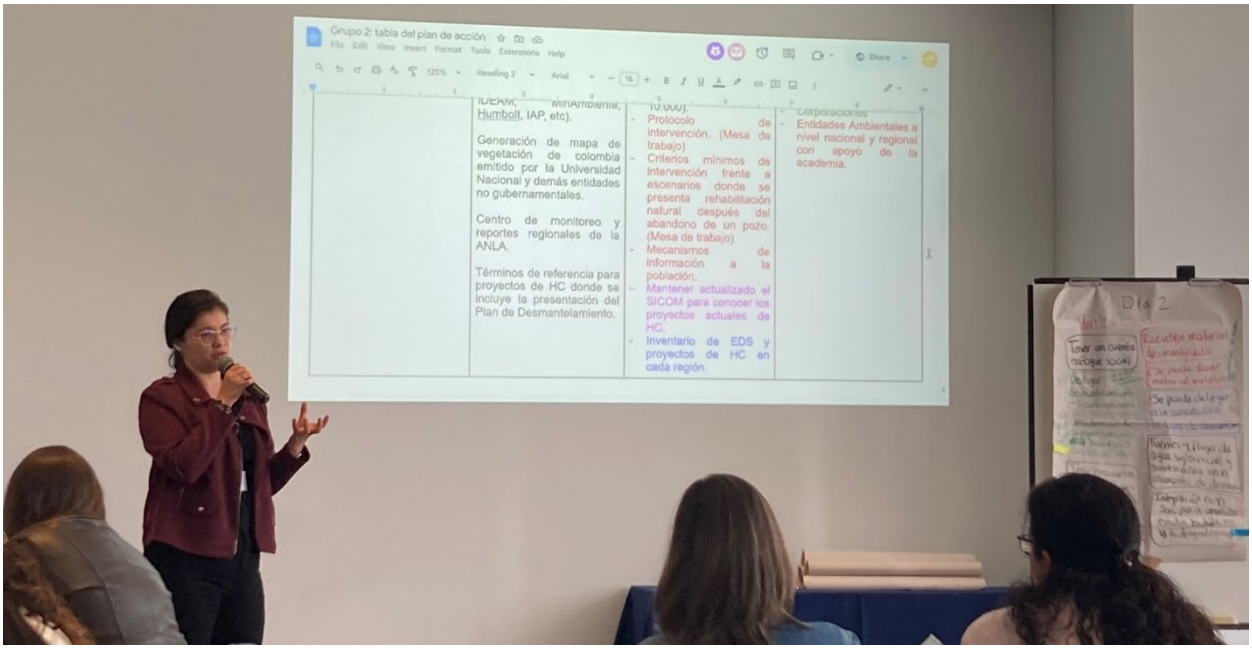
Group members:

- Diana Carolina Triana Ardila - Corporación Autónoma Regional de Santander
- Héctor Diego Felipe Corredor Forero - District Secretariat of the Environment

Group 2

Challenge/priority	Current efforts to address this challenge	What to do in the short term (1-3 years)	Entity responsible for making this happen
Dismantling of hydrocarbon projects in complex scenarios (e.g. swamps).	Greater recognition of the territory through cartographic information that identifies sensitive ecosystems in the country (IGAC, IDEAM, MinAmbiente, Humbolt, IAP, etc.) Generation of a vegetation map of Colombia issued by the National University and other non-governmental entities.	Intervention protocol. (Working group) Minimum criteria for intervention in scenarios where natural rehabilitation occurs after the abandonment of a well. (Working group) Mechanisms for informing the population.	Environmental entities at the national and regional level with the support of academia.

	ANLA Regional Monitoring and Reporting Center. Terms of reference for hydrocarbon projects including the presentation of the Decommissioning Plan. The Ministry of Mines is carrying out an exercise to identify orphan wells at the national level.	Keep SICOM updated to know the current HC projects.	Ministry of Mines
		Inventory of ESD and HC projects in each region. Inventory of orphan wells.	Corporaciones and support from the ANH, ANLA and community.
		Identify projects within sensitive ecosystems Identification of orphaned wells in sensitive ecosystems.	Corporaciónes



Group members:

- Sandra Cortes Sánchez - MinAmbiente
- Luisa Fernanda Ramírez - National Environmental Licensing Authority
- Catalina Bustamante - National Environmental Licensing Authority
- Ernesto Romero Tobón - MinAmbiente
- Paola Caicedo - District Secretariat of the Environment

Group 3

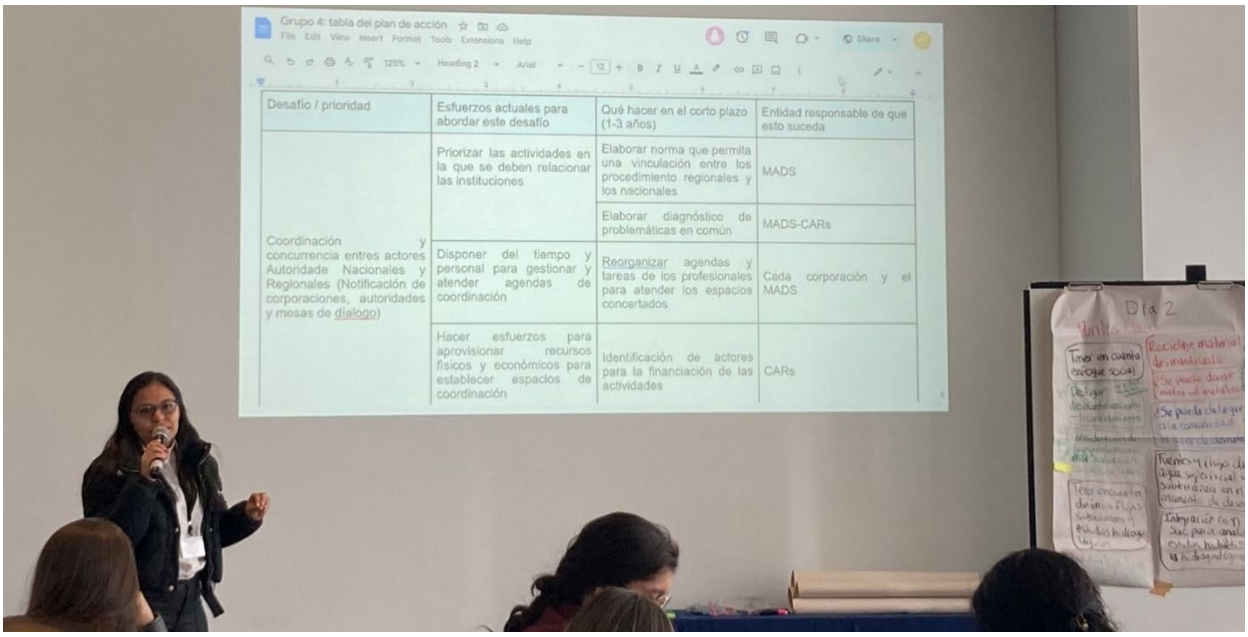
Challenge/priority	Current efforts to address this challenge	What to do in the short term (1-3 years)	Entity responsible for making this happen
Integrate the regulatory framework for the entire national territory. (Standardization)	Review by MADS of the gaps in the standards where spaces have been created with the CARs. Work in technical tables by topics. Form a base team for document traceability. Articulate cooperation with other ministries such as MinMinas.	Organize workshops Formulate and/or adopt terms for CARs that have not yet adopted them. Socialize terms of the CARs that have already advanced the task.	MinAmbiente
Define the competencies and scope of the actors (entities, authorities)	Approach between entities needed to identify problems.	Issue the regulation with the definition of the obligations per actor. Working group to bring together all the actors. Promote articulation.	MinAmbiente MinTrabajo

Group members:

- Jorge Jiménez Duran
- Viviana Marcela
- Javier Reyes Camacho
- Karen Lopez
- Amanda Herrera
- Sofía Rojas

Group 4

Challenge/priority	Current efforts to address this challenge	What to do in the short term (1-3 years)	Entity responsible for making this happen
Coordination and concurrence between National and Regional Authority actors (Notification of corporations, authorities and dialogue tables).	Prioritize the activities in which the institutions must relate.	Develop standards that allow a link between regional and national procedures.	MADS
		Develop a diagnosis of common problems.	MADS / CARs
	Have the time and staff to manage and attend to coordination agendas.	Reorganize agendas and tasks of professionals to attend to the agreed spaces.	Each corporation and the MADS
	Make efforts to provide physical and economic resources to establish coordination spaces.	Identification of actors for the financing of activities.	CARs



Group members:

- Viviana Tafur (CorpOrinoquia)
- Paula Rozzi (CorTolima)
- Lilian Silva (ACP)
- Oscar Calvo (ANH)
- Andrea López (CorpOrinoquia)

Full list of potential action items described throughout the workshop

Enhanced communication and regulatory alignment are needed between ANH, MinAmbiente, and ANLA for reporting pollution incidents from hydrocarbons, particularly those caused by third-party activities and illegal actions.
Regulations around oil pipeline dismantling in Colombia require improvement.
Financing is essential for the decommissioning of orphan wells, ghost wells, and aging infrastructure lacking proper closures, which constitute environmental liabilities. This effort should begin with a comprehensive national well inventory. Additionally, funding is lacking for monitoring intentional third-party actions impacting oil pipelines.
Service Stations (EDS) are not governed by environmental licenses, making closure processes unclear and reliant on monitoring by local environmental authorities. The work of Bogotá's District Environment Secretariat (SDA) sets a strong example in environmental guidance and monitoring for these facilities. However, there are legal gaps regarding land use post-dismantling, which should be addressed through district or even national planning. For instance, incomplete well closures have been discovered during land use transitions, with contaminated soils surfacing. Current territorial planning plans are insufficient to handle these cases.
Environmental regulations are inadequately applied to managing hazardous waste from the dismantling of hydrocarbon facilities, posing risks to local soil and water.
DIMAR and INVEMAR should be involved in eventual decommissioning in maritime settings.
Protocols are necessary for dismantling hydrocarbon infrastructure in sensitive ecosystems, such as swamps.
Decisions around pipeline dismantling, such as leaving them in situ or reusing materials, need careful consideration. In Colombia, most pipelines are above ground, which facilitates dismantling but shortens project lifespan due to exposure, especially in high-risk areas prone to illegal activities. Furthermore, there is no standard manual for dismantling refineries.
Colombia has few certified laboratories (IDEAM-certified) to measure parameters essential for monitoring water and soil contamination by hydrocarbons. Many certified labs do not cover enough parameters for thorough monitoring, posing challenges for environmental authorities. Oil leaks are dynamic and require long-term monitoring, as they impact soil differently depending on the hydrocarbon type and prior land conditions, leading to cumulative effects. These leaks can be difficult to detect and may emerge long after project closure and property transfer, underscoring the need for hydrogeological studies.
Operators should evaluate the potential need for remodeling, relocation, or disassembly before decommissioning, which requires a detailed plan and assessment.

Hydrocarbon transportation must be subject to regulation, control, monitoring, and management planning.
Storage regulations for hydrocarbons should be reassessed; for example, storage facilities for industries like palm oil are unregulated, as are many others.
MinAmbiente’s proposal to shift terminology to "environmental closure" requires reconsideration, as long-term impacts may emerge after the operator has relinquished the land.
Avoiding the term “abandonment” in Colombian legislation is advisable, as dismantling should prioritize best practices, material reuse, soil rehabilitation, recovery, and restoration.
The inclusion of climate change, human rights, and cultural considerations in the current TOR for all licensed projects is a positive step, and ANLA has developed TOR specifically for decommissioning plans.
It was suggested to establish notifications from corporaciónes' environmental departments to ANLA and set up dialogue forums among environmental actors involved in decommissioning, recognizing that each corporación has unique regional insights.
The importance of Decree 1347 of 2021 by MinTrabajo was underscored, which includes the Major Accident Prevention Program (PPAM) and a list of hazardous substances linked to major accidents, along with threshold quantities.
Resolution 40198 of 2021 by the Ministry of Mines and Energy was highlighted, containing technical regulations applicable to EDS, supply plants, large consumer facilities with fixed installations, storage tanks for end-users, and additional specifications.

Annex VI: Results of the training evaluation from participants

Participants were asked to rate the degree the primary learning objectives were met generally during the training. This helps the UNEP team know which aspects of the training were taught well and which aspects have room for improvement. Results were close across the board for this question, with most objectives receiving a 5 for “Completely met”. Objective number 6 was the lowest met category, though not to a significant degree. See Figure 1 below for full distribution of responses.

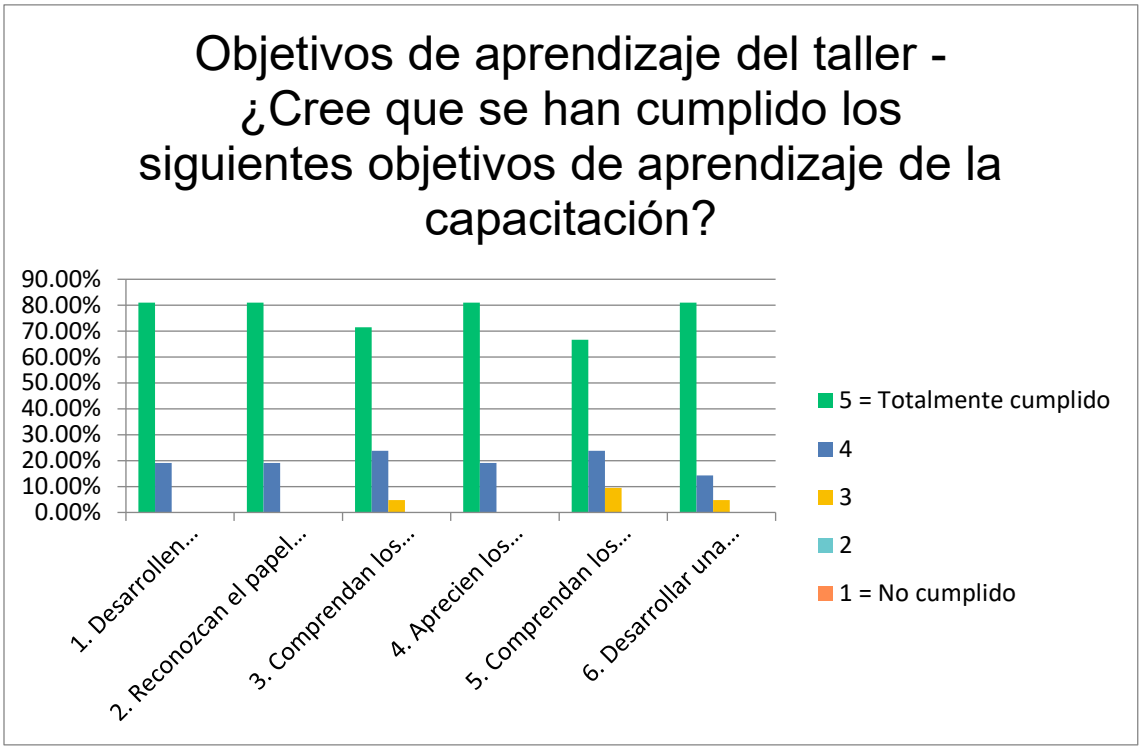


Figure 1: Degree that main learning objectives were met during the workshop

Full text of the learning objective labels:

1. Develop basic knowledge of the oil and gas value chain and the associated infrastructure/facilities existing in Colombia, focused on the continental environment ("onshore" or terrestrial).
2. Recognize the role of decommissioning in the oil and gas value chain in Colombia, including the timelines for planning and implementing decommissioning activities.
3. Understand the general risks, as well as the costs, technological challenges and opportunities related to continental decommissioning.
4. Appreciate the environmental problems and concerns associated with the decommissioning of oil and gas facilities in Colombia.
5. Understand Colombia's environmental legal and regulatory frameworks that apply to the decommissioning of oil and gas infrastructure, and the institutions associated with

permitting and monitoring, including institutional and corporate roles and responsibilities, financing and restrictions.

6. Develop an understanding through theoretical and practical exercises of the work involved in the preparation of the main elements and tasks required for a Decommissioning and Abandonment Plan according to Colombian standards.

Similar to the previous question, participants were asked to rate the degree that their learning objectives were met per session during the training. Results were again similar across the board, with modules often rated with a 5 for “Completely met”. Module 5 received slightly lower ratings compared to the other modules; however, overall satisfaction across all modules was generally high. See Figure 2 below for full distribution of responses.

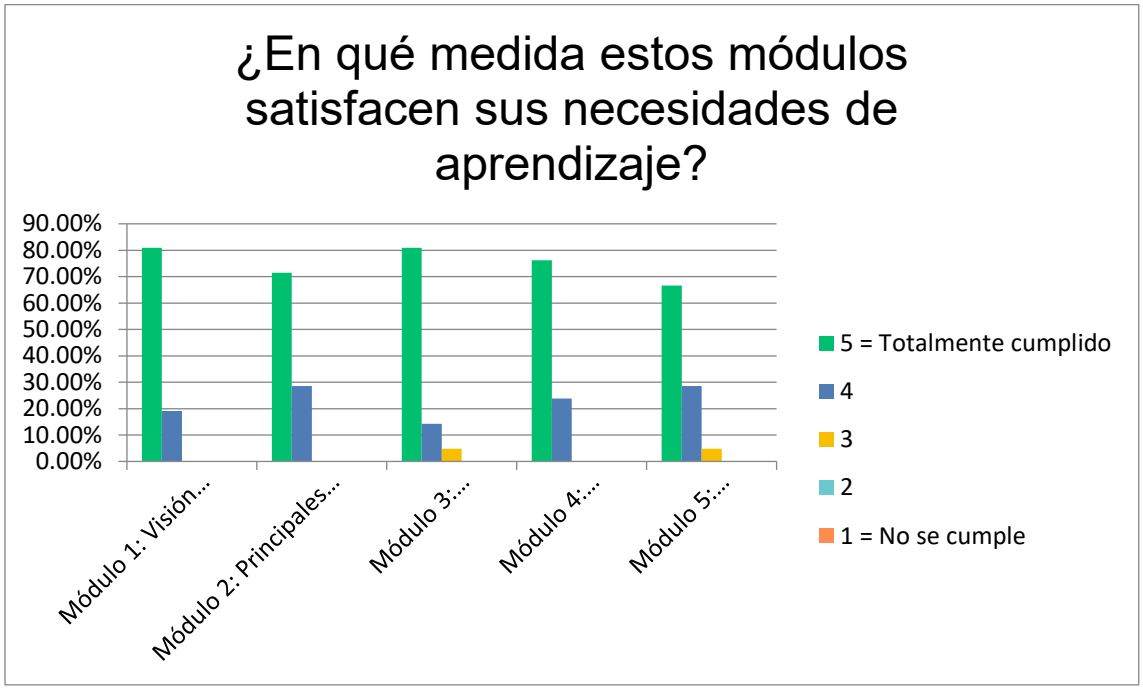


Figure 2: Degree that learning objectives per module were met

Full text of course module labels:

- Module 1: Overview of the decommissioning process and continental oil and gas infrastructure in Colombia
- Module 2: Main stages, challenges and obligations of decommissioning
- Module 3: Continental/terrestrial decommissioning
- Module 4: Environmental and social considerations
- Module 5: Assessments, site cleanup, restoration and reporting

Participants were asked to rate the degree their knowledge of the topics changed as a result of the training. Seventy-one percent indicated they gained significant new knowledge on the topics and 29% indicated they gained some new knowledge on the topics. No one indicated that they

did not learn anything new from the workshop. See Figure 3 below for full distribution of responses.

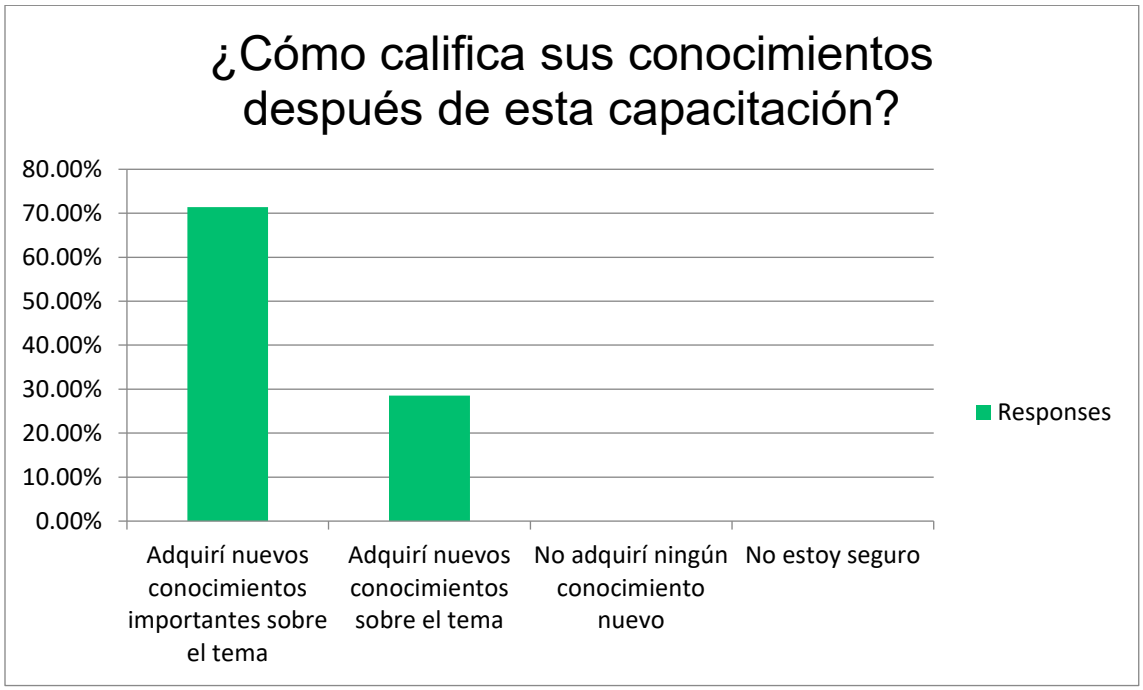


Figure 3: Degree of participants' change in knowledge resulting from the workshop

Participants were asked to rate the overall quality of the training. Seventy-one percent indicated that the training was excellent, while 24% indicated that it was highly satisfactory. Five percent indicated that it was satisfactory. No one graded it as poor or requiring improvement. See Figure 4 below for full distribution of responses.

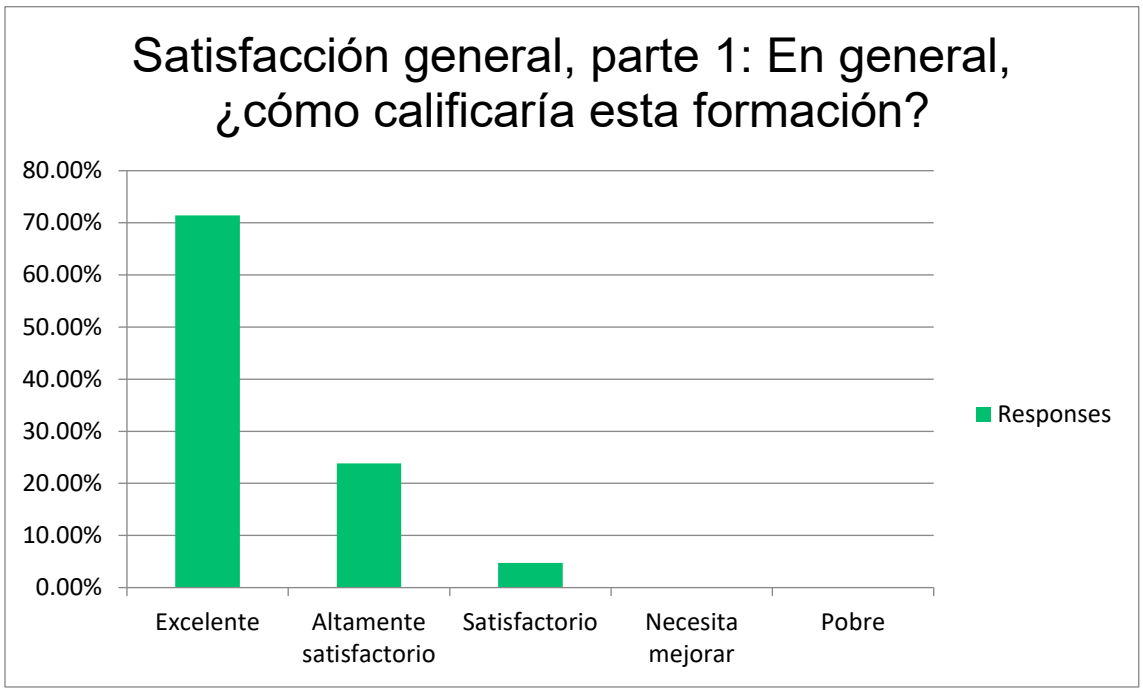


Figure 4: Overall quality rating of the workshop

Participants were asked to indicate ways they can apply the knowledge they received from the training. The top response at 52% was “Sharing workshop materials with other colleagues”. The lowest ranked responses, both at 33%, were “Organize a workshop to share knowledge and training materials with relevant staff” and “Other: please write in”. The standout write-in responses include collaborating with colleagues from other entities to update relevant regulations and procedures for the hydrocarbon sector; replicating the successful decommissioning activities shown by the operators; and create ways to maintain connections with workshop participants to allow for continued sharing of experiences and knowledge. See Figure 5 below for full distribution of responses.

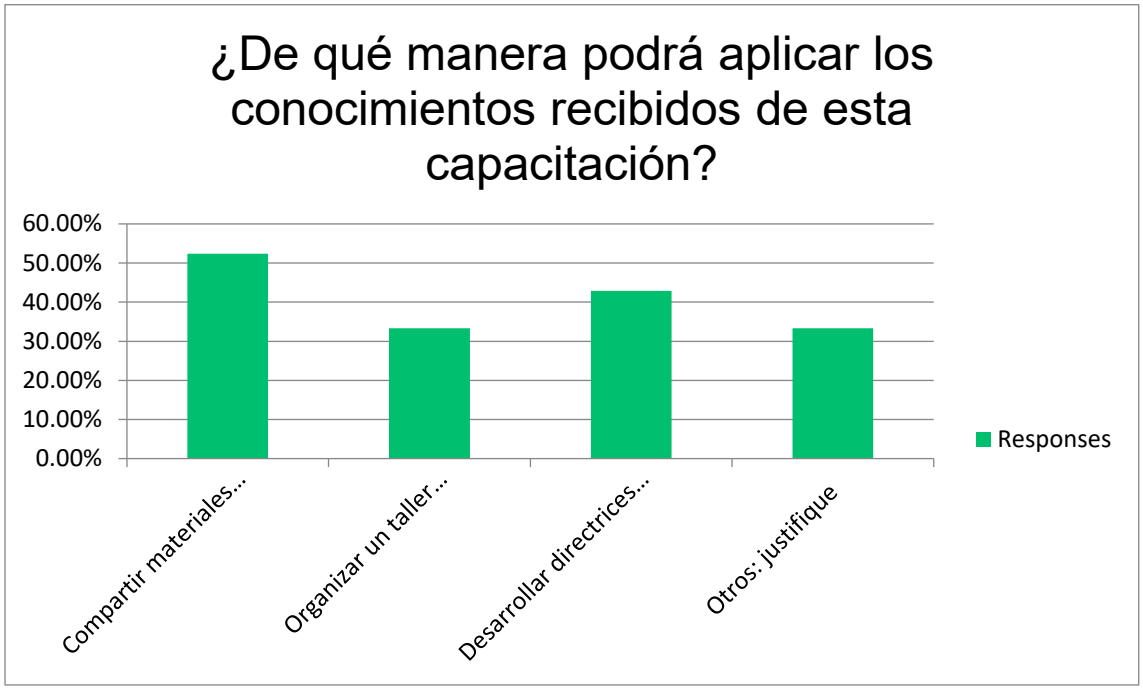


Figure 5: Ways that participants can apply knowledge gained from the workshop

Full text on how to apply resultant knowledge labels:

- Share training materials with other colleagues
- Organize a workshop to share knowledge and training materials with locally relevant staff who were unable to attend this training
- Develop guidelines on the decommissioning of oil infrastructure specific to your region/department

Annex VII: Question and answer summary

Participants were welcomed to ask questions of the training team and guest presenters throughout the workshop. See table below for the list of questions and answers under their corresponding presentation sections.

Day 1		
Session #	**Question**	**Answer / comment / discussion topic**
Module 1: Overview of the decommissioning process and onshore oil and gas infrastructure in Colombia (UNEP - Matthew Richmond)	Regarding the decommissioning of the offshore Brent Spar fuel storage facility, was the site monitored afterwards?	The structure was removed completely and eventually dismantled onshore, with no monitoring of the original site (as far as is known).
	What is the main objective of decommissioning? Do operators prioritize protecting the profits of their company or prioritize environmental management?	In certain cases, leaving infrastructure can be the better option, but only when it is deemed safe for both the surrounding environment and local communities. Regardless of the decision, protocols—such as infrastructure cleaning—must be followed. In offshore settings, additional considerations come into play, such as the intended future use of the nearby ocean area (e.g., for fishing) and the costs associated with decommissioning. The availability of a suitable disposal site for equipment also influences the decision. Module 2 addresses this question in more detail about whether infrastructure should be left in place or fully decommissioned.
	Are there specific treatment measures that have to be followed when decommissioning infrastructure in international waters?	Yes, international agreements, such as those established by the International Maritime Organization (IMO), provide guidelines on these matters. The IMO also has specialized teams of experts who can offer guidance and advice on this.

	When the final disposal of the oil storage tank was made (shown in one of the videos), was it because it reached the end of its life?	The tank itself wasn't particularly old, but it could no longer be utilized. With no alternative use, it was left in place by the exploration company.
	In Colombia, current operations require environmental licenses that include decommissioning plans referred to as "Decommissioning and Abandonment" plans. However, some prefer to avoid the term "abandonment" in Colombia; a more suitable term might be "environmental closure."	Terminology is important. In North America, the terms "decommissioning" and "closure" are also both used. The shift in terminology to "environmental closure," as suggested by MinAmbiente, requires reconsideration, particularly as certain impacts in the hydrocarbon sector emerge long after initial operations. This raises questions around accountability, specifically, who takes responsibility for managing these impacts if the original company is no longer present, given that environmental closure typically occurs at the end of the operating license.
	Some petrol stations in Colombia still operate without environmental licenses, highlighting the need for consistent decommissioning requirements across the entire value chain. In contrast, oil wells must have a license, which should include a decommissioning plan. An environmental guide produced by MinAmbiente on this process would be useful.	There is an older law on decommissioning for Colombia, but it should be expanded.
	-	Controversy has arisen around one of Ecopetrol's wells, Lisama 158, which was properly plugged and abandoned, yet later experienced a contamination flow issue that initially went

		undetected by the operator. Regulatory authorities subsequently identified deficiencies in the decommissioning process, noting similar issues with nearby wells. Such problems with plugged and abandoned wells are a recurring challenge in Colombia.
Guest presentation 1: Contingencies for impacted sites linked to third party actors in Colombia (MinAmbiente - Jesús Sepulveda and Ernesto Romero)	Regarding these third-party contingencies, does the characterization of the resources need to come from the environment authorities?	No, but there is a strategy at the federal level. Resources are finite, and how to prioritize them is yet unknown.
	What if the operator did not (or will not be able to) show responsibility to clean up a contaminated site? Should responsibility then be on the current landowner?	MinAmbiente would like to enable mechanisms that create a fund to pay for this sort of situation. People buy land in goodwill, without knowledge of such problems. If there is no fund to pay for this, it will be the responsibility of the current landowner. The country will need to review what the responsibilities are for specific situations, and then justify them.
	Regarding territories with impacts related to pipelines, is there a strategy to undertake prior consultations?	Yes, there is a need to coordinate this with local impacted communities.
	For third party impacts like illegal refineries, should the judicial authority draft the report?	The responsibility for the drafting of these reports is outlined in the national contingency plan.
	MADS has a protocol on preliminary assessment on impacts. There are other liabilities being assessed. EcoPetrol, often	Those issues should be covered in the government-led risk assessment. Private assessments should be based on the situation on the ground.

	the owner of pipes, often states that damage comes from a third party.	
	The government may need to build capacity on preliminary impact assessments.	Colombia's laws mandate this, but there is a clear lack of operation by the government, despite local communities demanding this. The Ministry should consider how to provide a better response.
	EcoPetrol contracts out another company to remediate contaminated areas, but this remediation is just on the surface. Underground contamination exists, which is hazardous, and new owners find hydrocarbons when they start using the land. EcoPetrol says that these problems happened decades ago. The national government should consider these experiences from the governments of the local departments and should audit EcoPetrol when these remediation efforts happen.	MinAmbiente and ANLA should investigate these issues, and there is actually a unit at MinAmbiente that already does this. ANLA does not visit the departments frequently enough to effectively detect these problems, so will need to better coordinate with local authorities on this. ANH needs to contribute and follow up on this, as it is mandated to uphold safety and environment standards.
Module 2: Decommissioning obligations, challenges, and main stages (UNEP - Matthew Richmond)	What is the government's overall role in decommissioning?	Prepare and update regulations and review environmental sustainability.
	What is the decommissioning plan?	The dismantling plan is associated with the Environmental Impact Study (EIA) for licensed projects. Environmental licenses have an abandonment and dismantling plan.

	What are the financing sources for decommissioning?	The ANH requires a trust fund within the contract to cover dismantling costs. Financial guarantees are established in the contracts, translating into a specific monetary amount. While contracts include financial guarantees and policies, these policies do not cover activities related to third-party losses.
Module 3: Onshore / terrestrial decommissioning (UNEP - Matthew Richmond)	Purpose of a well seal?	Wells must be plugged to prevent passage between the structure and possible source of contamination.
	Dismantle or leave in place?	Removal of the structure is not always necessary, and some material can be recycled. The risk must be eliminated before sealing on both sides.
Guest presentation 2: Decommissioning terrestrial exploratory wells in Colombia (EcoPetrol - Julian Gonzalez)	Are there tests done to assess the effectiveness of each well plug? What type of material is used to plug the wells?	Yes, there is a multidisciplinary group of experts that review the results of preliminary tests, which include laboratory analysis. Tests are done by weight with a pressure test. Reports are then submitted to ANH. The material is just cement with additives, providing greater consistency and allowing it to keep its strength longer.
	How is the test that corroborates the well seal performed?	Hermetic rubber plugs. In Santander, with a non-conventional method, bags of concrete are placed, and monitoring and follow-up is carried out to verify that there are no leaks.
	How is surveillance done over time for casing?	Through pipe quality and material records at the time of the study.
	Could the walls of a well plug become thinner over time? Could it last 50 years?	Pipe material can be measured to understand the integrity of the wall. Transversal plugs have a ceiling rock that prevents water migration. Plugs go down 100 feet minimum, and another couple hundred feet of cement. The thickness of piping is verified, and more cement is poured in if needed.

	After a well has been sealed, how long does monitoring last? What type of monitoring is conducted?	Abandoned wells are often in oil fields that are still active. Company workers regularly undertake monitoring, typically monthly, and ANH does additional monitoring every several months. Monitoring is done to detect methane leaks.
	How long has EcoPetrol been doing plug and abandonment?	EcoPetrol has done this for every well that it has utilized. In 2022, the regulations became stricter, requiring transversal plugs. Plugs do fail 1-2 percent of the time.
	In the well intervention guide, does it say how to conduct plug and abandonment in environmentally complex areas? Are there best practices for this?	EcoPetrol does not have guidelines on this particular scenario, but the company does follow a process. A permit is required for such activities within forested areas and must be coordinated closely with MADS.
	Some wells had been abandoned under the 2010 regulations. What regulations do abandoned wells currently follow?	Abandoned wells are fine if they are not impacting the environment, but if environmental problems do happen, then the current regulations and techniques need to be applied to fix the problem.
	There is a case in Nariño that came to our institution regarding a monitoring and control shack for the pipeline. No will was signed for this shack, which is abandoned and creates potential harm for the current owner. What could be done in this case?	Normally shacks are assigned to control points. It has to do with land use, because infrastructure is covered during this period. The term used is “occupants”, which are not necessarily owners of the infrastructure. Sometimes the land belongs to the government and not particularly to the occupants.
	Is the cost of RCDs covered by the operator?	This depends on what is said in the agreement. Could be the operator or a third party. EcoPetrol works with the local mayors’ offices, as they are more responsible than individual landowners.

Day 2		
Module 4: Environmental and social considerations of decommissioning (UNEP - Matthew Richmond)	What should be done with materials resulting from decommissioning?	The hazardous waste that can be generated must be accounted for and companies authorized for this management must be available. Dismantling may require other areas to sort materials or manage them before handing them over to third parties.
Guest presentation 3: Dismantling, abandonment, and restoration of petroleum infrastructure (CorpOrinoquia - Andrea Lopez)	Is the infrastructure shown in the case studies being used currently?	No, none of them are in use.
	There are clear regulations in Colombia related to disaster risk. The cases shown in your presentation have not yet been seen/reviewed by ANH. Every oil field must have these plans in place.	Risk management was considered in the diagnosis. Flood risk, landslides, and fires were considered.
	Are there resources for sampling verification? Are these the only resources available? Can you propose a prevention principle?	Monitoring was done through CorpOrinoquia's own resources. It was a thorough study conducted, which is a significant part of CorpOrinoquia's work. A pollution analysis was done in all the pools not contained in concrete to identify areas that need urgent intervention. Quantitative analysis is also done to understand chemical and biological risks.
	What has your experience been like working with ANLA? ANLA can benefit from this info, and it would help them take action. ANLA only visits oil fields	Yes, ANLA attempts to do joint work, and they are friendly to work with. ANLA helps address the shortcomings of the operators and also of the corporación regulators as well. CorpOrinoquia intends to produce technically accurate info to carry out joint work between the actors and the goal is to

	periodically. Have you shared your work with ANLA?	collaborate carefully and respectfully with the industry. We as the regulators can make legal decisions, but not technical decisions.
Guest presentation 4: Impacts of hydrocarbon leakage in soil and groundwater (UNAL - Leonardo Donado)	Demonstration with physical model	An example of how contaminants can move over time in the subsoil was presented, showing how in many years, due to the movement of groundwater and its flows, contaminants can be found in areas that are distant from an oil spill site. With isotopic hydrology studies, sources of origin of these contaminants can be determined.
Guest presentation 5: Dismantling and abandonment of the Tardigrade and Cachalote platforms (GeoPark - Ximena Rodgriguez)	How far in advance should the abandonment plan be submitted?	Regulations are not fully clear on timing, for example if you should wait for ANLA to approve. GeoPark has been waiting for 3 months for the authorities to review the submitted plan. There was a statement made by ANLA, which they requested to assess the entire abandonment plan. GeoPark recommends that the legal team close the file after agreeing that all operations have been terminated. No subsequent monitoring afterwards was required on site, but there was running water nearby, which was monitored.
	How long did it take to decommission the project area?	10 years
	During the 10-year decommissioning timeframe, in what manner did the environmental authority intervene?	ANLA conducted their visit and followed up annually. Visits included talking to the property owners and mayor's office to understand any complaints. In 2018, ANLA asked about the plans for the project. GeoPark did not receive a requirement by ANLA to do further actions.
Module 5: Assessment, restoration, site clean-up,	Are there international guidelines on monitoring after decommissioning?	Not aware of international guidelines, but there are operator and national guidelines for this.

and reporting (UNEP - Matthew Richmond)	-	Restoration can begin before site cleanup. Remediation takes longer than restoration. Annual monitoring is required.
Guest presentation 6: Decommissioning projects in Bogotá (SDA - Diego Corredor)	Does the SDA send soil and water samples to national or international labs?	Yes, to labs in the US or EU.
	How should disposal or treatment of contaminated soil be carried out?	Anything hazardous has a corresponding handling sheet to be followed. Companies remove the contaminants and sell them to be used for crops. Must ensure they are following the environmental licenses.
		ANLA is a newer agency and is taking on some of the projects that were previously done by MADS. ANLA does not always have knowledge of what happens in the corporaciones all of the time, and the corporaciones may not be following protocols throughout the year.
	How is contaminated soil treated?	In situ soil treatment by ECP. A request is made to the PDC and as RESPEL manager.
	-	Embassies own the land, but not the soil underneath. The US embassy for example has a gas station. SDA needs to know what is under the soil, because it belongs to Bogotá city.
	-	Smaller assets, like microgenerators, cannot be followed up on because they are too small to be legally covered by the Basel Convention.
Preparing for the site visit (UNEP - Matthew Richmond)	Can metal infrastructure be donated?	Yes, but it must be free of hazardous waste. Once it is cleaned by the oil company it can be sold as normal material (non-hazardous).

	Should decommissioning tax be delegated to communities?	No
	-	Assessments should create an obligation to decommission infrastructure. Need to create an instrument that is mindful of underground water flows.
	-	Bogotá is a district without large rivers, which is different from many other parts of the country that have to consider issues with rivers. Bogotá's SDA experience is limited and focused on the Bogotá setting.
	-	Every corporación has their own considerations, and laws must be adapted to each corporación. This workshop is a good time for feedback to be given to MADS, as they are now reviewing a proposed decommissioning regulation. Each corporación should also have their own Terms of Reference. For example, oil storage should be managed by local environmental authorities.