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The Region
of South Bohemia

RERA

LINDANET ACTION PLAN FOR THE SOUTH BOHEMIAN REGION

RERA - REGIONAL DEVELOPMENT AGENCY OF SOUTH BOHEMIA

2021

This Regional Action Plan was developed within the LINDANET project under the INTERREG EUROPE programme. The LINDANET project is co-financed by the European Union (ERDF) and South Bohemian Region. More about the project on *interregeurope.eu/lindanet* and *rera.cz/lindanet*.

1. PART I - GENERAL INFORMATION

Project: LINDANET - European Network of Lindane waste affected regions working together towards a greener environment

Partner organization: 3-PP - RERA a.s. (Regional Development Agency of South Bohemia)

Country: Czech Republic

NUTS2 region: CZ03 - Southwest

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2. PART II - POLICY CONTEXT

The Action Plan aims to impact: Other regional development policy instrument

Policy instrument addressed: Plán odpadového hospodářství Jihočeského kraje (Strategy on Waste Management of South Bohemian Region)

Context and lesson learnt from the project implementation:

The policy instrument addressed is a key regional strategy on waste management. The current strategy is designed for the period 2016 - 2025. Besides many other topics, it also deals with persistent organic pollutants (POPs) which include HCH substances, including Lindane.

The following actions describe how the policy instrument will be improved. Both actions will improve the Policy instrument via the same specific type of change in accordance with the Interreg Europe programme's manual - type #3: Change in the strategic focus of the policy instrument, so called structural change. Changes will be incorporated in the regional waste management strategy 2016-2025 through the annual monitoring and evaluating process, that is being done by a private company ISES, Ltd. contracted by the regional authority for this purpose. RERA is already in contact with the company, so the process of incorporation will be smooth.

The strategy has defined objectives, which should be reached during the implementation period. Objective no. 37 focuses on "Raising awareness about POPs and their effects on human health and the environment." From the annual monitoring of implementation, it is visible that this objective is not being fulfilled. Thus, the first action of the Action plan focuses on raising awareness about the issue addressed among the concerned professionals. To have at least a basic knowledge about the issue is an important necessity for the staff of the environmental departments of the regional offices. Even though there are no active sites at the moment, the former usage of Lindane in the area presents a potential risk, since new contaminated sites are discovered almost every year. The Exchange of experience during the project implementation showed how critical it is to have an experienced staff, which can for example create committees for communication to public or other authorities (as

partners from Aragon or Galicia presented during Interregional Thematic Workshop no. 1) or coordinate the remediation works (as a partner from Saxony-Anhalt presented during Interregional Thematic Workshop no. 2).

Even though the first action addresses one of the strategy's objectives that is not being fulfilled so far and thus is improving the concerned ecosystem, a direct improvement of the policy is also needed. At this moment, the strategy doesn't contain any elaborated information on how to deal with the contamination in case there is a site discovered. To improve the policy, a methodology will be created and it will consist of two parts. The first part will include the good practice examples identified during the project implementation including valuable information gained through the Interregional Thematic Workshops no. 1 to no. 3. The second part will consist of remediation methods and procedures how to tackle the problem.

To conclude, at the end of the implementation of phase 2, the professional capacity of the staff concerned should be increased and the policy instrument addressed should be improved due to created methodology.

3. PART III - DETAILS OF THE ACTIONS ENVISAGED

3.1. ACTION 1 - INCREASING CAPACITY AND PROFESSIONAL KNOWLEDGE OF INVOLVED STAFF

3.1.1. THE BACKGROUND

Many chemicals used historically as tools to improve the protection of crops, human health before insects or for technical help have shown to be rather a burden and harm to human health and living organisms in general. They have been banned and their use stopped some time ago but we can still find them as contaminants in our environment as well as food and/or in our bodies. They were introduced to help and save us money but to clean the environment from their contamination can cost a lot of it would be possible at all. Also, medical care caused by illnesses related to contamination with these chemicals can reach paramount.

Lindane, a pesticide produced and used historically in European countries including the Czech Republic in substantial amounts belongs to chemicals which last in the environment for a long time and cause above mentioned problems. It is not a sole substance of these properties, and most of the sites contaminated with lindane show also high levels of other POPs, in particular pesticides such as DDT, hexachlorobenzene and others (Holoubek 2003, Bajer, Sákra et al. 2007, Dvorská, Petrlík et al. 2007).
There was 584 100 kg (l) of obsolete pesticides in the country in 1991. This included only officially declared obsolete pesticides by commercial legal entities and by communities in the Czech Republic. The actual amounts were larger because there were found hidden obsolete pesticides storages and/or sites, where pesticides were buried. All these pesticides were incinerated in Bavaria and the Czech Republic in hazardous waste incinerators (Beránek and Petrlík 2005, Holoubek, Adamec et al. 2006).

Although HCHs and lindane as one of HCH isomers levels in the environment of the Czech Republic seem to be low last decade there are some indications that at certain places contaminated with lindane and/or HCH isomers in general we can meet increased or high levels of these contaminants. Their high levels were measured in free-range chicken eggs from Lhenice (South Bohemia) where obsolete POPs were stored (Mach, Petrlík et al. 2016).

The situation in the Czech Republic seems to be comparable with other countries like e.g., England where increased levels of DDT, HCH, and lindane, in particular, were observed near Wheathampstead, a site with former production of OCPs (Jurgens, Crosse et al. 2016). "Production sites of POPs were/are a source of pollution for the surrounding" (Vijgen, Abhilash et al. 2011, Oliaei, Kriens et al. 2013, Weber, Bell et al. 2019)

3.1.2. THE ACTION

As demonstrated in the background description, lindane and other HCH compounds still present a considerable risk to the environment and the population. Despite low overall concentration, there might be hidden hotspots nowhere recorded so far. The large dumpsites have been detected and they are properly monitored but there may be undetected sites within brownfields or abandoned farms. It can be a result of local usage, leading to the contamination of the site, soil, water and/or constructions, or a result of improper storage before its relocation somewhere else. Because of lindane widespread usage in the country, the question of discovery of such a site is just a matter of time. And the regional authorities should possess knowledge of how to handle such harmful substances, their effects on human health and the environment. And, of course, how to deal with the burden.

Based on the experience and expertise gained within the Lindanet project, the action focuses on the education of regional authorities' staff of environmental departments to properly evaluate the severity of discovered contamination and proposition of appropriate measures to eliminate the threat.

The creation of the action was inspired by the good practices identified by the Lead partner from Aragon, Spain and also by the group discussions with the consortia during the 1st Interregional Thematic Workshop organized by the Lead partner in Zaragoza, Spain in November 2019.

The good practices "Committees for the monitoring of the lindane waste management" and "Publication of daily water analytics of the river Gallego in www.stoplindano.es" showed how important the proper education of critical staff is when dealing with contaminated sites. Even though that the situation in South Bohemia is not the same, since there is no active site at the moment, a great lesson can be learnt from these situations. Partners from Spain (Aragon and Galicia), from Italy and from Germany presented (also as a GP "Strategic Environmental Action Plan against lindane waste contamination in Aragon") a clear vision and plan of management, division of roles and responsibilities for all stakeholders involved. The first step would be to educate relevant responsible stakeholders and prepare them for a situation were they will have to engage in such a site.

The proposed action consists of a series of workshops for environmental departments' staff to be ready for future HCH contaminated sites discoveries and methods to monitor, handle and eliminate the contamination.

The workshop series will be divided into three main topics:

- Topic #1: potential sources of contamination and their monitoring
- Topic #2: how to properly evaluate potential findings and how to communicate the topic to the expert and general public
- Topic #3: propositions of appropriate measures to eliminate the contamination

Each topic will be presented by an experienced coach, specific to each topic. Their expertise will range from environment protection or chemistry to public relations. The audience is expected to recruit from environmental departments of regional administrations, specifically of the South Bohemian region and Pilsen region. Both regions include well-known contaminated sites identified in the past and there is a high chance that another site could be discovered.

The action is divided into several steps:

STEP 1 – Establishment of a working group for the conception of the educational programme and the contents of it

The programme working group (WG) will consist of representatives of the Regional Development Agency of South Bohemia (RERA), Regional Authority of South Bohemia (JČK), South Bohemian Chamber of Commerce (JHK), South Bohemian Chamber of Agriculture (RAK), Arnika (NGO focusing on environment protection, decontamination and disposal of hazardous substances). Other relevant entities might join the WG to bring in additional expertise.

A qualified professional with deep knowledge of the creation of educational programmes will be a member of the working group as well.

The WG will meet on regular basis (at least 5 times) and will create a curriculum for the course. The themes of the course are planned as follows: potential sources of contamination, fast response to findings, public relations when communicating the findings, a proposition of appropriate measures or sources of funding for remediation. The themes are the first proposal and the content, of course, depends on the outputs of the working group.

STEP 2 – Pilot course to validate the concept and eventually improve it

Selected representatives of the South Bohemian regional authority will be included in the pilot course and will verify its viability while we collect their feedback and recommendations for improvements. The final course shape and contents will be based on the feedback gained from this activity. The course is planned to take 4 hours.

STEP 3 – Realization of the educational programme

The educational programme will consist of at least two cycles, each time with a different audience. The first cycle will be performed in South Bohemia while the second one in the Pilsen region. The coursed will target the staff of environmental departments but any other interested staff is welcome. We expect to promote the courses among agricultural and entrepreneurship-support departments because the appearance of HCH is closely linked to agricultural enterprises and agricultural brownfields.

STEP 4 – Validation of the gained knowledge

The attendees of the course will have to verify their newly-gained knowledge in a validation procedure where they will show that, based on the course, they are prepared to manage any HCH contamination that would potentially appear in their regions. The validation process will be refined within the working groups, as well as the final evaluation of the responses.

STEP 5 – Evaluation

After the courses and validation processes are over, the evaluation of the whole venture will be performed. It will combine the results from the validation process and survey among the attendees.

Also, the lecturers will bring in feedback from the courses. The evaluation will be summarized in a final report.

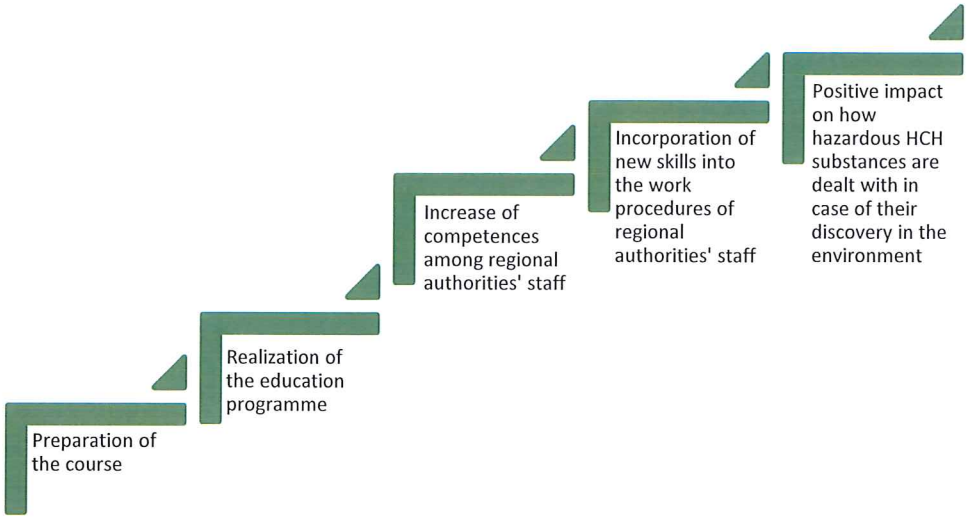
Monitoring indicators

Indicator	Monitoring	Target
Creation of the course	Number of course curriculums	1
Realization of the course	Number of courses	2
Realization of the course (2 iterations)	Number of attendees	20

Risk assessment

Low interest among potential participants	Medium	The course will be communicated with the directors of the environmental departments and heavily promoted within the regional authorities. Preliminary checks have been performed and it seems that there is serious interest among the staff to get new information on the topic of HCH
Unsuitable lecturer	Low	The lecturer(s) will be hired after consultation within the working group. Direct experience with the HCH problematics and presentation skills will be sought.
Unsuitable contents of the course	Low	The contents will be consulted within the working group and with the lecturer(s). The course contents will be aligned with the work specifications of the staff and should directly focus on activities the staff performs on daily basis.
Poor validation results	Medium	The courses will be designed to maximize the information value for the attendants. All materials will be available also separately and the attendants will be able to check them whenever they need, not only during the course itself.

Intervention logic



3.1.3. PLAYERS INVOLVED

- RERA - Regional Development Agency of South Bohemia
- Regional Authority of South Bohemia
- Regional Authority of Pilsen Region
- ARNIKA - environmental NGO

3.1.4. TIMEFRAME

• establishment of the working group	February 2022 - April 2022
• pilot testing	April 2022
• realization of the courses	May 2022 - November 2022
• validation & valuation	December 2022

3.1.5. COSTS

- staff costs for working group activities and the preparation of curricula - 2 employees, 60 hours - approx. 1800,00 EUR
- expert fee (lecturer) - 1 expert, 2 days + preparation - 16 hours - approx. 1000,00 EUR
- premises rental & catering - approx. 800,00 EUR

3.1.6. FUNDING SOURCES

- RERA
- Regional Authority of South Bohemia

3.2. ACTION 2 - TREATMENT AND REMEDIATION METHODOLOGY FOR POPs CONTAMINATION

3.2.1. THE BACKGROUND

The Lindanet project has introduced a lot of good practice examples that deals with monitoring and disposal of HCH compounds. Some of the disposal methods are well-known for decades while others emerged only recently. The new methods aim at being more environment friendly, less bulky, more energy-efficient or otherwise more favourable than traditional ones. However, some of the methods have a relatively narrow "operational envelope", which means that they require very specific conditions to work as intended. Thus, the usage of each method is heavily dependent on the characteristics of the contaminated matter, its volume, spatial distributions and dozens of other aspects.

The Lindanet partners have experienced a wide range of conditions under which HCH compounds were found. Partner regions include different climate conditions, soil characteristics or water flows. Moreover, also non-technical aspects come into play, e.g. availability of funding, politics or site ownership. Good practices from all over Europe have been presented and several of them served as inspiration for actions in South Bohemia.

Bitterfeld, Germany

The examples presented from Bitterfeld, Germany have demonstrated the importance of being ready for any sudden discovery of contamination. The contamination may propagate quite fast, given the right conditions, and fast response from environmental actors play a key role in suppressing widespread contamination. The selection of the most suitable method seems crucial, since some methods, despite being less expensive or easier to perform, doesn't necessarily fit the specific circumstances. The examples from the Mulde river flood plain have clearly shown that, even after heavy investments and long-term effort, there remain hotspots that need to be treated differently due to specific in-situ conditions, using new methods of decontamination.

Jaworzno, Poland

The situation in Jaworzno, Poland has shown that the extent of contamination can reach far beyond the primary area, eventually, it can reach areas hundreds of kilometres away from the original contamination source. Especially water contamination can propagate along the river flows and, through tributaries, can reach places that never experienced production or usage of HCH but it gets discovered in river sediments, in plants along the rivers, and in soils. Proper monitoring and decontamination methods should be adopted to minimize such side effects. The example of Jaworzno also shows that, apart from technical readiness, political and financial support is no less important.

3.2.2. THE ACTION

The action envisages the adaptation of the regional waste management plan according to the findings made in the Lindanet project. The research performed within the frame of the project has shown that there are multiple methods of how to dispose of HCH compounds, all of which with different levels of complexity, financial demands and end products. In the current state, the waste management plan doesn't directly present methods of HCH disposal. But the Lindanet implementation

has demonstrated that not all methods are suitable and traditional methods, i. e. burning in an incinerator, isn't the best practice and it produces harmful end products. There is a whole range of more environmentally friendly methods. These methods usually bring in additional requirements for inputs but, on the other hand, they produce only a fraction of harmful substances or none at all.

These innovative methods should be introduced to the regional policy instrument to offer multiple choices for those who decide which method is to be used when a new contaminated site is found. The action will produce an annex, in a form of a methodology, to the waste management plan. This methodology would provide details on disposal methods, their pros and cons, conditions of use and requirements for the inputs. All these factors differ greatly and some of them have narrow use-case but produce no side products while others are widely available, relatively cheap but with some drawbacks. All these parameters will be included in the document, with typical use cases. The methodology will include, among others, GPCR (gas-phase chemical reduction), SCWO (supercritical and subcritical water oxidation), alkali metal reduction, BCD (Base-catalysed decomposition), CHD (catalytic hydrodechlorination), ITDU (Indirect Thermal Desorption unit), CDC (Catalytic dechlorination using copper catalysis) or mechanochemical methods – ball milling (mechanochemical dehalogenation).

These methods don't offer the perfect solution that would suit all scenarios. There is a lot of aspects that should be taken into account – conversion capacity, waste form, water content, organic carbon content, the capacity of the installation, local applicability, reliability and maintenance requirements, the volume of the by-products and its disposal or re-use, risks the technology presents (high pressures or temperatures, chemical pre-requisites, noise pollution, micropollutant emissions...). The methodology would provide responsible persons with a tool, a guide which of the disposal methods is the most suitable for the given case.

Monitoring indicators

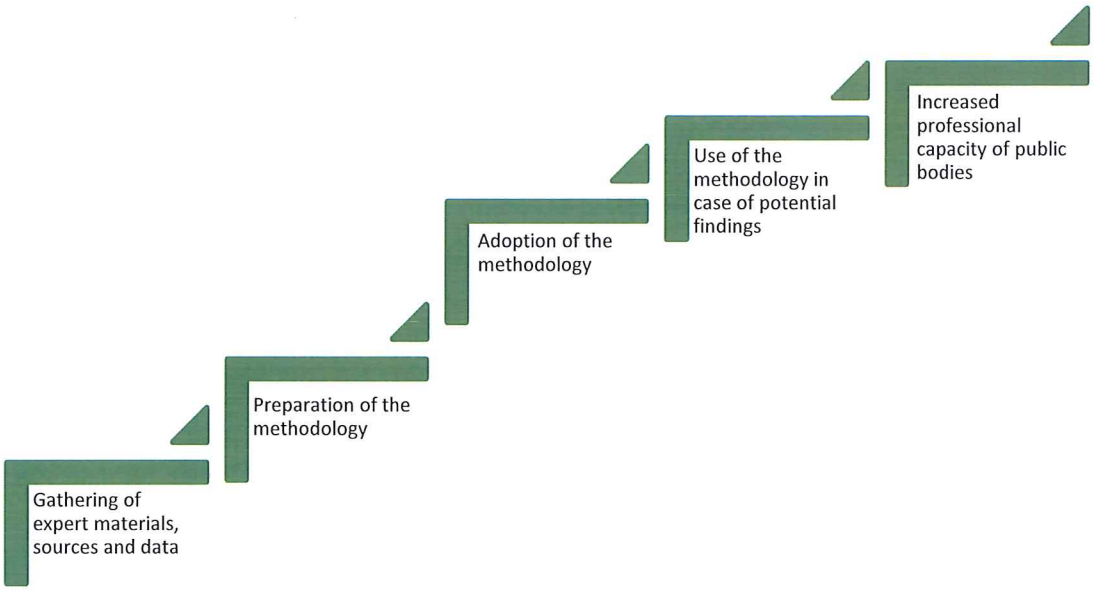
Indicator	Monitoring	Target
Creation of the methodology	Number of methodologies	1
Adoption of the methodology	Number of public institutions to adopt the methodology	1

Risk assessment

Lack of expert materials, sources and data	Low	The methodology will be created in collaboration with nationwide expert institutions with rich experience and knowledge base.
Lack of professional warrantor of the methodology	Low	RERA will contract an expert in the field, there are several potential candidates for the warrantor position.
Delay in preparation of the methodology	Low	The timeframe of the preparation is designed to include enough buffer time in

		case of delay in preparation (e. g. due to covid)
Poor adoption by public institutions	Low	The methodology will be created in cooperation with the regional authority to allow a smooth adoption process.

Intervention logic



3.2.3. PLAYERS INVOLVED

- RERA a.s. - it will prepare the methodology and ensure its adoption by the policy instrument
- ISES s.r.o. - it will evaluate the current policy instrument and propose adjustments for its update. The update will include the methodology
- Regional Authority of South Bohemia - it will implement the policy instrument and use the methodology within its structures
- Arnika - environmental NGO, deeply involved in HCH decontamination remediation. It will contribute to the technical part of the methodology and provide expert counselling of the methodology
- Technical University of Liberec - it will provide expert advisory on proposed methods and, according to the latest knowledge, can propose an additional method of decontamination into the methodology

3.2.4. TIMEFRAME

- preparation of the methodology — February 2022 - April 2022
- expert validation — April 2022
- distribution to regional authorities and inclusion into the updated version of Waste Management Strategy — May 2022 - November 2022

3.2.5. COSTS

- staff costs for creation of the methodology - approx. 50 hours - 1.500,00 EUR
- expert fees to ensure a good level of quality - approx. 15 hours - 1.000,00 EUR

3.2.6. FUNDING SOURCES

- RERA
- Regional Authority of South Bohemia

4. REGIONAL ACTION PLAN ENDORSEMENT

This Regional Action Plan will be implemented and monitored by RERA a.s. - the Regional Development Agency of South Bohemia, Project Partner no. 3 of the LINDANET project.

I hereby confirm, that I have the required authority in my organization to sign this endorsement of the Regional Action Plan and that the organization I represent will implement the listed activities as described.

Date and Place: 24th January 2022, České Budějovice, Czech Republic

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Position: CEO & Chairman of the Board

Organization: RERA a.s. - Regional Development Agency of South Bohemia