2022

SUMMARY OF ACTION PLAN FOR REDUCING PERSISTENT ORGANIC POLLUTANTS IN GUJARAT

INDIA-NORWAY COOPERATION PROJECT ON CAPACITY BUILDING FOR REDUCING PLASTIC AND CHEMICAL POLLUTION IN INDIA (INOPOL)

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Acknowledgements

The POPs Action Plan for Gujarat is a joint effort by the **Norwegian Institute for Water Research (NIVA)**, Norway's leading institute for fundamental and applied research on marine and freshwaters; **Mu Gamma Consultants Pvt Ltd (MGC)**, a research and consultancy organization working towards environmentally-friendly solutions in promoting green development across India; **SRM Institute of Science & Technology (SRMIST)**, a private deemed university at the forefront of research and innovation in environmental sciences and other areas; **Toxics Link (TL)**, an NGO dedicated to bringing toxic-related information into the public domain with unique expertise in the areas of hazardous, medical and municipal wastes. The research for the POPs Action Plan for Gujarat was carried out under the scope of the India-Norway cooperation project on capacity building for reducing plastic and chemical pollution in India (INOPOL), under the Marine Pollution Initiative developed by the two governments, and funded through NORAD's Norwegian Development Program to Combat Marine Litter and Microplastics. The INOPOL group would like to thank the project owner, the Royal Norwegian Embassy in New Delhi, and the Norwegian Ministry of Foreign Affairs (MFA), for funding and supporting the project.

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Disclaimer

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SUMMARY

The INOPOL project

The India-Norway cooperation project on capacity building for reducing plastic and chemical pollution in India (INOPOL) is a collaboration project between Indian and Norwegian institutions with the objective to build knowledge and capacity to reduce plastic and chemical pollution from major sources within industry, public sector, and civil society in India. The INOPOL project is led by the Norwegian Institute for Water Research (NIVA), in close collaboration with Mu Gamma Consultants Pvt. Ltd. (MGC), Central Institute of Petrochemicals Engineering and Technology (CIPET), The Energy and Resources Institute (TERI), SRM Institute of Science and Technology (SRMIST) and Toxics Link(TL). The project aims to address the highly interlinked challenges of marine litter, microplastics and Persistent Organic Pollutants (POPs), with the overarching goals of enhancing capacity to reduce marine litter and microplastic pollution in Gujarat State, and building capacity to reduce releases of plastic wastes and POPs in India by supporting the implementation of the Stockholm Convention (SC). The POPs Action Plan for Gujarat focuses on INOPOL's work in the latter domain.

POPs Policy and the Stockholm Convention

India ratified the SC in 2006 and submitted a National Implementation Plan (NIP) in 2011 to act on the twelve listed POPs. Thereafter, twenty-one (21) new POPs were listed. The same year, the Supreme Court of India passed an ad-interim order to ban with immediate effect the manufacture, sale and use of endosulfan throughout the country. In 2018, the MoEFCC promulgated additional regulations on seven (7) new POPs and subsequently ratified these in 2020. Affirmative actions have been initiated by the government at various levels to deal with some of the POPs, although there is potential for improving policy coherence. Further, India actively participates in various international treaties and conventions related to pollution control.

India has a wide set of environmental laws and policies (National Implementation Plan, newly enacted legislation on the control of seven new POPs (2018), Draft Chemicals (Management and Safety) Rules, 20xx and the development of a set of National Environmental Standards). However, existing policy frameworks remain fragmented, necessitating greater harmonization and cohesion.

To enhance the POPs management capacity and to align with the increasing global efforts on environmental monitoring of chemical contamination, India needs to improve efforts to establish nationwide monitoring of POPs in the human population and standardize sampling and analytical protocols.

In India, research studies have reported and established the environmental occurrences, source identification, fate, and behavior of POPs in different environmental matrices. Research has indicated the potential for exposure of organisms, as relatively high levels of POPs have been detected in drinking water, food products, and human breast milk. Though there is limited research to document the direct impact of POPs on human health, multiple studies have established that the ecosystem in India is contaminated by these chemicals.

National Implementation Plan (NIP) for POPs

The Ministry of Environment, Forest and Climate Change (MoEFCC) developed the first National Implementation Plan (NIP) to manage the 12 initial POPs. Most central

government agencies who are executing the NIP are the Central Pollution Control Board (CPCB), Central Power Research Institute, National Environmental Engineering Research Institute (NEERI, Nagpur) and National Institute for Interdisciplinary Science and Technology (NIST), Trivandrum. The CSIR-NEERI is the regional centre for the Stockholm Convention in the Asian region. The CPCB is constituted to function at the national level for the control of water and air pollution, and provide technical advice to the MoEFCC on the various aspects of environmental pollution including POPs. Furthermore, along with the CPCB, the State Pollution Control Boards are entrusted with the responsibility of monitoring the emission levels and enforcement of the regulations on POPs at various levels.

The NIP of India was expected to be updated within 2022, to accommodate the implementation under national law. India could either develop a *new* NIP for these seven POPs or *expand* and *update* the original NIP to also include the seven new POPs. Since 2011, when India's NIP was first published, various guidance documents have been revised and published by the Stockholm Convention. In addition, specific documents directly linked to the seven new proposed POPs to be included in India's NIP are provided. During the revision of the last updated NIP, it was recommended to evaluate the efficiency of the previously adopted action plans, strategies, and measures. It is common to focus on the reassessment of priorities due to new POPs. This involves updating and reconsidering earlier action plans and developing separate new action plans for newly listed POPs, as appropriate. The expected timeline of NIP-II is 2025. The levels of detail in the NIP should be in accordance with the needs, priorities, and resources available. The process of updating a NIP can broadly be categorised into five phases:

1. Establishment of a coordinating mechanism and organization process
2. Establishment of POPs inventories and assessment of national infrastructure and capacity
3. Priority assessment and objective setting
4. Formulation of the revised NIP
5. Endorsement and submission of the revised NIP

While developing this Action Plan, a selection of the **listed alternatives** to POPs (in SC guidance documents) was reviewed, with the status under the EU Chemical regulation. Several of those listed'POPs are are currently regulated regulated and controlled under the EU law, due to their hazardous nature. The findings highlight one significant drawback of the opt-in ratification approach chosen by India, as many of the supporting guidances developed under the convention are outdated and not relevant when needed. That said, it was out of the scope of this report to assess the safety and potential hazards of each of the alternatives listed under the SC. Hence, India needs to adopt a more careful approach, applying state-of-the-art science to critically evaluate the alternatives listed in the SC documents (of which some are outdated), to ensure that new harmful chemicals are not put into circulation.

POPs montoring and inventorization in Gujarat

INOPOL was conducted in Gujarat state in two catchment areas of the Tapi river, with the city of Surat as an urban industrial centre, and the Daman Ganga catchment, which has the city of Vapi as its industrial hub (Figure 1). The sampling sites were determined based on the catchment area covering upstream, midstream, and downstream of the two riverine systems. In addition, hotspots along urban and suburban transects include industrial discharges, open dumpsites, and wetlands. A control site was selected >20 km away from the hotspot region. Passive air sampling in the plastic manufacturing belts at Vapi in Gujarat was included. Secondary research has revealed that a few industries in Gujarat have been identified as producing new POPs and/or using them to produce secondary chemicals and Acid Mine Drainage (AMD) products, most of which are industrial chemicals. Industries have been mapped in Gujarat that produces POPs such as hexabromobiphenyl, hexachlorobutadiene, and decabromodiphenyl ether.

As part of INOPOL, in selected catchments of Gujarat, 27 polybrominated diphenyl ethers (PBDE) congeners and three hexabromocyclododecane (HBCD) isomers were analyzed in water and surface sediment samples in major locations upstream, midstream, and downstream of both Tapi and Daman Ganga rivers. In the industrial and residential soils in Vapi and Surat, concentrations of PBDEs were found in industrial activity-oriented soil (Daman Ganga) and residential soil (Tapi). Also, bovine milk samples revealed a considerable amount of PBDEs. The results showed that buffalo milk contained average levels of PBDEs comparable to cow milk samples collected from Vapi. As in bovine milk, PBDE contamination in biota showed the dominance of heavier BDE congeners. Air sampling results revealed higher

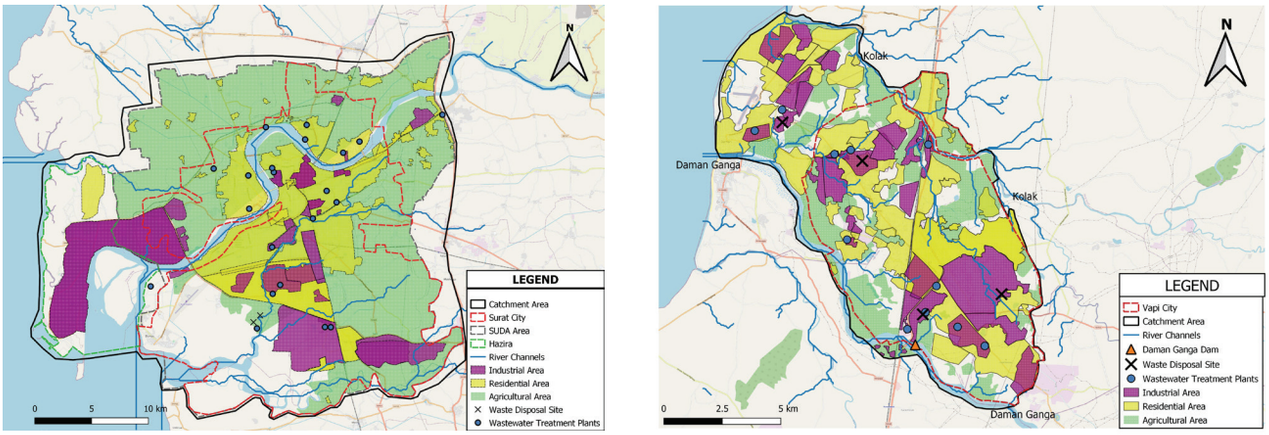

Figure 1: Land use map and catchment of (A). Surat & (B). Vapi (Map developed on QGIS 3.18)

levels of PBDEs in Surat. The potential factors could include higher building density as well as combustion-oriented processes (open burning of plastics and higher vehicular emissions) compared to Vapi. Figure 2 shows the results of POPs monitoring conducted in different environmental matrices under the project.

A hydrological catchment model was set up for the Tapi and Daman Ganga River catchment systems, composed of PERSiST model (Precipitation, Evapotranspiration and Runoff Simulator for Solute Transport) and INCA-Tox model (Integrated Catchment Model), which presented some key findings and future recommendations.

Sampling and monitoring guidelines were established and followed in terms of identification of sampling sites, sample collection technique, extraction and cleanup process (in air, soil and sediment, surface water, and bovine milk), and instrumental quantitation techniques. Sampling and analyzes of POPs in the different environmental compartments during the INOPOL project have provided significant information for the establishment of a POPs monitoring program for Gujarat. Information gathered has provided insight into levels of POPs in air, water, soil, sediments, bovine milk, and biota. Levels of POPs have been identified that may pose a threat to human health and the environment. Since sampling was only conducted at limited sites, seasonal variations are missing. This research gives a snapshot of Gujarat's POPs situation. A further strengthening of the capacity for field sampling, laboratory analyses, supporting parameters for POPs, and a holistic interpretation of the gathered environmental data is needed.

Adding to the scale and impact of plastic pollution, significant concern has been raised in recent years about how plastics interact or relate to POPs. Elevated levels of specific compounds were detected at open burning sites. The report discusses the potential important interlinkages between POPs and plastics from different waste streams in India and provides recommendations such as promoting POPs disposal techniques that will destroy them irreversibly to eliminate their presence in the environment and avoid giving rise to toxic byproducts (Figure 3). Further, the report emphasizes the importance of eliminating the use of POPs and other hazardous chemicals in plastic production and products, thereby avoiding the recycling of such substances in plastic waste, facilitating new market opportunities and a circular economy with safe feedstocks of recycled material.

About this report

The POPs Action Plan discusses the releases and emissions of POPs related to anthropogenic activities **(source categories)** and categorizes them as intentional and unintentional use and release of chemicals. The intentional chemicals are actively added through industrial processes, agricultural applications, and consumer products, whereas POPs are produced as by-products in industrial processes or combustion processes, or waste and leachate thereof, are referred to as 'unintentional' releases. It has been identified that the seven newly banned POPs in India (in 2020) are **used for various purposes** including as fungicides and pesticides to control specific pests in agriculture; solvents, greasing agents and in abatement

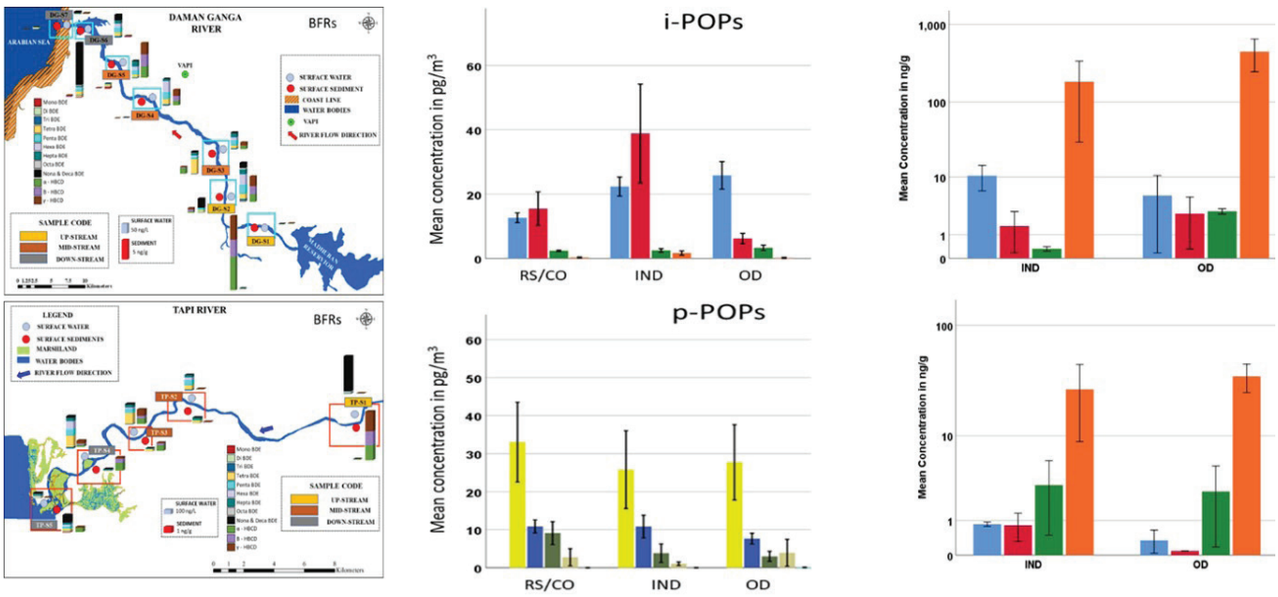

Figure 2: Results of POPs monitoring in different environmental matrices

technology in industrial processes; and in plastic materials and products. All these chemicals can also be found unused or leftover in stockpiles and/or specific waste fractions, potentially leaching into the local environment.

Outline

The proposed actions in this report are directly linked to the goals and strategies of the Basel Convention, Rotterdam Convention and Stockholm (BRS) Convention and will contribute towards achieving the UN Sustainable Development Goals (SDGs) related to chemicals and wastes, including 2.1, 3.9, 6.3, 11.6, 12.4, 12.5, 14.1 and 16.1.

The aims, objectives, and context of INOPOL are outlined in **Chapter 1** of this POPs Action Plan. **Chapter 2** details the approach and methodology of the study. It also specifies the study locations, catchment areas, and sampling sites as well as the socio-economic context, policy environment/ management capacity, and the industrial and potential sources of POPs in these locations. **Chapter 3** presents an overview of the situation analysis (baseline) indicating the history of POPs in the Indian environment, human exposure to POPs, source categories, common uses, and alternatives. This chapter also covers the global and national legislative framework as well as the status of existing regulations for POPs management in India. **Chapter 4** presents an outline of POPs concentrations in selected catchments of Gujarat, and establishes sampling and monitoring guidelines as well as recommends a POPs monitoring program for Gujarat. **Chapter 5** emphasizes modelling and management considerations for the catchment areas, identification of hotspots, and the crucial aspects related to the interlinkages between POPs and plastics. **Chapter 6** presents the Action Plan for POPs for Gujarat and lays out the goals, objectives, key actions (for handling POPs in Gujarat), and implementation plan, defines the roles and responsibilities of stakeholders, and lists the main performance indicators for the POPs Action Plan. **Chapter 7** presents the key challenges and opportunities including pollution issues, trade issues, science and research, education and outreach, and leveraging financial and human resources. It also touches upon the challenges related to compliance, accountability and commitment to POPs management as well as its integration with regional/ global activities and efforts.

About the Action Plan

The **POPs action plan** report is developed to identify key actions to reduce the use and release of legacy and new POPs. This will minimize the exposure to human health and environment in Gujarat. The aim of the POPs Action Plan is also to support and help strengthen regulations, cooperation, and awareness among stakeholders in the management of POPs in Gujarat.

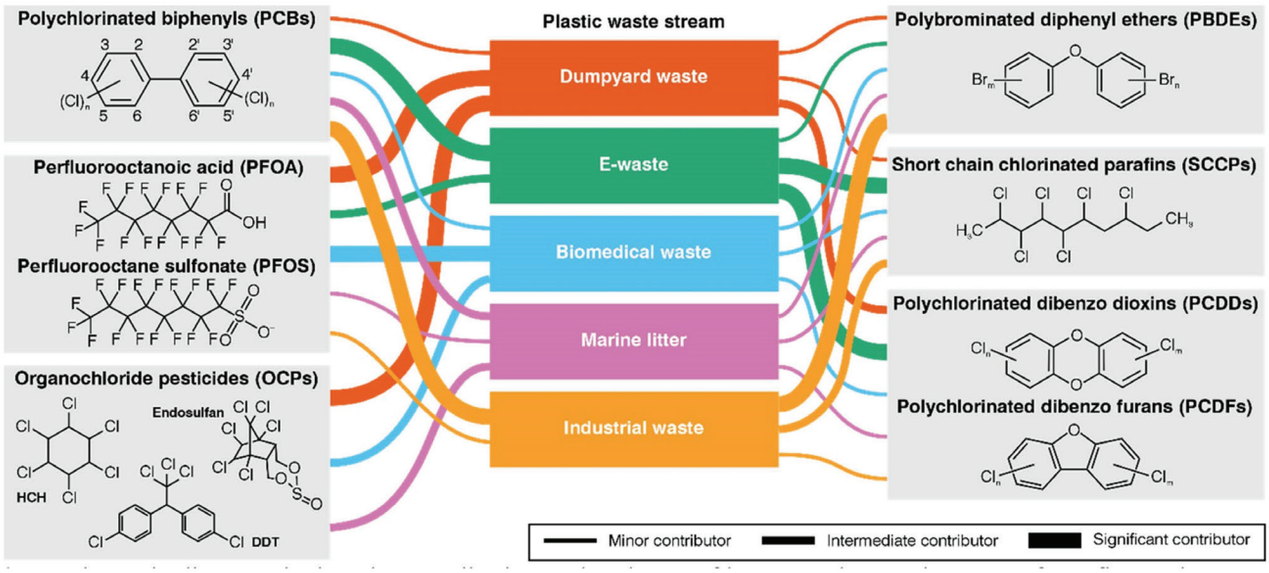

Figure 3: Linkage between POPs and plastic waste (Chakraborty et al., 2022)

The **key action areas** for handling POPs in Gujarat are:

a) Strengthen regulation, management and control of unintentional releases of POPs and contaminated land/sites as well as institutional capacity building through enhancing chemical analyses capacity/ labs/ equipment/skills,

b) Manage the production and use of chemicals listed in Annex A (Elimination) unless there are specific exemptions; Annex B (Restriction); and Annex C (Unintentional Production) of the Stockholm Convention

c) Identify and manage POPs stockpiles, articles in use and wastes (Annexes A, B and C),

d) Identify and manage POPs contaminated sites,

e) Knowledge management,

f) Reporting of credible data,

g) Monitoring and Evaluation,

h) Research and Development,

i) Technical and Financial assistance and,

j) Coordination and Sustainability of efforts in this regard

Management tools for POPs

Key Performance Indicators (KPIs) for the management of POPs pollution can potentially play an instrumental role in measuring the impacts of the different action areas proposed in the plan. Despite the difficulty of estimating potential risks, replacing these POPs should not cause any additional harm, such as mutagenicity, carcinogenicity, or effects on the developmental, endocrine, immune, or nervous systems. The POPs Action Plan for Gujarat lists 23 KPIs under 7 categories and could be a useful tool for the Government of India's ongoing initiative of updating the NIP (with GEF support), is given in Figure 4.

The key challenges and opportunities identified in the POPs Action Plan are as follows:

- *Pollution issues:* Concentrations of certain POPs (like PBDEs) were found in water, soil, surface sediments, bovine milk, biota, and air samples. Elevated concentrations of specific compounds were found in industrial areas and sites associated with open burning.
- *Trade issues:* The Draft Chemicals (Management and Safety) Rules (CMSR) recommended the development of an inventory registration scheme for chemicals and outlined plans for the adoption of the Globally Harmonized System (GHS) of Classification and Labelling of Chemicals (GHS). India has not officially adopted GHS for chemicals yet that needs to be done for environmental and health protection during the handling, transport, and use of chemicals.
- *Science and research:* The Stockholm Convention supports the transition to safer alternatives. KPIs are quantifiable metrics that reflect actions in relation to achieving goals. They have clearly defined targets and benchmarks that help measure and capture the impact.

Figure 4: Key performance indicators under POPs Action Plan

Further scientific research on the fate and long-range atmospheric transport of POPs is essential.

- *Education and outreach:* The key components of the education and outreach program for the POPs Action Plan must include generation of public awareness, institutional capacity building, and network development amongst governmental institutions, the public, and private sector, and other relevant stakeholders.
- *Leveraging resources:* There is a specific need for prioritization of POPs management by enhancing human and financial resources to control the growing environmental and health challenges associated with POPs. To bring attention to the negative impacts of POPs on environmental and human health, a structured awareness generation program is desperately needed for policy makers, research community, and other stakeholders. Bi and Multilateral financial support systems should be solicited, to enhance reduction efforts in India.
- *Control, compliance and accountability:* The implementation of the POPs Action Plan needs to address several aspects including compliance with food safety and quality standards, creating public awareness on the impacts of POPs pollution (point and non-point sources) on human health and environment, enabling a regulatory and pricing environment that would provide incentives for compliance and managing the transition (to improved technologies/practices). The implementation should be followed up with a robust compliance regime, including inspection, control, enforcement and sanctionary measures.
- *Integration with Regional/Global activities:* INOPOL addresses the highly interlinked challenges of POPs in India and facilitates cross learning across the spectrum. There are great opportunities and potential synergies through regional cooperation on POPs management in South Asia. The bulk of actions will undeniably have to happen at the national and sub-national scales, but regional and bilateral cooperation offers novel opportunities for progress.

ABOUT US

Norwegian Institute for Water Research (NIVA), https://www.niva.no/en, is Norway's leading institute for fundamental and applied research on marine and freshwaters. Their research comprises a wide array of environmental, climatic, and resource-related fields. NIVA's world-class expertise is multidisciplinary, and combines research, monitoring, evaluation, problem-solving and advisory services at international, national, and local levels.

Mu Gamma, https://www.mugammaconsultants.com/, works towards environmental-friendly solutions in promoting green development across India. Mu Gamma's work entails research, advocacy, consultancy, and capacity building on waste management (hazardous chemicals, POPs, plastics, marine litter, emerging contaminants), water resources management in rural and urban areas (water & sanitation, chemical pollution control), public health and environment, climate change, corporate social responsibility, sustainable governance, and education for sustainable development.

SRM Institute of Science and Technology (SRM), https://www.srmist.edu.in/, is a private deemed university at the forefront of breakthrough research and innovation in environmental sciences and other areas. It is one of the top-ranking universities in India offering undergraduate, postgraduate, and doctoral programs in six major faculties. SRM Research Institute hosts the 'Environmental Science and Technology Laboratory' that specializes in research on the fate, transport, and remediation of organic contaminants, apart from addressing other issues of environmental concern.

Toxics Link (TL), http://toxicslink.org/, is an environmental NGO that brings toxics-related information into the public domain with unique expertise in the areas of municipal, hazardous, and medical waste management, food safety, international waste trade, and managing emerging issues of pesticides and POPs. Working in networks, utilising community outreach and education, policy analysis, research, training, and program development, TL functions at the state and central levels to help create solutions. This is driven by the needs of people at the grassroots level.

NOTES

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