CHAPTER 8 EXPERIENCES, ACHIVEMENTS AND LESSONS OF THE PILOT PROJECT

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8.1 General

One of the main purposes of the study is to formulate Master Plan (M/P), which includes details, policies and procedures of the soil contamination management related to mining, considering the whole area of Macedonia for the future. Starting from setting middle to long term targets, it is intended to formulate a more practical and viable M/P including short term targets.

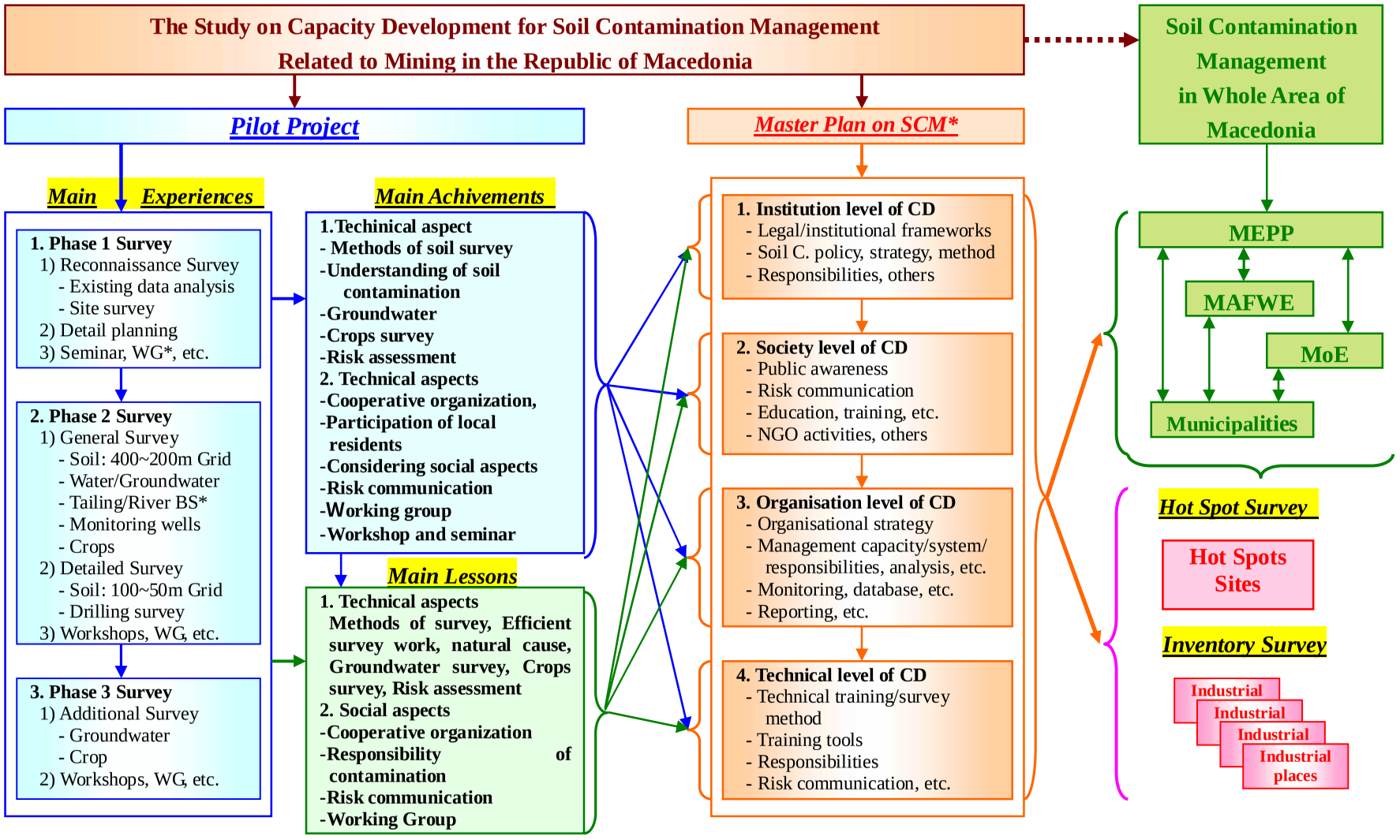
Since the Pilot Project (P/P) was conducted to obtain the basic ideas for formulation of M/P, the experiences, achievements and lessons attained thorough the P/P are indispensable for constructing the framework of M/P.

The experiences, achievements and lessons attained through the P/P are summarised below, and the procedure of formulating the M/P in line with them is shown in flow chart of Figure 8.1.

8.2 Main Experiences and Achievements of the Pilot Project

The field work of P/P was carried out in Probistip from January 2006 to August 2007. The study items and work achievements of the P/P are given below.

- General Survey
  - Soil survey: 400m and 200m grid soil survey
  - River bottom sediments survey
  - Surface water survey
  - Drilling wells and monitoring of groundwater
  - Drilling survey in tailings dams
- Detailed Survey
  - Soil survey: 100m and 50m grid soil survey
  - Crops survey
  - 5m deep drilling survey of soil
- Additional Survey
  - Groundwater and surface water survey
  - Additional crop and soil survey
- Distribution map of heavy metal concentration
- GIS data construction work
- Compilation of survey results
- Progress Report, Interim Report and Action Plan of the Pilot Project
- Seminar, 1st, 2nd and 3rd Workshops



*WG: Working Group meeting, *BS: River bottom sediments, *C.: Contamination, *SCM: Soil Contamination Management

Figure 8.1 Relationship among Pilot Project, Master Plan and Further Soil Contamination Management in Whole Area of Macedonia

During the P/P, all through the work listed above, many technical aspects of the soil contamination survey, such as soil, surface water/groundwater, crops surveys, chemical analysis and interpretation of results, were experienced and learned together with counterpart (C/P), government staff, stakeholders and sub-contractors engaged in sampling and chemical analysis. Further, through communication with residents of the area (landowner), working group, workshop and seminars, information and opinions were shared with stakeholders. Based on the experiences of these, the main achievements of P/P are given below.

- Technical Aspects
  - Methods of Soil Survey
    grid survey, narrow down method, five points mixing method
  - Understanding of Soil Contamination
    Understanding the topographic and hydrologic nature
    Considering land use and existing facilities
    Soil with high heavy metal concentrations by natural causes
  - Groundwater contamination
  - Crops survey
  - Risk assessment
- Social Aspects
  - Establishing cooperative organization for survey
  - Participation of local residents to the survey
  - Survey considering social aspects
  - Risk communication
  - Organizing working group
  - Workshop and seminar

The achievements accomplished through the P/P are to be applied for a better understanding of the situation of the soil contamination and smooth implementation of the survey in the other areas of Macedonia. Details of the each achievement of the P/P are given below.

8.2.1 Technical Aspects

(1) Methods of Soil Survey

In the P/P, the soil survey was conducted by grid survey with narrow down method, reducing the size of target by reducing the size of grid. The sampling was conducted by five points mixing method and sampling sites were determined by GPS (Global Positioning System).

Since the area of the P/P is immense, as large as 201.5km^2, 400m×400m grid sampling, covering the whole area, was conducted at the first stage to understand the boundary of the contamination

area with relatively high concentrations of contaminants. Based on the results of 400m grid survey, 200m, 100m and 50m grids survey were subsequently conducted in the specific area of contamination to narrow down the target.

For equally evaluating the whole survey area, it is necessary to cover the whole survey area with a relatively large grid system, and this method was very effective for understanding the distribution of the contaminated area and analysis of risk assessment in the P/P. The narrow down method was efficiently used in the P/P to narrow down the target of the contaminated area evaluated by the survey of the previous stage, and the situation of contamination and boundaries of contamination could be efficiently identified.

Five points mixing method was adopted for all the soil samples of the P/P. This method can increase the accuracy of soil contamination survey by increasing the number of samples. One sample method is enough for a small grid survey of 10m grid in the factory site, but in case of grid size bigger than this, five points mixing method is recommended.

In the P/P survey GPS was efficiently used for locating the sampling sites. For soil contamination surveys of extensive areas, it is recommended to use GPS for sampling of soil and other materials. It has advantages of efficiently locating a sampling site and memorizing the coordinates.

(2) Understanding of Soil Contamination

For the soil contamination survey, it is very important to consider various aspects of the survey area, such as topography, hydrology, land use and existing facilities, all through the survey stages. For soil with high heavy metal concentrations, not only human causes but also natural causes must be considered.

a. Understanding the Topographic and Hydrologic Nature

For making a plan of soil contamination survey of extensive areas, like the P/P area, it is necessary to include potential contamination areas as much as possible to understand the whole view of the contamination mechanism. For a better understanding of the contamination area and contamination mechanism, it is necessary to collect the information listed below.

- Topographic features
- Geological features
- Hydrological information（nature of drainage system, flooding, erosion and etc.）
- Meteorological information (temperature, precipitation, snowfall, wind direction, wind speed and etc.)
- Land use

- Water (groundwater) use
- History of the area
- History of using harmful substances, history of accidents
- History of soil contamination survey, history of counter-measures
- Existing information and data
- Situation of agriculture land (irrigation, fertilizer and etc.)
- Others

Particularly, natural conditions such as topographic features and hydrological situations play important roles for migration and diffusion of the contaminants, and they are important factors for estimating an area of contamination. In the P/P, this information was efficiently used for estimating the area of contamination.

1) Topographic Feature

Because of a gentle topographic feature of the P/P area consisting of hill-plateau-flat plain of valley bottom, gentle migration of contaminants through surface water, groundwater and dust make contaminants easier to migrate a further distance and, consequently, form a relatively larger area of contamination. In the P/P area, both soil and groundwater contamination were, actually, not limited in the area along rivers, but further extended to hill areas.

On the other hand, in the area of valley topography, migration of contaminants is limited to one way toward downstream and the contamination area is limited only in the narrow valley plain.

The topographic features were considered for planning of the P/P survey, and sampling sites of soil and other samples were selected taking into consideration of topographic feature.

2) Hydrological Feature

In the area of gentle topography of the P/P area, consisting of hill-plateau-flat plain of valley bottom, contaminants migrate slowly being included in slow flowing surface water and groundwater, and the area of contamination is in the process of extending. In this case, discharge and migration of the contaminants (tailings in the P/P area) are slow, dominated by sedimentation rather than migration. In the P/P area, contaminants migrate and diffuse slowly, being included in the slowly flowing groundwater, and the area of contamination tends to be extended.

Sedimentation dominates over erosion in the middle stream area of the drainage system and alluvial fan typically occurs. Small size alluvial fans are observed in many places in the P/P area. The P/P area, located in middle stream area of drainage system, is characterised by rare cases of flooding, dominant sedimentation, occurrences of river forest and poor erosion. These characteristic features of the drainage system of the middle stream area of the P/P area suggest that discharge of tailings material is poor and re-sedimentation of the tailings material occurs in the area. The secondary

sedimentation of tailings material was actually observed in the P/P area.

The hydrological features were considered for planning of P/P survey, and sampling sites of soil and other samples were decided taking into consideration the hydrological features.

b. Considering Land Use and Existing Facilities

This section includes important factors for considering the source and mechanism of soil contamination and is related to a history of using harmful substances, history of accidents, history of soil contamination surveys and history of counter-measures.

The P/P area is dominated by agriculture land and pasture, while forest and residential area including Probistip are limited. Particular attention was, consequently, not paid to residential area for P/P survey.

For considering the contamination mechanism and risk assessment, the information of land use is important. In addition, information concerning facilities of the mine including tailings dams and history of old mining activities is indispensable for understanding the source and mechanism of contamination.

In the P/P, information, such as land use, existing mining facilities and history of their operations was considered in detail for understanding the contamination mechanism and risk assessment.

c. Soil with High Heavy Metal Concentration by Natural Causes

This is related to geological features and is a key factor for understanding the causes of high heavy metal concentration in soil. Two types of high heavy metal concentrations by natural causes were confirmed in the P/P area by considering geological features of the area and site investigation.

1. Co-Cr-Ni : Sedimentary rock of Miocene, Tertiary (mudstone) source
2. As : Pb-Zn mineralisation source

(3) Groundwater Contamination

Groundwater contamination in the P/P area was anticipated from topographic and hydrological features at the beginning, and groundwater contamination by As, Pb, Co, Ni and Zn, extending over nearly whole area of the P/P, was revealed by the P/P survey. Particularly, a serious problem was found that nearly half of wells/springs located in the groundwater contaminated area are currently used for drinking water.

(4) Crops Survey

In the P/P, the crops survey, conducted to 84 grids of 679 grids of 400m soil survey, revealed that 36% of wheat samples had Pb concentrations exceeding the standard of Macedonia (Agriculture Standard for Products, CRP 251, 2005). The concentrations of Pb in wheat seem to be not directly related to both Pb content and elution concentrations of soil samples collected from the same grid. Although high concentrations of Pb in soil do not directly reflect the Pb concentrations of wheat, it is necessary to pay attention to the concentrations of heavy metals in crops in and near the area of potential soil contamination.

The crops survey should be included in parallel to the soil contamination survey of the agriculture areas with potential heavy metal contamination.

(5) Risk Assessment

The risk assessment in the P/P area was comprehensively implemented by exposure risk and agriculture risk. The exposure risk was calculated by harmfulness of heavy metals using the TDI of WHO. The results of the exposure risk assessment showed that exposure risk was the highest in and around the old tailings dam. Since the residential area of the Probistip is located closely to the old tailings dam, the exposure risk of the residential area of Probistip is high, affected by the old tailings dam. Because groundwater is used for drinking, the exposure risk is higher from groundwater than contaminated soil.

Qualitative agricultural risk based on the results of crops analysis show that the whole area of agriculture land in P/P is characterised by relatively high agriculture risk.

The definition of soil contamination in the P/P area was examined from the environmental risk assessment. The definition of soil contamination and reference values were discussed at the technical committee. The definition of soil contamination includes content and elution values of the heavy metals of soil. The heavy metals defining soil contamination were selected referring to the Environmental Standard for Water of Macedonia and standards of EU countries, and nine heavy elements were chosen.

As for the exposure risk, the reference values for soil content values were obtained from the TDI of WHO. The reference values for soil elution values were taken from the Environmental Standard for Water of Macedonia.

8.2.2 Social Aspects

(1) Establishing Cooperative Organization for Survey

To carry out a large scale soil/groundwater contamination survey like the P/P, it is quite important to establish a cooperation network as well as to organise the survey team. In the P/P, at the start of actual survey work a cooperation network was established with staff of Probistip Municipality and local staff of MAFWE Agriculture Department by the strong support of the Mayor of Probistip Municipality. The local members related to the P/P are given below.

- Municipality of Probistip ：Mayor
- HSZ ：Advisor
- MAFWE ：Local Staffs of Agriculture Department, MAFWE
- Cadastre Office ：Local staffs
- Civil Engineering Institute ：Site Manager
- Zletovo Mine ：Person in charge of environment
- P/P survey working Group：MAFWE, MEPP, MoE, HSZ and Municipality of Probistip

After the accident of spillage of tailings, the soil contamination over the area once covered by the spillage of tailings is the still main concern in Probistip, and Probistip Municipality was wanting the soil contamination survey to be conducted to clarify soil contamination. Under such circumstances, the survey team of the P/P was welcomed by Probistip Municipality with full cooperation.

By the cooperative network of Probistip, the field survey was proceeded smoothly with the help of exchanging information of the P/P area (survey area, land owner, history of tailings dam, communication, preparation of workshop and etc,.) and supplying a series of advice for field survey, space for desk work and so on.

(2) Participation of Local Residents to the Survey

During the P/P survey, it was organized for local residents to have opportunities to joining the actual survey, such as sampling of soil. It was particularly effective for raising awareness of soil contamination. They could observe the actual situations of soil in the field, such as tailings material remaining on the riverbed of the Kiselica and Zletovska Rivers. They could learn survey methods, organizing soil survey, sampling methods, understanding the topographic sheet, using GPS. Further, they are very helpful to communicate with landowners of sampling sites.

(3) Survey Considering Social Aspects

During the Phase 1 survey, the preliminary survey, including various surveys such as natural environment, social environment, environmental situation, actual situation of contamination, was conducted. The chemical analysis of contaminated soil, including the tailings materials, was conducted in the survey to understand the actual situation of contamination. For groundwater, on site water quality tests were done for some of the groundwater samples and relatively high As concentration was detected.

In the Phase 2, detailed surveys of land use and water use were conducted and detailed information of land use was obtained. Because high risk facilities of tailings dams and floatation plant are closely located, most of the residential area of Probistip is covered by relatively high risk area of Level 3 (partly Level 4). The results of groundwater monitoring conducted along the main river of the P/P area, Zletovska and Kiselica Rivers, showed that groundwater of the P/P area is contaminated, and an additional groundwater survey was proposed. The groundwater survey conducted in Phase 3 showed that most of the groundwater samples in the P/P area were contaminated.

Since the soil/groundwater survey was of a large scale and it is difficult to cover, uniformly, a whole area, the preliminary survey, including various aspects of the P/P area conducted in the Phase I was very useful. Information, particularly, land use, water use, awareness of soil contamination, could be collected through social environment survey at the preliminary stage of study, so that the collected information could be used for planning and analysis of the soil/groundwater survey. It is, therefore, necessary to conduct social environmental survey as a part of soil/groundwater survey.

(4) Risk Communication

The results of the P/P survey showed three types of contamination in the P/P area.

1. Soil contamination of As-Cd-Cu-Pb-Zn-Mn
2. Groundwater contamination of As-Co-Ni-Pb-Zn
3. High Pb in crops

Particularly, the groundwater of wells is used of as drinking water in nearly half of the villages of the P/P area.

The risk communication was started at the beginning of the P/P survey when the permission from the load owners was obtained to enter their premises for soil sampling through the mayor of the Probistip Municipality. In that occasion, it was clearly explained to land owners that the purpose of

the sampling was soil contamination survey. There was not any trouble reported with land owners for the sampling team entering their premises during the P/P survey, because they knew the reason of soil survey and they were interested in the outcomes of the survey. During the P/P survey, the First Seminar and the Third Workshops were held in Probistip and each stage of results of the P/P survey, including results of grid soil survey, monitoring well and crops survey, were presented. Although it was not an official disclosure of the results to the local residents, workshops were one of the occasions to disclose the results of survey to the stakeholders.

The official disclosure of the results of soil contamination of the P/P area by State Agricultural Inspectorate of MAFWE is now being suspended until the decision of the Government and MAFWE.

The additional groundwater and surface water survey showed that groundwater of many wells/springs showed high heavy metal concentrations greater that the Standard of Drinking Water. For the groundwater contamination, although the drinking of groundwater seems to still continue by some of the village residents, following the authorized procedure of MoH, sampling for official analysis was conducted and the official analysis is in progress to confirm the contamination.

Through the experiences of P/P, risk communication was confirmed to be very important for local residents to understand the potential risks caused by harmful substances.

(5) Organising Working Group

Through the course of implementation of the P/P, a working group was organized for on the job training (OJT) of management of soil contamination, management of survey and survey technique. The members of the working group are staff of MAFWE, MEPP, MoE and HSZ. Because most of the members did not have necessary experiences of survey of soil contamination, the training of the project achieved results of capacity development. Also discussions in the process of formulating the Action Plan by organising working group (WG-AP) brought useful results. Besides WG-AP, a working group for formulating the Master Plan (WG-MP) was also organised and fruitful discussions were attained in regular meetings.

(6) Workshop and Seminar

During the P/P, three workshops and two seminars were held not only in Skopje but also twice in Probistip. The updated survey results of the P/P project were reported at each meeting. They were very beneficial occasions for exchanging opinions and sharing information among all of the stakeholders. These were good opportunities for disclosing the actual results of the P/P and risk communication to stakeholders.

8.3 Main Lessons of the Pilot Project

Through the course of implementation of the P/P, a series of experiences and achievements have resulted, and, in addition to them, various lessons were learned. These lessons learned will give important indication to the plan of soil contamination management in the M/P and its implementation in future.

Lessons learned from the P/P are shown below;

- Technical aspects
  - Method of soil survey
  - Efficient survey work
  - High heavy metal concentration in soil by natural causes
  - Groundwater survey
  - Crops survey
  - Risk assessment
- Social aspects
  - Establishment of cooperative organization for survey and role of local municipality
  - Responsibility of contamination
  - Risk communication
  - Organizing working group
  - Workshop and seminar

The main lessons learned through the P/P given above are discussed in detail.

8.3.1 Technical Aspects

(1) Method of Soil Survey

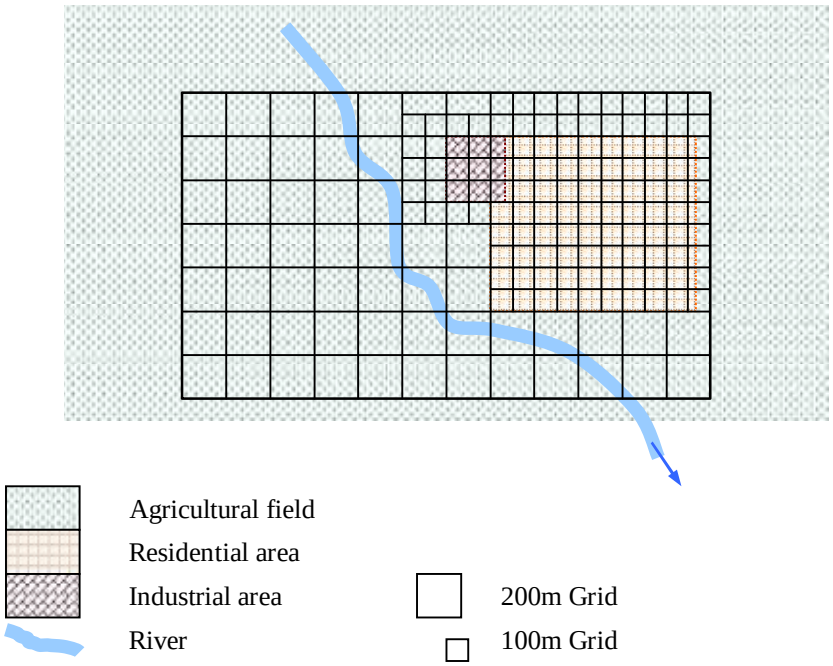
The survey area of the P/P is large and almost all of the area is occupied by agricultural land with the remaining small portion of urban area, forest and mountain area. Highly polluted zones are observed along major rivers. In this situation, 400m grid was set covering the whole survey area at the first stage of survey, considering the whole area to be agriculture land.

The 400m grid is quite normal for the purpose of soil contamination survey of agricultural land. The actual situation of the survey area was not in normal condition as it contains residential areas, tailings dam and mineral dressing plant, which are sources of the contamination. If a smaller grid, for example 200m grid, was adopted, allowing the survey to follow actual situation of land use, the result might have provided more detailed information on the source of pollution and its vicinity concerning the immigration and diffusion of pollutants. Also over the residential area, contamination could have been indicated in a more detailed manner and diffusion mechanism to the residential areas may have been explained.

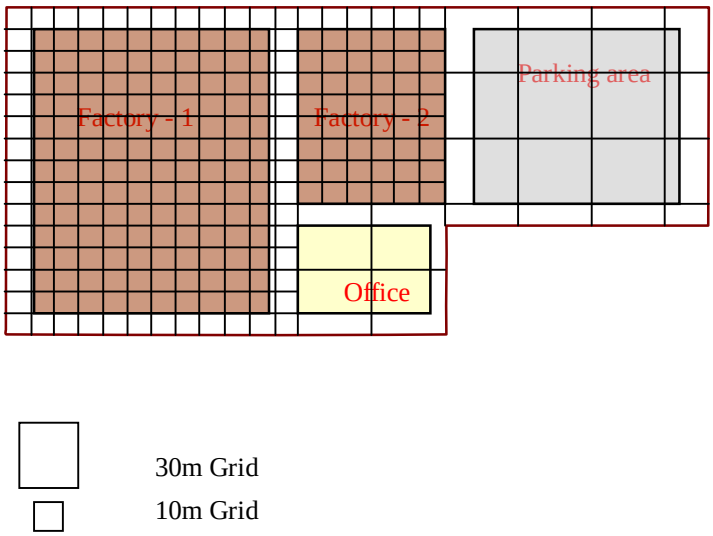
In the P/P, based on the results of the 400m grid survey, 200m, 100m and 50m grids survey were subsequently conducted in the specific area of contamination to narrow down the target. Although it was possible to understand the detailed distribution of soil contamination by the narrow down method of four stages (400m, 200m, 100m and 50m grids) in the P/P, the four stages narrow down method takes too much time and budget and is not economical. In a normal area of soil contamination, the narrow down method of two stages seems to be enough for efficient evaluation of the contamination situation of the area.

Considering the existing information of contamination and land use of the area, it is possible to organise the soil contamination survey using two types of grid, simultaneously, from the beginning. Examples of this are shown in Figure 8.2. Case 1 of the figure shows an example of a large scale soil contamination, and the 200m grid and the 100m grid are set over the areas, respectively, for agriculture land and residential area. Case 2 of the figure shows an example of relatively small scale industrial site, and detailed survey of the 10m grid is set in the area of factory site with a history of previously using the harmful substance and the 30m grid is set in the area of office and parking lot without any history of using harmful substances. As can be seen from Figure 8.2, it is better not to use many different sizes of grid at same time for clear understanding of distribution of contamination area and risk assessment.

Lessons learned from the P/P suggest that it is necessary to make survey plan depending on the situation of land use explained in section of 8.2.1 (2) to obtain better information on the soil contamination



(1) Case- 1 : Large Survey Area



(2) Case- 2 : Industrial Places Survey Area

Figure 8.2 Selection of Size of Soil Survey Grid

(2) Efficient Survey Work

Survey work must be conducted efficiently. For sampling work, it is recommended to use GPS (Global Positioning System) for deciding sampling location precisely and storing the coordinates of sampling location. For compilation work, it is better to use GIS (Geographical Information System) to represent the survey results efficiently and conveniently.

(3) High Heavy Metal Concentration in Soil by Natural Causes

It was confirmed that the soil with high Co-Cr-Ni concentrations caused by Miocene (Tertiary) sedimentary rock (mudstone) and the soil with high As concentrations caused by Pb-Zn mineralisation occurred in the P/P area. They are considered to be an enrichment of heavy metals to the soil by natural causes.

The source of high heavy metal concentrations in soil by mineralisation can be relatively easily traced. However, since there is no visible evidence for high heavy metal concentrations in sedimentary rocks, interpretation of survey results must be done carefully. Some of the sources of information for considering natural causes of high heavy metal concentrations in soil are given below.

- Geochemical atlas (map)
- Occurrences of mineral showing and mineralisation
- Geological map
- Existing reports on the geochemistry, mining, geology, soil contamination, etc.
- University, Faculty of Mining and Geology

The possibility of natural causes must be considered for soil contamination of restricted areas when there is no indisputable reason for human causes.

Similarly, natural causes of heavy metal enrichment to soil may exist in some contaminated area related to mining elsewhere. Attention should be paid that even for soil contamination survey of small scale factory and plant, soil with high heavy metal concentrations by natural causes may occur.

For conducting the soil contamination survey in an unfamiliar area, it is better to collect information concerning the possibility of natural causes before the survey. Natural causes should be considered when soil has a high concentration of certain elements that are not the results of human activity and are possible to be the results of geological nature.

(4) Groundwater Survey

The P/P revealed groundwater contamination of heavy metals over a large area, especially including wells/springs used for supplying drinking water for the local residents.

It is recommended to include the groundwater survey in parallel to the soil contamination survey. Particularly, for the area where groundwater contamination is anticipated from topographic and hydrological features and wells are used for drinking water, soil/groundwater survey should be conducted promptly.

Generally, contamination of soil and groundwater are closely associated, monitoring of soil contamination is conducted by monitoring wells being set on upper-stream and downstream sides of ground water flow from contaminated soil zone (Figure 8.3).

Therefore, in a soil contamination survey, monitoring of groundwater should be included from the beginning and situation of utilization of groundwater should be clarified by a social environmental survey in the target area. In an early stage of groundwater survey, by the sampling from existing wells, information of quality of drinking water can be known easily. In the subsequent detailed survey, contamination mechanism and effective counter-measures are considered by understanding the source of contamination and the area of diffusion of contaminants.

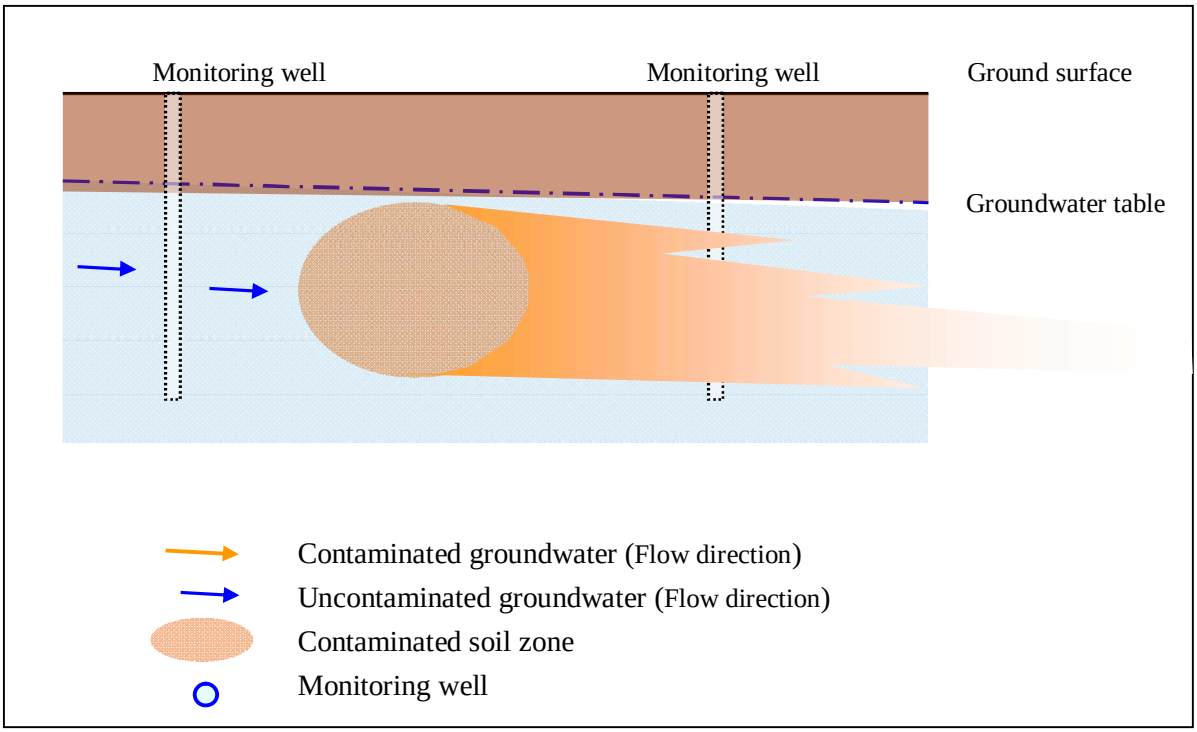


Figure 8.3 Monitoring wells in Contaminated Soil Site

(5) Crops Survey

The crops survey in the P/P area revealed high Pb concentrations of wheat. Since no particular relation of Pb concentrations between soil and wheat was observed, there is potential for occurrence of wheat with high Pb concentrations even in the area distributed by soil with low Pb concentrations.

This will mean that if there is potential for contamination of heavy metals in a certain area, a crop survey with similar amount of sampling to the soil survey should be planned over agricultural land from the beginning. In this case, a clear guideline for crop survey is necessary and an example of this is given in the M/P of this study.

(6) Risk Assessment

The risk assessment was conducted in the P/P by the exposure risk of soil and groundwater and agriculture risk. As for exposure risk, high risk zone was clarified along the Old Tailings Dam and the major rivers, and residential areas of Probistip are affected by the Old Tailings Dam, resulting in a relatively high risk zone. It is also revealed that agricultural risk by crops is generally high over the whole area of agriculture land in the P/P area. Moreover, groundwater (direct used for drinking) entails exposure risk higher than soil contamination.

Risk assessment of contaminated soil is conducted in all EU countries, and it is recommended to Macedonia to implement risk assessment approaches as soon as possible, especially before full-scale contamination surveys and counter-measures will start. The need for, and effectiveness of, environmental risk assessment was recognised by this study, however, technical transfer was not fully completed because of limitation of time. Tracking the EU policy of soil contamination and introduction of practical method of risk assessment should be considered in Macedonia.

The definition of soil contamination, including the reference values, should be discussed and established following the EU policy of soil contamination.

The considerations of risk assessment and the reference values of soil were a very meaningful approach for understanding soil contamination and realising the necessity of the standard values, and these will, in future, contribute to the soil contamination management in Macedonia.

8.3.2 Social Aspects

(1) Establishment of Cooperative Organization for Survey and Role of Local Municipality

To carry out a large scale soil/groundwater contamination survey, it is quite important to establish a cooperation network as well as to organise a survey team consisting of local municipality and central governmental institutions such as MEPP, MAFWE and MoE.

By the cooperative network of the local municipality, the field survey proceeds smoothly with the help of exchanging information such as survey area, land owner, history of contamination, and local municipality can supply advice for the field survey and communication with local residents.

In case of a soil contamination survey over a large area such as the P/P (e.g. Hot Spot Survey), a local municipality may not take direct management of such survey work, instead, a local municipality plays a key role for communication and risk communication between stakeholders (local people), polluter and contamination survey team (Figure 8.4).

In a case of relatively small size survey in independent factory and plant (e.g. Inventory Survey), a survey and management directly conducted by local municipality are considered to be most effective because the local municipality has very close relationship with operators of factory and plant. The local municipality, as with the case of large area survey mentioned above, should play an important role in communication among stakeholders (local people), polluters and contamination survey team.

In future surveys of soil contamination, as discussed above, the local municipality is expected to play a major role.

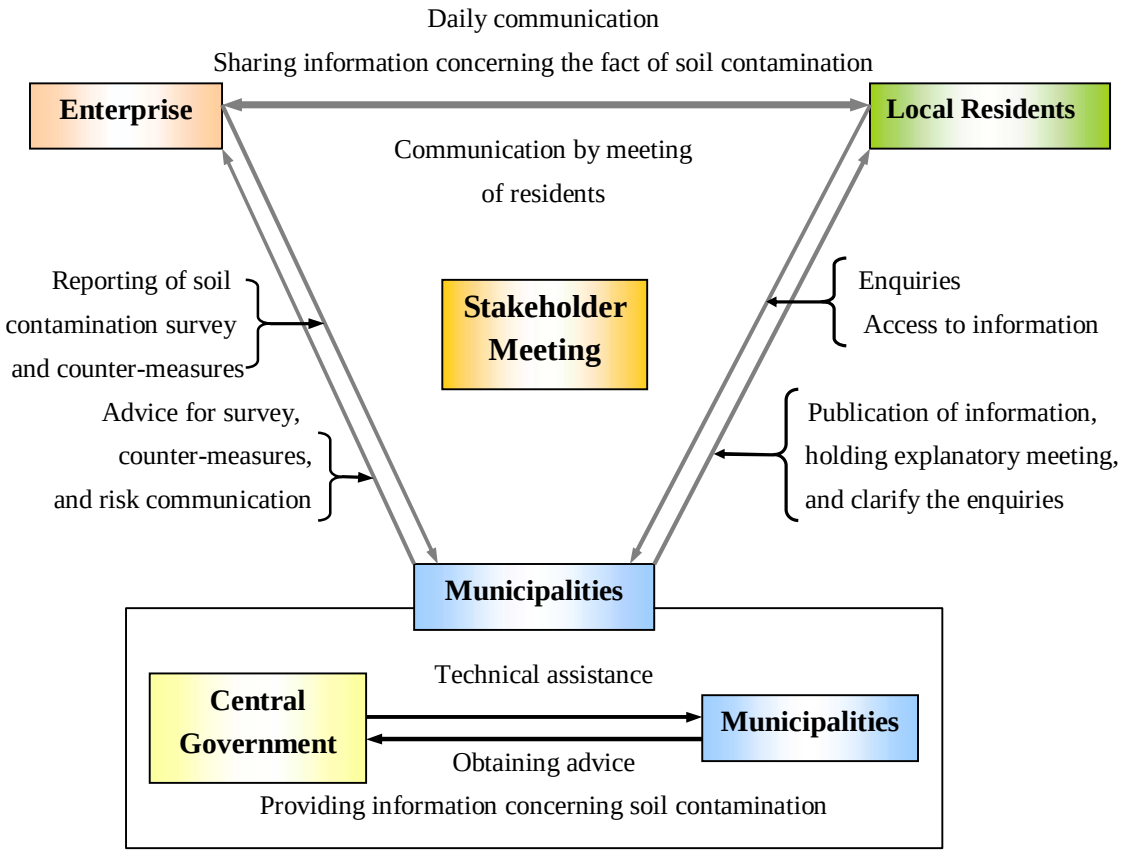


Figure 8.4 Relation of Stakeholders and Risk Communication

(2) Responsibility for Contamination

In Macedonia, historically in former Yugoslavian age, state-run companies were common, especially almost all mines were operated by government, and they caused soil contamination. State-run mining companies generally no longer exit and this resulted in disappearance of responsible polluters.

Under such situation, negative heritage of former Yugoslavian age should be cancelled and present government, though it is neither polluter nor direct responsible body, is expected to carry out contamination survey and counter-measures for mitigation instead of polluters of the old regime. In the P/P area, since the old tailings dam and polluted agriculture land are managed by MAFWE, it seems to be reasonable for MAFWE to take all the responsibility of contamination in the area.

Based on the polluter pays principle, which is now consensus of the most countries, the government is responsible to pay the cost of counter-measures of contaminations. As an action from now, although legal cancellation of negative heritage of former Yugoslavian time is necessary, the M/P recommends that the present government shall definitely accept responsibility of taking counter-measures of contamination instead of polluters, which have already disappeared. The "Basic Law on Soil Contamination Management" should refer to this principle mentioned above. Soil/groundwater contamination, which may occur in future, should be treated by the polluter pays principal.

(3) Risk Communication

From the results of the soil/groundwater contamination survey, soil contamination of As-Cd-Cu-Pb-Zn-Mn and groundwater contamination of As-Co-Ni-Pb-Zn have been confirmed. An action of information disclosure concerning the results of the survey at the earliest occasion is recommended. As mentioned in section 8.2.2 (4) as to the risk communication, a due action of information disclosure to the local people has not yet been taken.

Since the P/P survey including analytical work was completed, it is necessary to hold a meeting explaining and disclosing the results of soil and groundwater contamination survey to land owners of the P/P area, municipality and related stakeholders, at an appropriate time when the counter-measures have been agreed and approved.

Although MAFWE is not a polluter itself, it has a duty to administrate agriculture land as an administrative organization at present, and, therefore, an obligation of information disclosure of the contamination attributes to MAFWE. It is necessary to hold a stakeholder meeting at earliest occasion to notify stakeholders such as local people, farmers, etc. of the risks of soil contamination, groundwater and crops by harmful heavy metals and to discuss with them concerning counter-measures.

If groundwater is considered to be contaminated by harmful substances and it has been used as drinking water, then, using the groundwater for drinking must be stopped immediately and the official analysis must be conducted by MoH to confirm contamination. If the groundwater is confirmed to be contaminated by the official analysis, then, the local municipality and MAFWE should declare the ban for using the groundwater for drinking and disclosure of the results of the official analysis must be conducted following method of risk communication. Further、an alternative source of water supply must be made by MAFWE.

For soil contamination, a meeting of the stakeholders must be held for understanding the situation of soil contamination and discussion of counter-measures.

As contamination of soil and contamination of groundwater are closely correlated and polluted areas are almost overlapping, stakeholder meetings should cover both soil contamination and groundwater contamination at single meetings for a better understanding of contamination by stakeholders. It is strongly recommend that at the meeting a report of the situation of contamination should be followed by the introduction of environmental risk and risk mitigation, and discussion of risk management by both sides of administrative (e.g. MAFWE) and stakeholders should be conducted.

A polluter should maintain information sharing with local administration and local people, and should maintain risk communication. Furthermore, a pro-active risk communication is necessary inviting stakeholders in regional (large scale) contamination areas or factory and plant with possible small scale contamination to share information mentioned above.

One point to note concerning risk communication, it should be kept in mind that in Macedonia "soil contamination" has not been defined by law and discussion with firm on legal ground is almost impossible. In this survey, it is proposed to refer to WHO's TDI (Tolerable Daily Intake) for environmental risk assessment. This numeric standard is applicable to both soil and groundwater (drinking water) and Macedonia is partly adopting WHO's recommendation in the case of drinking water.

(4) Organising Working Group

In the P/P, organizing the working group on a regular basis for discussions of survey methods, the action plan and the master plan, was very successful, deciding the matters by full discussion. For future soil/groundwater contamination surveys elsewhere, it is expected to organise a working group as an inter-ministry meeting consisting of staff in-charge for the soil/groundwater contamination and a survey is conducted depending on the opinion and comments from various points of view.

(5) Workshop and Seminar

The workshop and seminar held during the P/P were very useful for exchanging opinions and sharing up dated information among stakeholders concerning the survey. It is recommended to hold a workshop or seminar in the future survey, particular, survey of large scale, at the end of major steps of each survey.

8.4 Application of Achievements and Lessons of the Pilot Project to the Master Plan

The achievements and lessons obtained by implementation of the P/P should be fully utilised for formulation of the M/P of soil contamination management. The relationship between items of

achievements/lessons of the P/P and CD (Capacity Development) plan of the M/P is given below and relationship between CD of each level and achievements/lessons is shown in Figure 8.5. Since the lessons were obtained through the achievements, application of the results of the P/P to the M/P is described giving a focus on the lessons.

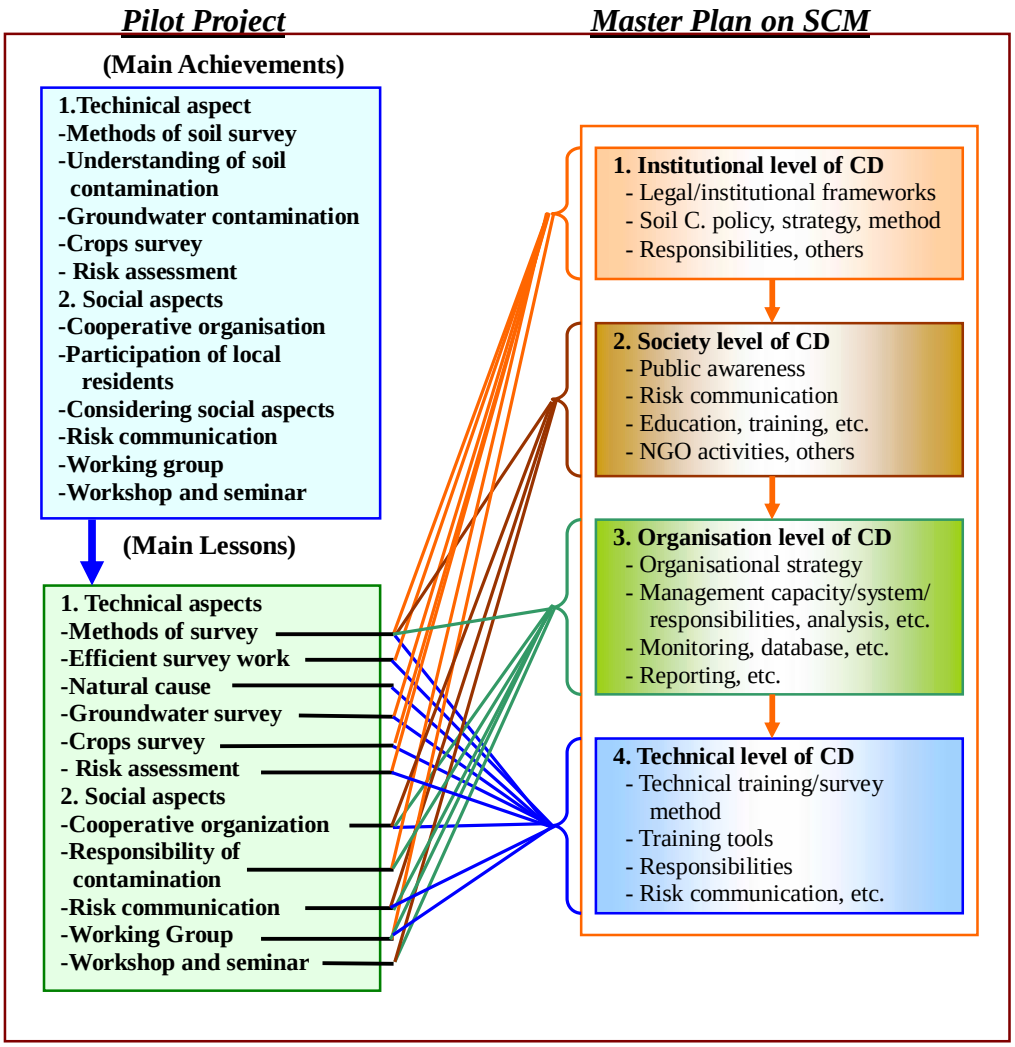


Figure 8.5 Relationship between Master Plan and Main Achievement and Lessons of the P/P

8.4.1 Institution Level of Capacity Development

From the results of the P/P, following items given below have relationships with CD at institutional level.

- Technical aspects
  - Method of soil survey
  - Efficient survey work
  - Groundwater survey
  - Crops survey
  - Risk assessment
- .Social aspects
  - Responsibility of contamination
  - Risk communication

For the institution level of CD, the achievement/lesson of the P/P contributes mainly to the planning of the soil contamination survey method. At the early stage of the soil contamination survey, the surveys of all of the Macedonia should be conducted in same way for establishing standards of accuracy of survey and level of risk assessment. Risk assessment is related to definition and evaluation of soil contamination and risk communication is indispensable as a method of communication with stakeholders.

For the institutional level of CD, targets are to clarify responsible administrative body for soil contamination, definition of soil contamination and survey method of soil contamination. The importance of risk communication is, also, emphasized.

It is also recommended to provide in the law that responsibility of polluters shall be clarified and, particularly, the present government shall compensate negative heritage of the Former Yugoslavian time and shall work out counter-measures against these contaminations.

8.4.2 Society Level of Capacity Development

From the results of the P/P, the following items given below have relationships with CD at society level.

- Technical aspects
  - Method of soil survey
- Social aspects
  - Establishment of cooperative organisation for survey and role of local municipality
  - Risk communication
  - Workshop and seminar

As the survey method of soil contamination, social environment survey, at the early stage of the soil contamination survey, must be conducted. The results of the social environment survey should be used for understanding soil/groundwater survey. The risk communication by sharing information of contamination with local residents is a very important social factor.

Roles of local municipalities, organisation of survey and collection of information from society are the main issues relating to management of soil contamination.

8.4.3 Organisation Level of Capacity Development

From the results of the P/P, the following items given below have relationships with CD at organisation level.

- Technical aspects
  - Method of soil survey
  - Groundwater survey
- Social aspects
  - Establishment of cooperative organisation for survey and role of local municipality
  - Risk communication
  - Organising working group

It is necessary to train experts of risk communication and social environment. The role of local municipality in survey organisation is important and for communication with local community, especially in risk communication, the contribution of local municipality is indispensable. Contamination of soil/groundwater is one of the greatest concerns at local community and activities of major industries are essential information to local municipality. Organising the working group concerning certain topics is very useful for exchanging the opinions with inter-ministry basis.

8.4.4 Technical Level of Capacity Development

From the results of the P/P, the items given below have relationship with CD of technical level.

- Technical aspects
  - Method of soil survey
  - Efficient survey work
  - High heavy metal concentration in soil by natural causes
  - Groundwater survey
  - Crops survey
  - Risk assessment

- Social aspects
  - Risk communication
  - Organising working group

Techniques required for soil contamination management consist of soil contamination survey, sampling, chemical analysis and risk assessment. Technique of risk communication is, also, necessary to discuss with local community.

As mentioned in social aspects, training experts of risk communication is quite important. Not only knowledge but also experience is necessary to cope with risk assessment, risk communication and polluters.

Crops survey should be one of the indispensable components in the case of regional scale soil contamination over large area where agricultural land exists. Therefore, understanding the concept of crops survey is important.

PART III

THE STUDY ON CAPACITY DEVELOPMENT OF SOIL CONTAMINATION MANAGEMENT RELATED TO MINING

CHAPTER 9 MASTER PLAN ON SOIL CONTAMINATION MANAGEMENT

CHAPTER 9 MASTER PLAN ON SOIL CONTAMINATION MANAGEMENT

9.1 General

Based on the achievements and lessons of the Pilot Project (P/P), the Master Plan (M/P) was formulated for developing capacity for soil contamination management related to mining for improving the environment in Macedonia.

The outline of the Master Plan is given below.

9.1.1 Objectives and Scope of the Master Plan

(1) Objective

The purposes of the M/P are to develop capacity for soil contamination management related to mining for improving the environment in Macedonia and to facilitate the process of independently driving forward the sustainable system of soil contamination management after this study.

(2) Target Materials

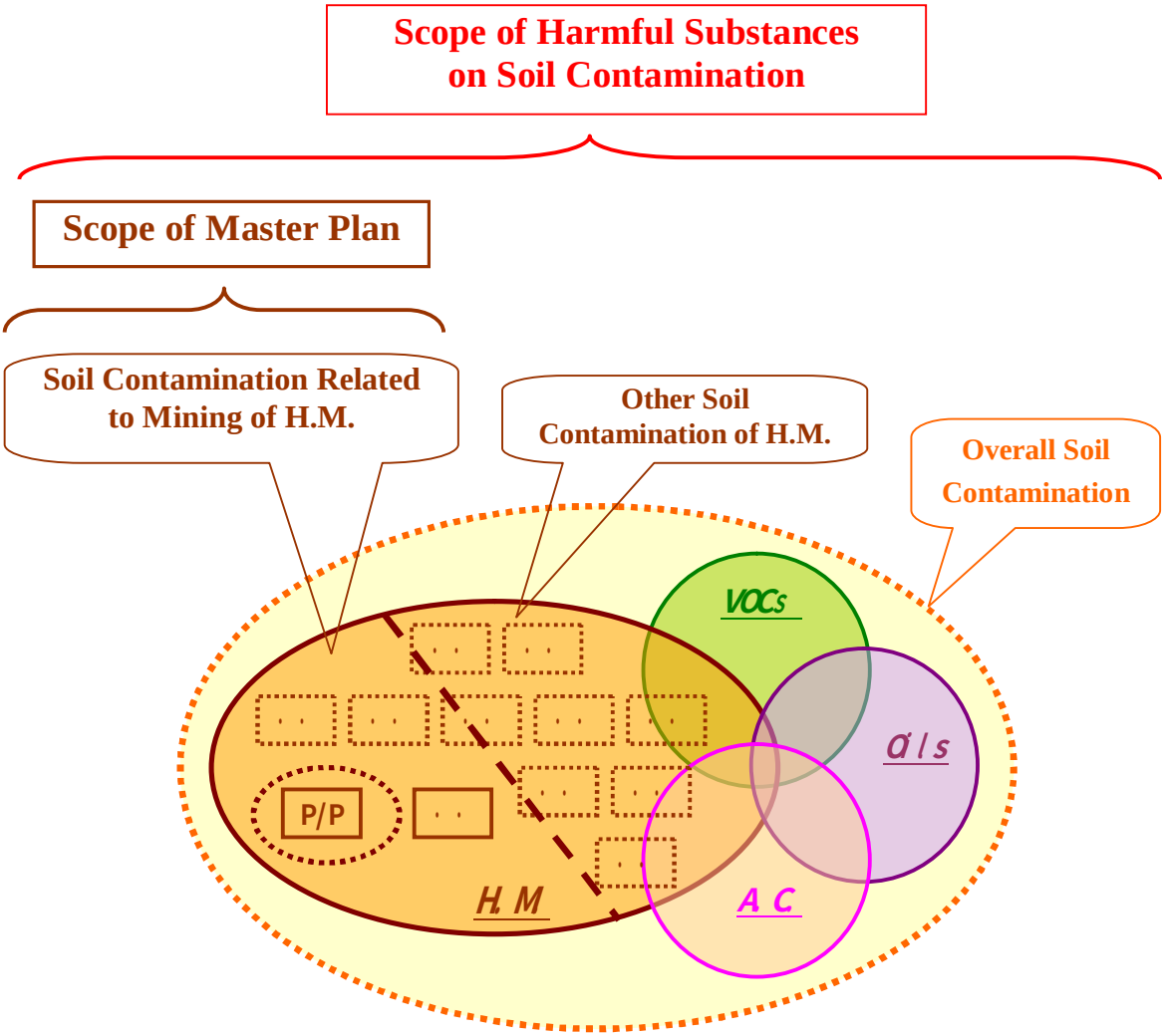
The target materials of the M/P are contaminants of soil related to mining, namely heavy metals such as arsenic (As), cadmium (Cd), lead (Pb) and others (Figure 9.1).

(3) Target Area

The M/P was formulated considering the whole area of Macedonia.

(4) Target Year

The target year for completing the establishment of legislation and management system for soil contamination management is set at 2010. Since it may take a longer time for enactment of the Basic Law on Soil Contamination Management, in that case, a provisional law for soil contamination management should be formulated within two years.



: Confirmed soil contamination sites

: Unconfirmed soil contamination sites

: Pilot Project area

VOCs : Volatile organic compounds

Oils : Oils and fats

A.C. : Agricultural chemicals

H.M.: Heavy metals

P/P : Pilot Project

Figure 9.1 Holistic Scope of Harmful Substances and the Part of Scope for the Master Plan

9.1.2 Visions and Goal

The M/P of soil contamination management was formulated aiming at implementing appropriate counter-measures for mitigating environmental risk of human health caused by soil contamination related to mining in the past and to prevent further soil contamination in future in Macedonia. The target is establishing a sustainable management system of soil contamination through working group consisting of the members of related governmental organisation and establishing information management system for sharing techniques and information concerning soil contamination.

It is hoped that the knowledge and manpower for the smooth implementation of soil contamination management system can be acquired through training on soil contamination management, and further hoped that the unfavourable repetitions of industrial activities including mining and soil contamination will be terminated through proper recognition, by the people of Macedonia, of risks caused by soil contamination to human health and the environment.

9.2 Overall Framework of the Master Plan

For the capacity development (CD) for establishing soil contamination management (SCM), it is necessary to define and agree the basic concept, including principles and frameworks, of soil contamination management, based on the existing capacity for soil contamination management and identifying the issues in the levels of institutions/societies, organisations and individuals.

The M/P, the plan of Capacity Development for Soil Contaminating Management, is composed of capacity development at four levels, namely capacity development of “institutional level ”, “social level”, “organization level” and “technical (individual) level” (Figures 9.2 and 9.3).

Overall Framework of Master Plan

- Institution Level

- **MEPP** : Leading Ministry for SCM, SCM in urban, industrial and commercial areas.
- **MAFWE** : SCM in the area of agricultural land.
- **MoE** : SCM in the mining area.
- **MoH** : Conservation of public health, Environmental risk assessment.
- **Municipalities** : SCM in local areas, Cooperation with Ministries.

- Social Level

- **MEPP** :
- **MAFWE** :
- **MoE** :
- **MoH** :
- **Municipalities** :

Raising Public awareness of soil contamination, Environmental education, Risk communication.

- Organisation Level

- **MEPP** : Improvement of "Department of Waste and Soil".
- **MAFWE** : Sharing of responsibility, improvement of " Sector of Registration and Management of of Agricultural Land".
- **MoE** : Improvement of "Sector of Energy and Mineral Resources".
- **MoH** : Improvement of Conservation of public health, Environmental risk assessment.
- **Municipalities** : Improvement of environmental section.

- Technical (Individual) Level

- **MEPP** :
- **MAFWE** :
- **MoE** :
- **MoH** :
- **Municipalities** :

Technical aspects of soil contamination survey, data analysis, soil contamination counter-measures and SCM.

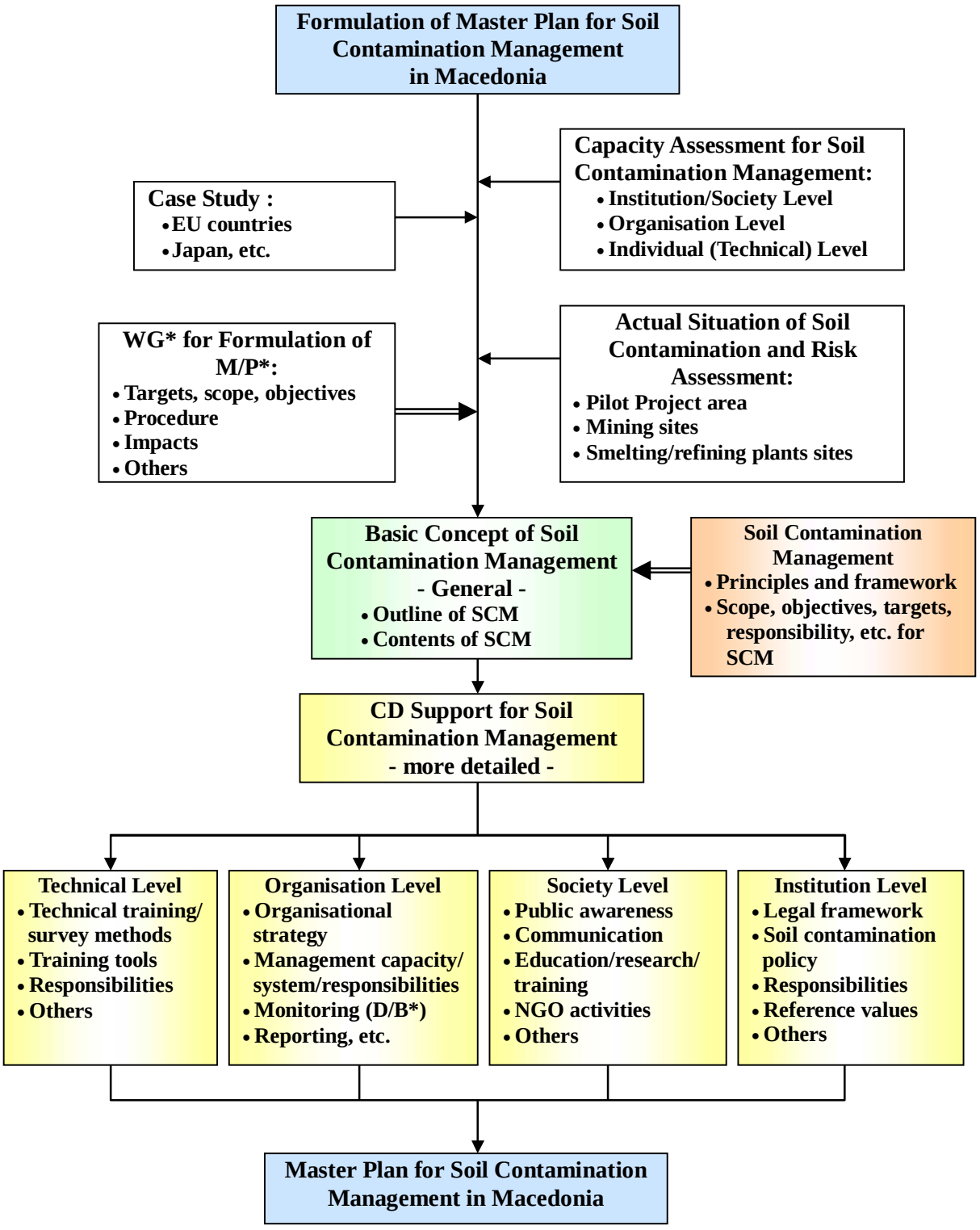
9.2.1 Capacity Development Plan of Institutional Level

On the legal framework of soil contamination management in Macedonia, the Ministry of Environment and Physical Planning (MEPP) should take the initiative of soil contamination management and establish the "Basic Law on Soil Contamination Management" as the leading ministry. However, the Ministry of Agriculture, Forestry and Water Economy (MAFWE) has obligation to manage soil contamination in the agricultural land and the Ministry of Economy (MoE) in the mining area and the area of mining facilities. MEPP has obligation to manage soil contamination in other areas, including urban and industrial/commercial areas.

During the period until the adoption of the Basic Law on Soil Contamination Management, the process of establishing a provisional institution of system is necessary. The contents and framework

of the provisional soil contamination management would be basically similar to those of the Basic Law.

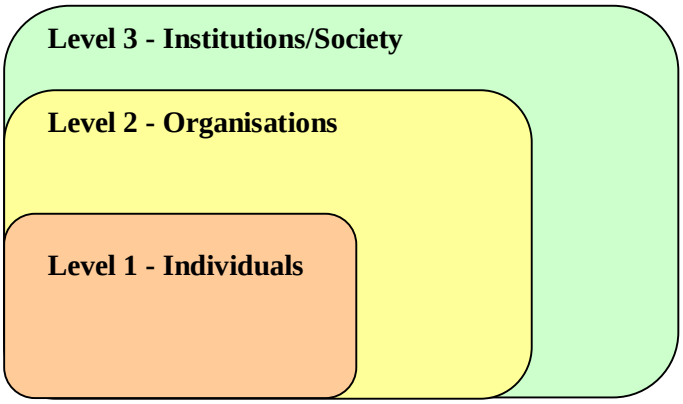
The main tasks for constructing of the legal framework of Soil Contamination Management (SCM) consist of Task -1 to Task -8 and each task needs to be discussed adequately step by step in the working group (WG-SCM) organised by MEPP. The important technical issues, such as environmental standards for soil and groundwater, should be discussed in the Technical Advisory Council and WG-SCM and after approval of the related ministries, it is included in the system of soil contamination management. After the establishment of system of SCM through series of Tasks, the actual system of SCM will start through approval at the parliament of related regulations such as “Implementation law” “regulation of implementation” and “guidelines”.



* CD: Capacity development, M/P: Master Plan, D/B: Database

WG: Working Group for formulation of M/P, SCM: Soil Contamination Management

Figure 9.2 Main Procedure for Formulation of the Master Plan



(*from JICA , 2004*)

The definition of Capacity Development is "*the process by which individuals, organisations, institutions and societies develop 'abilities' (individually and collectively) to perform functions, solve problems, and set and achieve objectives*" (this is the UNDP/JICA definition).

Figure 9.3 Layers of Capacity Development

9.2.2 Capacity Development Plan at Social Level

The capacity development at social level includes public awareness, social education for soil contamination, risk communication and residents participation.

Risk communication is, particularly, an important aspect for the SCM. The stakeholders, such as local residents, enterprises, ministries and local municipalities, share and discuss the situation of soil contamination for implementation of the remedial and management measures to mitigate soil contamination. Since, at present, the levels of awareness is relatively low among communities, farmers and other stakeholders in Macedonia on soil contamination and its potential impacts, it is essential to raise awareness through risk communication. It is necessary for this to be regulated in the law that prompt disclosure of the situation of contamination and holding stakeholder meetings among administrators, enterprises, local residents and other stakeholders are required.

9.2.3 Capacity Development Plan at Organisation Level

CD at organisational level will be necessary to ensure the successful implementation of the M/P and implementation of improved SCM on an ongoing and sustainable basis. Specific tasks on CD at organisational level are given below.

- Ministry of Environment and Physical Planning (MEPP): The MEPP will have overall responsibility for SCM and implementation of the M/P. Therefore, organisation for soil contamination management must be established immediately. The Division of Waste and Soil was established in the Department of Environment in 2007 and this department has the responsibility for soil contamination management.

-Ministry of Agriculture, Forestry and Water Economy (MAFWE): The MAFWE will play an important role and must take responsibility for SCM with respect to agricultural land. The new structure of MAFWE includes the Sector for Registration and Management of Agricultural Land and this sector is expected to have the responsibility for Soil Contamination Management.

- Ministry of Economy (MoE): The MoE will play an important role in relation to SCM in mining areas and paying more attention to the soil contamination is needed.

-Ministry of Health: The MoH will play an important role in soil contamination management in relation to public health protection and environmental risks.

-Municipalities: Municipalities will have an important roles to driving forward the soil contamination management together with MEPP, MAFWE and MoE. An improvement of the section in charge of environmental issues and close relation with ministries concerning the environmental issues are needed.

9.2.4 Capacity Development Plan at Technical (Individual) Level

The target of technical (individual) level of capacity development on soil contamination management consists of individuals of four categories of organisation/body: 1) relevant administrative offices of soil contamination management, 2) soil contamination investigation and remediation firms, 3) analytical and soil mechanical laboratories, and 4) business firms using harmful substances (objective sites of soil contamination survey). The contents of capacity development on SCM at technical (individual) level consist of four items of 1) soil contamination survey, 2) data analysis, 3) counter-measures for soil contamination and 4) management of information on soil contamination. The MEPP should have the overall responsibility of acting as a focal point for CD, organisation of training and equipments for soil contamination management to individuals of municipalities. Training is likely to be needed in some of the fields, such as 1) Institutional/Legal Framework, 2) Soil Contamination Survey, 3) Data Analysis, 4) Management of information on soil contamination and 5) Construction of Data Bases

9.3 Institution Level of Capacity Development of Soil Contamination Management

9.3.1 Institutional Basic Concepts of Soil Contamination Management in Macedonia

In relation to the capacity development for establishing of the soil contamination management in Macedonia, it is necessary to define and agree the basic concept including principles and frameworks of soil contamination management, based on the existing capacity for soil contamination management and by identifying the issues of each level of institutions/societies, organisations and individuals. The strategy for improving soil contamination management in each level has been formulated based on the basic principles of legal and institutional frameworks (Figure 9.4).

The basic concepts including principles and frameworks for the soil contamination management are described below.

9.3.2 Establishment of Basic Law on Soil Contamination Management

It is necessary to establish the "Basic Law on Soil Contamination Management" having the objectives of investigation, counter-measures and prevention of soil contamination, as soon as possible, and to establish the institutional framework for proper soil contamination management in Macedonia.

The fundamental policies of soil contamination management of Macedonia will be stipulated in the Basic Law of Soil Contamination Management, then the system of the soil contamination management will come into effect. Although the basic institutional framework of the Soil Contamination Management will be given in the Basic Law of Soil Contamination Management, the details of the management system will be decided through the work of Working Group by task method and discussion at Technical Advisory Council (TAC). As a result, development of supplemental regulation, such as “implementation law”, “regulation of implementation” and “guidelines” will be enacted.

In order to promote the adaption of legislation and regulation necessary for the Soil Contamination Management, it is better to put the items of the Soil Contamination Management in the National Programme for Adaptation of Acquis (NPAA) and to link the necessary EU legislation to the national legislation of Macedonia.

(1) Legal Framework of Soil Contamination Management

In relation to the legal framework of soil contamination management in Macedonia, the MEPP should take the initiative of soil contamination management and establish the "Basic Law on Soil

Contamination Management" as the leading ministry.

However, the MAFWE has an obligation (and responsibility) to manage soil contamination in the agricultural land, and the Ministry of Economy (MoE) has an obligation (and responsibility) to manage soil contamination in the mining areas and the areas of mining facilities. Therefore, MEPP has an obligation to manage soil contamination in the areas other then these, including urban and industrial/commercial areas. It is necessary for local municipalities to take part of the soil contamination management in the area under their responsibility.

After the "Basic Law on Soil Contamination Management" is established by MEPP, the administrative institution of MAFWE and MoE should be unified to the new Law. Examples of the contents of the draft Basic Law on soil contamination management are shown in Box 9-1. The Soil Contamination Management System is formulated based on the legal framework and the process of establishing it is shown in Figure 9.5

(2) Provisional Legal Framework of Soil Contamination Management until Establishment of the Basic Law of Soil Contamination Management

a. Process of Institutional Level of Capacity Development

The period until the adoption of the Basic Law on soil contamination management is likely to take much time, so that it is necessary for MEPP to implement the provisional institution system (e.g. ordinances and guidelines) until establishment of the Basic Law. The contents and framework of the provisional soil contamination management are basically similar to those after the establishment of the Basic Law (Figure 9.6).

The provisional legal framework of Soil Contamination Management, until establishment of the Basic Law on soil contamination management, is that each ministry (including MEPP, MAFWE and MoE) should operate within the existing laws, provisional law and/or additional ministerial ordinances, if needed.

MEPP: "Law on Environment"
MAFWE : "Law on Agricultural Land"
MoE : "Law on Mineral Resources"

The responsibilities of institutions in soil contamination management should be concordant among ministries.

- Legal Framework -

Establishment of the "Basic Law on Soil Contamination Management"

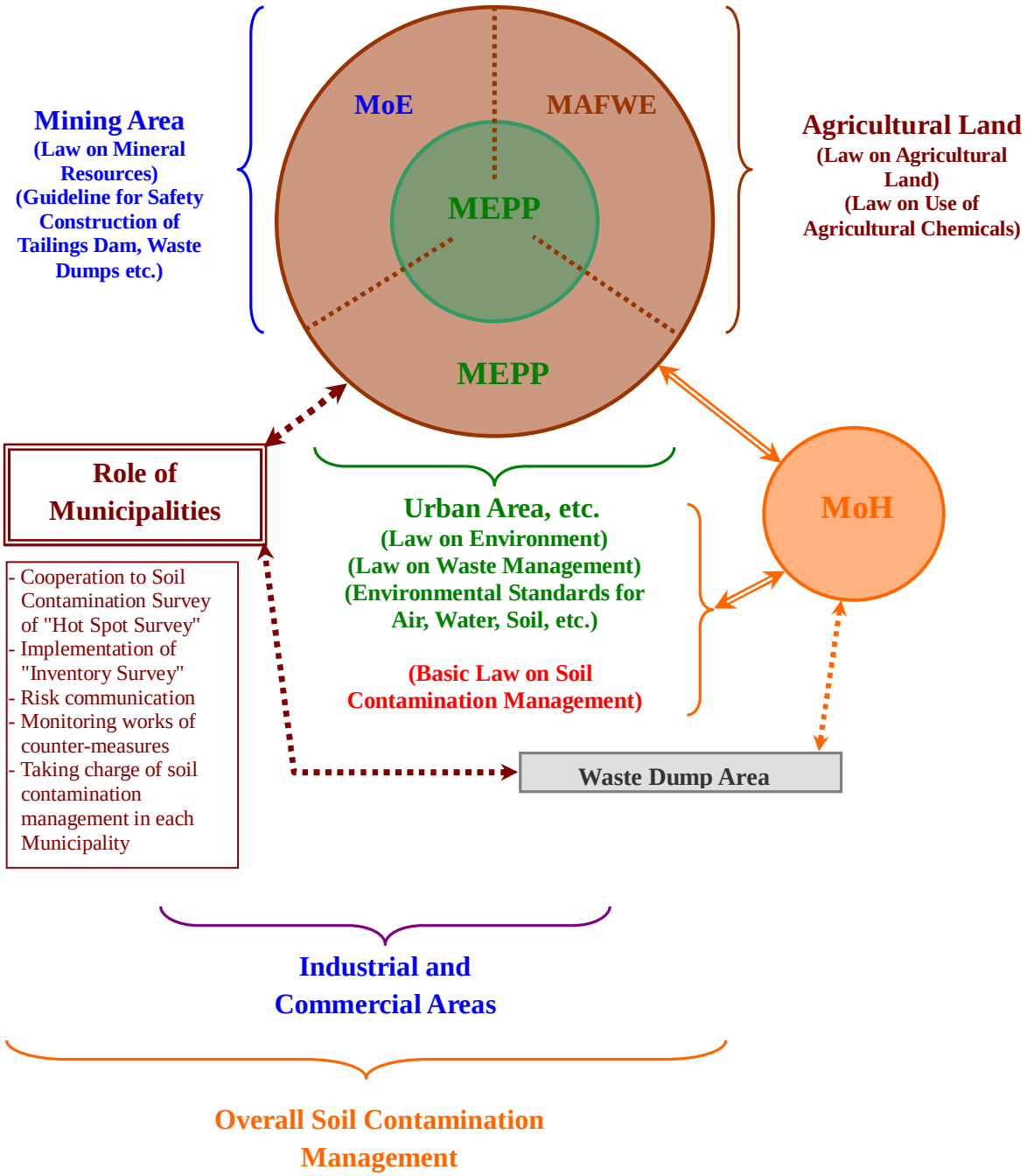


Figure 9.4 Legal Framework of the Soil Contamination Management

Box 9-1

Examples of contents of the "Basic Law on soil contamination management"

("Draft Basic Law on Soil Contamination Management")

1. General Provisions
- 1.1 Purposes and Scope
- 1.2 Definitions

2. Soil Contamination Management
- 2.1 Responsibilities and Payment of Investigation and Mitigation
- 2.2 National Soil Contamination Management
  - MEPP, MAFWE, MoE, etc.
- 2.3 Local Soil Contamination Management
  - Municipalities

3. Investigation of the Situation of Soil Contamination
- 3.1 Investigation of Small Scale Industrial Site Using Harmful Substances (Inventory Survey in Whole Area of the Country)
- 3.2 Priority Investigation in Hot Spots
- 3.3 Monitoring of Groundwater

4. Designation and Registration of Soil Contamination Sites
- 4.1 Designation of Soil Contaminated Sites
- 4.2 Registration of Soil Contaminated Sites

5. Action Preventing Health Damage by Soil Contamination
- 5.1 Procedure of Mitigation for Soil Contamination
- 5.2 Request of Mitigation Fee of the Soil Contamination
- 5.3 Cancelling of designation by Completion of Action
- 5.4 Assistance of the State

6. Authorisation of Soil Survey and Chemical Analysis Institutes

6.1 Soil Survey Institute
- Standard of the Authorisation
- Registration, Change and Abolition of the Business

6.2 Chemical Analysis Institute
- Standard of the Authorisation
- Registration, Change and Abolition of the Business

7. Miscellaneous Provisions
- 7.1 Reporting and Inspection
- 7.2 Consultation
- 7.3 Request for the Presentation of Documents, etc.
- 7.4 Promotion of Research, etc.
- 7.5 Raising Awareness of Soil Contamination
- 7.6 Relevant Regulations, etc.

8. Punitive Provisions

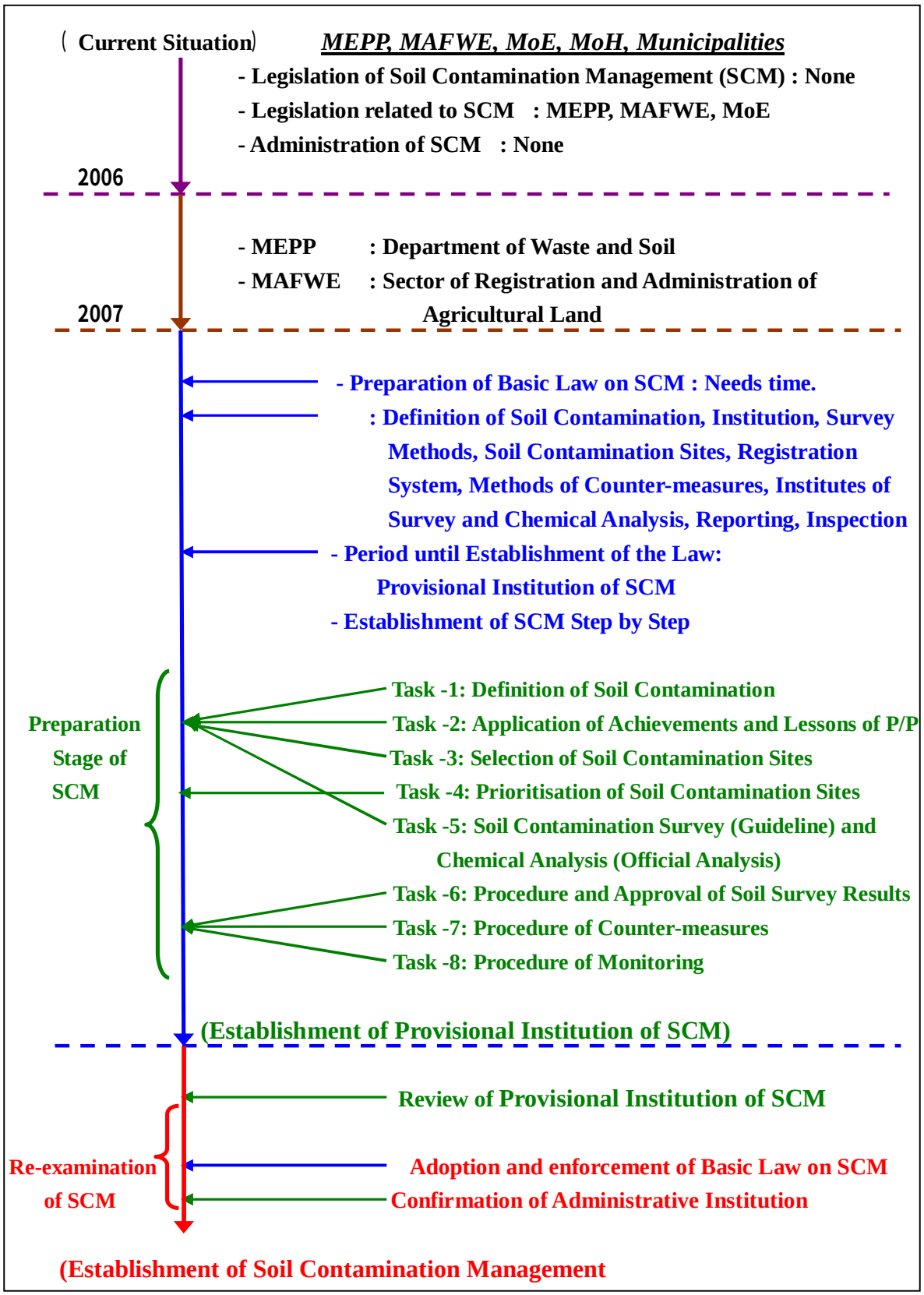


Figure 9.5 Process for Establishment of Soil Contamination Management

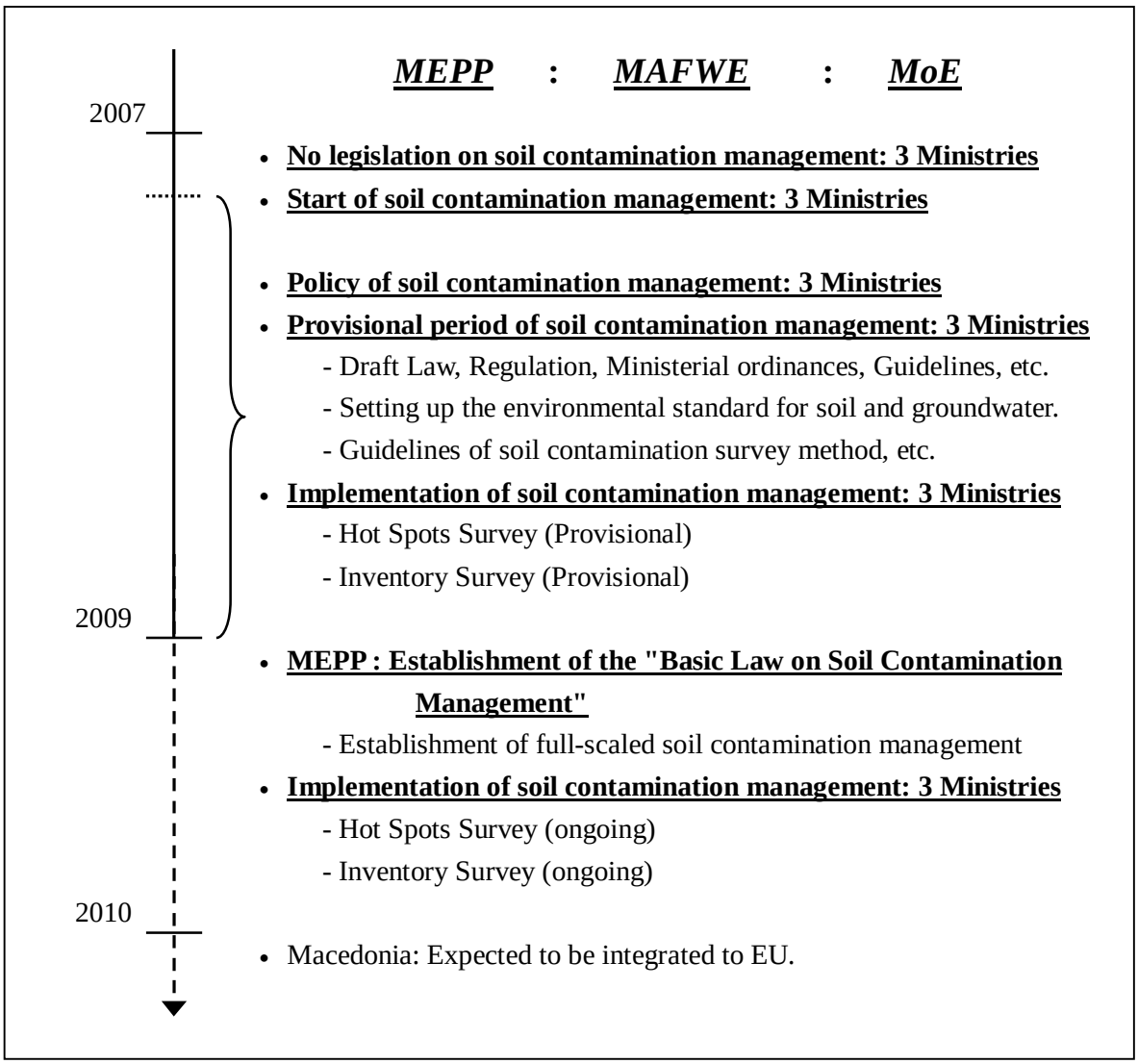


Figure 9.6 Process of Soil Contamination Management

b. Provisional Soil Contamination Management in MEPP

Although MEPP needs to start developing the Basic Law on Soil Contamination Management, it is necessary for MEPP to take provisional actions (e.g preparation of ordinances and guidelines) for starting and operating the soil contamination management as soon as possible. The ordinances and guidelines should be discussed in the WG-SCM (with MAFWE, MoE, MoH, etc.) before they are established.

The provisional law and/or additional ordinances and guidelines are likely to consist of the following items.

- Act or Regulation on provisional soil contamination management
  - Purposes
  - Scope
  - Soil contamination management and responsibility
  - Definition of soil contamination
  - Polluter Pays Principle
  - Method of finding contaminated soil sites
  - Soil contamination survey method
  - Appropriate counter-measures method of soil contamination
  - Others
- Setting up the Environmental standard for soil and groundwater
  - Content and elution values of soil
  - Content value of groundwater
- Guidelines
  - Guideline of soil contamination survey method
  - Guideline of counter-measures method of soil contamination

The member of Working Group of SCM consists of the following.

- MEPP
- MAFWE
- MoE
- MoH
- MLSG (Ministry of Local Self-Government; representative of municipalities)

Consequently, MEPP should prepare the legal framework concerning institution level at the beginning, because there is no existing legislation so far on SCM.

c. Provisional Soil Contamination Management in MAFWE

MAFWE is responsible for the implementation of the "Law on Agricultural Land" as its basic law. Particularly, Article 31, as shown in Box 9-2, includes the protection of agricultural land against pollution and contamination for human health, food production, soil, etc. and to prohibit the release of damaging substances into the soil and define their maximum permitted concentration in the soil. Therefore, MAFWE has a responsibility to protect agricultural land and should manage soil contamination for the agricultural land.

Box 9-2

Law on Agricultural Land

Article 31: Protection of the agricultural land against pollution and contamination is carried out for the purpose of healthy food production, protection of public health, protection of animals and plants, and undisturbed exploitation and protection of the nature and environment. Protection of the agricultural land against pollution and contamination is done by prohibiting, limiting and preventing a direct carrying in of damaging substances into the soil, through the water and air, and also by taking up other measures for preserving and improving the soil productivity. The Minister of Agriculture, Forestry and Water Economy determines, the substances which are damaging for the agricultural land, defines their maximum permitted concentration in the soil and prescribes the measures to be taken if their concentration in the soil is higher than permitted.

It is necessary for MAFWE to establish provisional ordinances and guidelines for the provisional soil contamination management. The ordinances and guidelines should be discussed in the WG-SCM before they are established and they should be consistent with the provisional ordinances and actions of MEPP. The additional ordinances and guidelines following "Law on Agricultural Land" of MAFWE should consist of the following items.

- Regulation on soil contamination management
  - Purposes
  - Scope
  - Soil contamination management and responsibility for agricultural land
  - Definition of soil contamination for agricultural land
  - Polluter Pays Principle
  - Method of finding contaminated soil sites (same as method of MEPP)
  - Soil contamination survey method (same as method of MEPP)
  - Appropriate counter-measures method (same as method of MEPP)
  - Others
- Guidelines
  - Guideline of Soil contamination survey method (same as method of MEPP)
  - Guideline of Counter-measures method of soil contamination (same as method of MEPP)

MAFWE should attend to the Working Group of SCM organised by MEPP for discussing important items of SCM.

Consequently, MAFWE also should contribute to the preparation of the legal framework from the start, because there is no existing legislation so far on SCM.

d. Provisional Soil Contamination Management in MoE

MoE is responsible for the implementations of the "Law on Mineral Resources", which includes articles related to preserving nature and environment in and around mining areas. It is necessary for MoE to set up detailed methods, procedures and monitoring for preservation of the environment against various mining activities. Hence, MoE also needs to establish provisional ordinances and guidelines, however they should be discussed in the WG-SCM before they are established and they should be consistent with the direction of the provisional ordinances and guidelines of MEPP.

The additional ordinances and guidelines of MoE consist of the following items.

- Regulation on soil contamination management
  - Purposes
  - Scope
  - Soil contamination management and responsibility for mining areas
  - Definition of soil contamination
  - Polluter Pays Principle
  - Soil contamination survey method (same as method of MEPP)
  - Appropriate counter-measures method (same as method of MEPP)
  - Others
- Guidelines
  - Guideline of Soil contamination survey method (same as method of MEPP)
  - Guideline of Counter-measures method of soil contamination
    (same as method of MEPP)

MoE should attend to the Working Group of SCM organised by MEPP for discussion concerning important items of SCM.

9.3.3 Institutional Framework of the Soil Contamination Management (SCM)

The soil contamination management (SCM) has objectives to clarify existing soil contamination in Macedonia, to implement appropriate counter-measures for mitigating environmental risk of human health and to prevent further soil contamination in Macedonia.

Therefore, the establishment of effective and feasible institutional frameworks of SCM is presently required to ensure the identification, remediation and prevention of soil contamination in Macedonia.

(1) Institutional Framework of SCM in Each Ministry and Municipality

The Institutional Frameworks of the Soil Contamination Management in each ministry are shown in Box 3, Figure 9.7 and described below.

These organisations are same as members of the "Working Group of Soil Contamination Management (SCM)" (Figure 9.7).

a. Main Relevant Ministry for Soil Contamination Management: MEPP

- MEPP: taking the initiative and in charge of soil contamination management of urban, industrial/commercial areas.

b. Agricultural Land: MAFWE

- MAFWE: taking charge of soil contamination management of agricultural land.

c. Mining area: MoE

- MoE: taking charge of soil contamination management of mining area.

d. Municipalities

- :Municipalities: cooperating with ministries to implement the soil contamination survey of "Hot Spot Survey" in the sites, especially communication with local residents and farmers, etc., taking charge of implementation of soil contamination survey of "Inventory Survey" and taking charge of soil contamination management in each municipality, subject to the support of the relevant ministries.

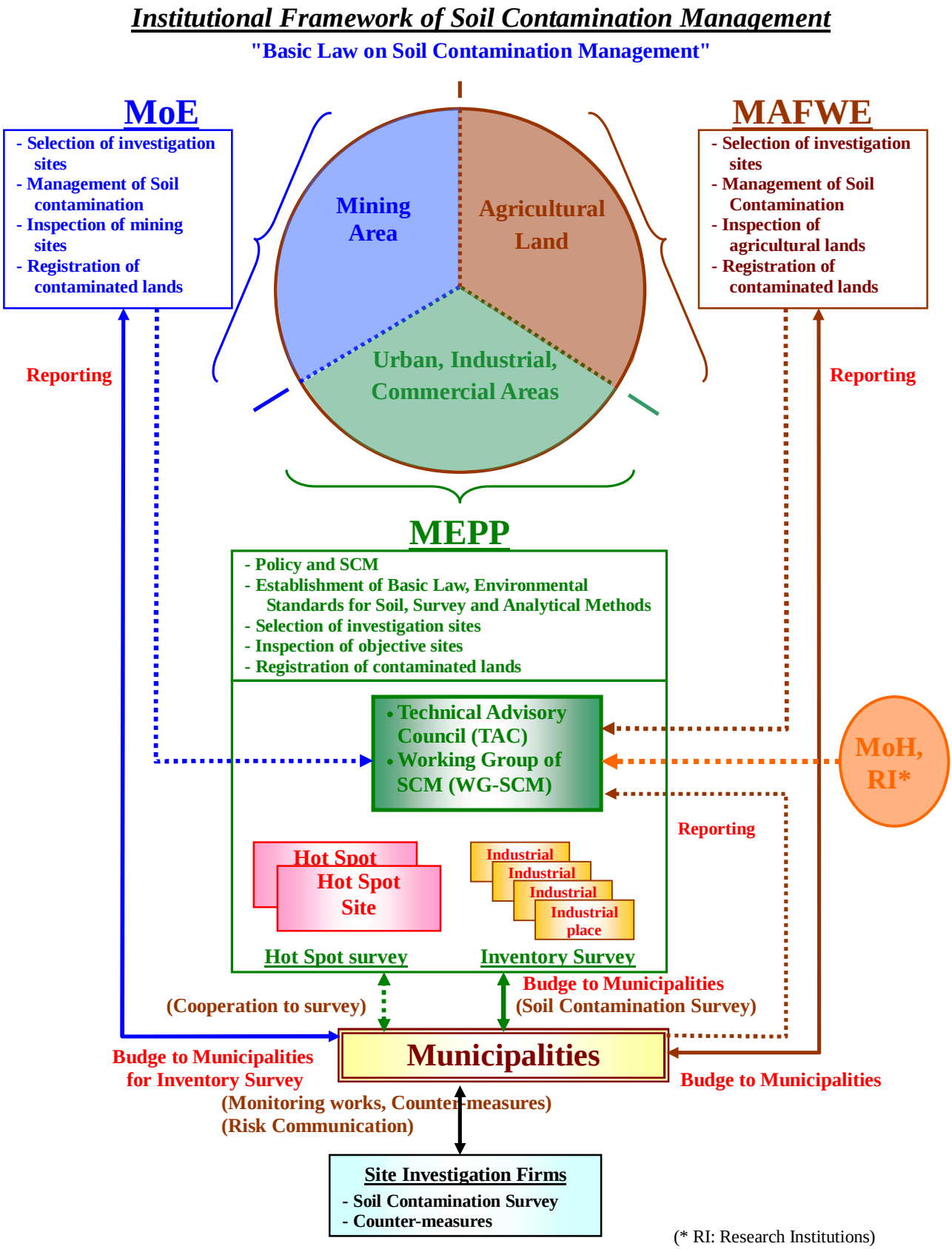


Figure 9.7 Institutional Framework of the Soil Contamination Management

(2) Main Tasks of Institutional Framework of SCM

a. Contents of Tasks for Constructing Institutional Framework of SCM

The main tasks for constructing the Institutional Framework of SCM, consisting of Task -1 to Task -8, are shown in Box 9-3.

Box 9-3

Relationship between Main Tasks of Institutional Frameworks of SCM and "Basic law on Soil Contamination Management"

Main Task		Basic law on Soil Contamination Management
Task -1:	Definition of Soil Contamination	: Chapters 1 and 2
	1) Selection of Harmful Substances Related to Soil Contamination	: Chapters 1, 1.2 and 2
	2) Setting the Environmental Standard for Soil (for heavy metals)	: Chapters 1, 1.2 and 2
Task -2:	Applying of the P/P Survey Results (Review of P/P)	: Chapters 1 to 8
Task -3:	Finding and Selection of Soil Contamination Sites:	: Chapters 2 and 3
	1) Hot Spots Survey: Soil contamination sites	: Chapters 2 and 3, 3.2
	2) Inventory Survey: Whole Area of Macedonia	: Chapters 2 and 3, 3.1
Task -4:	Prioritisation of Investigation Sites for Soil Contamination Surveys	: Chapters 2 and 3
Task -5:	Soil Contamination Survey (Guideline of survey method)	: Chapters 2 and 6, 6.1
	Chemical Analysis (Official Analysis)	: Chapters 2 and 6, 6.2
Task -6:	Reporting of Soil Survey Results	: Chapters 2, 4 and 7
Task -7:	Counter-measures Method of Soil Contamination (for heavy metals)	: Chapters 2 and 5

b. Process of Institutional Level of Capacity Development on Main Tasks

The process of institutional framework of the soil contamination management (SCM), including Task -1 to Task -8, is shown in Figure 9.8. Also, the main tasks of each Ministry on SCM are shown in Figure 9.9.

Each task needs to be discussed adequately step by step in the Working Group of SCM (WG-SCM), facilitated by MEPP. The Environmental Standards for Soil and Groundwater should be discussed in the Technical Advisory Council and WG-SCM. These discussions have been provisionally facilitated during the JICA Study, so that it is more likely that the discussions will be progressed smoothly on an ongoing basis.

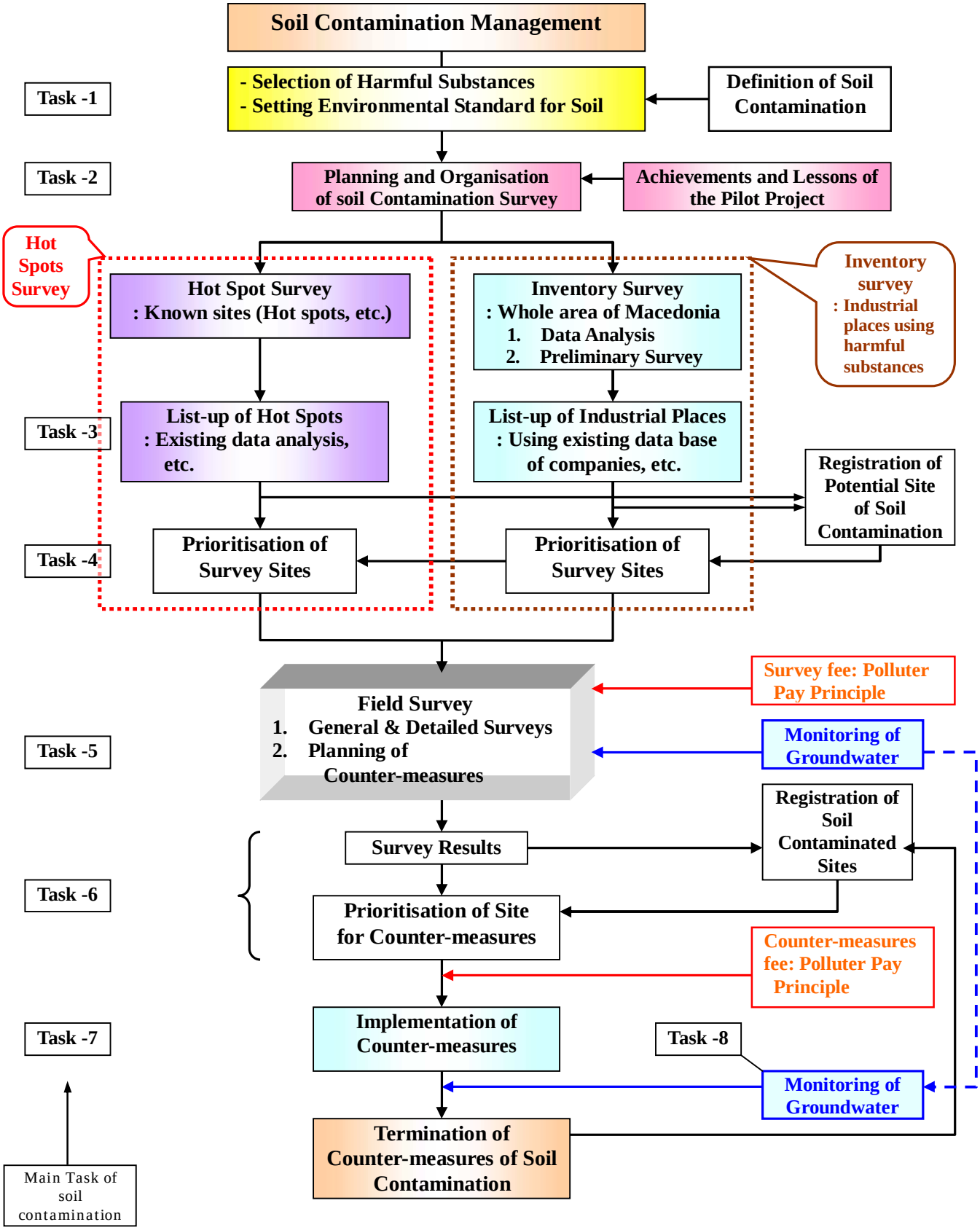


Figure 9.8 Process of Institutional Frameworks of Soil Contamination Management

	Main Tasks	MEPP	MAFWE	MoE
2007	**Task -1:** Definition of SC*1 1) Selection of Harmful Substances Related to SC 2) Setting the Environmental Standard for Soil (for heavy metals)	Main role and conducting WG-SCM *3	WG-SCM	WG-SCM
	Task -2: Applying Achievements and Lessons of Survey Results of the P/P	- ditto -	WG-SCM	WG-SCM
	Task -3: Finding and Selection of SC Sites 1) Hot Spot Survey: SC sites 2) Inventory Survey: Whole area of Macedonia	- ditto -	WG-SCM	WG-SCM
	Task -4: Prioritisation of Investigation Sites for SC Surveys	- ditto -	WG-SCM	WG-SCM
	Task -5: SC Survey Method (Guideline of survey method)	- ditto -	WG-SCM	WG-SCM
	Task -6: Reporting of Soil Survey Results	- ditto -	WG-SCM	WG-SCM
2009	**Task -7:** Counter-measures Method of SC (for heavy metals)	- ditto -	WG-SCM	WG-SCM
	Task -8: Monitoring Method of SC	- ditto -	WG-SCM	WG-SCM
2010	- Establishment of full-scaled SCM*2 1) Hot Spot Survey (Provisional) 2) Inventory Survey (Provisional) 3) Training of Soil and Groundwater Contamination Survey	Approved	Approved	Approved
	- Commence full-scaled SCM 1) Hot Spot Survey (ongoing) 2) Inventory Survey (ongoing) 3) Training of Soil and Groundwater Contamination Survey	Implement	Implement	Implement

*1 SC: Soil contamination

*2 SCM: Soil contamination management

*3 WG-SCM: Working Group on SCM

Figure 9.9 Process of the Main Tasks of Institutional Framework of SCM in each Ministry

(3) Details of Main Tasks of Institutional Framework of SCM

The main tasks for constructing the Institutional Framework of SCM are elaborated below

a. Task - 1: Definition of Soil Contamination

The contaminated soil is defined as the soil exceeding the standard value of soil, and the contaminated soil should be considered to prevent human health. Then, the contaminated soil

should be remediated by appropriate counter-measures as soon as possible.

The definition of soil contamination is in common with each ministry.

1) Selection of Harmful Substances Related to Soil Contamination

Harmful substances related to soil contamination include lead, arsenic, trichloroethylene and other substances which are prescribed by the Ministerial Order, that have the potential to cause damage to human health due to their presence in soil.

Harmful substances related to soil contamination mainly consist of heavy metals, volatile organic compounds, agricultural chemicals, oils and fats, etc.

Soil contamination related to mining is generally caused by heavy metals including at least the 9 components (As, Cd, Co, Cr, Cu, Hg, Ni, Pb and Zn), which were examined in the Pilot Project of JICA Study. However, Mo and Se should be added in order to be consistent with other EU countries as shown in Table 9.1.

In relation to the agricultural land, the definition of maximum permitted concentration of damaging substances is mentioned in the Article 31, "Law on Agricultural Land" as shown in Box 9-2. According to the Law, the MAFWE needs to take necessary actions for soil contamination, including definition of damaging substances and setting up the maximum permitted concentration for food production. However, necessary actions by MAFWE have not been enforced to date.

2) Method for Setting the Definition of Contaminated Soil

There are three methods for setting the definition of contaminated soil. Each method has a general approach based on the risk assessment.

The three procedures are shown below.

Method - 1 : Risk Assessment

(Setting the Reference Value in each Site by Risk Assessment)

: Although the Environmental Standards for Soil are not set, the Reference Value for evaluating whether a soil contamination survey is needed at a site or not is generally set in advance based on the risk assessment by land-use. After the general and detailed soil contamination surveys and risk analysis based on the survey results, a Committee Meeting consisting of near neighbours of the site, environmental consultants, Municipal officers including committee members, land-owners, polluters and other relevant persons as stakeholders, should be

held and the Reference Values for counter-measures, etc. are mainly set based on the risk assessment.

: Implementing countries: U.S.A., Germany, etc.

Method - 2 : Environmental Standards for Soil (Uniformly)

(Setting the Environmental Standards for Soil in Advance)

: The Environmental Standards for Soil are set in advance based on the risk assessment. The soil standards are uniformly adopted to the contaminated sites.

: As the standards are generally targeted at urban areas, the standards are relatively stringent for industrial and agricultural areas.

: Implementing countries: Japan, etc.

Method - 3 : Environmental Standards for Soil Set by Land-use

(Setting the Environmental Standards for Soil by Land-use, etc.)

: The Environmental Standards for Soil are set in advance based on the risk assessment. Several standards in each component are set based on the land-use, etc.

: In case of setting the standards by land-use, etc., meetings of stakeholders are generally held for setting the Target Values (Standards) before counter-measures at the sites based on the data and information of risk assessment.

: Implementing countries: U.K., Holland, Austria, etc.

Method-3 for setting the definition of contaminated soil for Macedonia is recommended in this Study.

3) Setting the Environmental Standards for Soil

Although the Environmental Standards for Soil are generally set by environmental risk assessment using direct exposure pathways between soil and human body, existing standard values of EU, USA, Japan, etc. are different for each country due to geological background, environmental condition, policy, etc.

Setting the Reference Value for definition of contaminated soil in the P/P was discussed through the Technical and Steering Committees meetings of the Study.

Through the Committee Meetings of the Study, the preliminary Reference Values of content concentration (mg/kg) in the soil were tentatively set for evaluating soil contamination in the P/P area. The nine components consisting of As, Cd, Co, Cr, Cu, Hg, Ni, Pb and Zn and their Reference Values, suggested through results of discussion in the (technical) meetings, are shown in Box 9-4.

Table 9.1 Environmental Standards of Soil in EU Countries

No.	Metal Element		Holland	England	Germany	Austria	Remarks (P/P*2)
			Content	Content *1	Content	Content	
			mg/kg	mg/kg	mg/kg	mg/kg	
1	As		29	20 - 500	25	20	25
2	Ba		200	-	-		-
3	Cd		0.8	1 -1400	10	1	10
4	Co		20	-	-	50	20
5	Cr	Cr (VI)	-	130 - 5000	-	-	-
		T-Cr	100	-	200	100	200
6	Cu		36	-	-	100	125
7	Hg		0.3	8 - 480	10	5	3
8	Mo		10	-	-	5	-
9	Ni		35	50 - 5000	70	60	70
10	Pb		85	450 - 750	200	100	100
11	Se		-	35 - 8000	-	5	-
12	Zn		140	-	-	300	140
13	V			-		50	-
14	Tl			-		1	-

*1: Soil Guideline Value (SGV):Content value is decided by land-use.

*2: Reference value in the Pilot Project of JICA Study.

Box 9-4

Reference Value for Soil

Items	As	Cd	Co	Cr	Cu	Hg	Ni	Pb	Zn
Reference Value for Soil **- Content -** (mg/kg)	25	10	20	200	125	3	70	100	140

Items	As	Cd	Co	Cr	Cu	Hg	Ni	Pb	Zn
Reference Value *1 for Soil **- Elution -** (mg/L)	0.03	0.01	0.1	0.05	0.2 (*2)	0.0002	0.05	0.01	0.1

*1: The Reference Value for elution of soil is the same value as the Macedonian Water Quality Standard.

*2: Reference Value of Cu (0.01mg/L) in the Macedonian Water Quality Standard was amended to 0.2 mg/L, being same level of Zn value.

Although the Environmental Standard for Soil of Macedonia needs to be developed consistent to future EU Directives concerning soil contamination policy, it is important to set up affordable and viable soil standards for Macedonia. The "Technical Advisory Council (TAC)" is recommended for development and establishment of the Basic Law on Soil Contamination Management, Environmental Standard for Soil, etc. Also MEPP should organise the "Technical Advisory Council" and appoint the MAFWE, MoE, MoH and relevant organisations as permanent members as well as other members of the "Technical Committee" of the JICA Study.

The Environmental Standard for Soil is common to each ministry, therefore the standards should be officially discussed in the "Technical Advisory Council (TAC)" and "Working Group of SCM (WG-SCM)".

b. Task - 2: Applying the Pilot Project Survey Results (Review of P/P)

The main purposes of the P/P are to understand the situation of soil contamination in the P/P area and for use as a case study for understanding the situation of the other similar mine areas in Macedonia. Hence, the experiences, achievements and lessons obtained from the P/P have been used for formulating the Master Plan on soil contamination management.

The experiences of the Pilot Project consist of basic concept of the soil contamination, survey planning, general and detailed field surveys, drilling survey, surface water and groundwater survey, crops survey, integrated analysis of survey results, risk assessment, risk communication, examination of counter-measures, etc., discussions in the Working Groups on soil contamination survey, Workshops, etc. These experiences were obtained together with cooperation of MAFWE, MEPP, MoE, HSZ, Probistip Municipality, survey consultants, laboratories, etc.

Although the main achievements and lessons acquired through the P/P are discussed in Chapter 8, they are summarised below.

1) Achievements of the P/P

- **Technical Aspects**

- Methods of Soil Survey

In the P/P, the soil survey was conducted, systematically, by grid survey with narrow down method, reducing the size of target by reducing the size of grid. The sampling was conducted by five points mixing method and sampling sites were determined by GPS (Global Positioning System).

- Understanding of Soil Contamination

For the soil contamination survey, it is very important to consider various aspects of the survey area,

such as topography, hydrology, land use and existing facilities, all through the survey stages. For soil with high heavy metal concentrations not only human causes but also natural causes must be considered.

- Groundwater Contamination

Groundwater contamination in the P/P area was anticipated from topographic and hydrological features at the beginning, and groundwater contamination extending over nearly the whole area of the P/P, was revealed by the P/P survey. Groundwater contamination usually has a close relation with soil contamination.

- Crops Survey

In the P/P, wheat with Pb concentrations exceeding standard value were found and the concentrations of Pb in wheat seem to be not related to Pb concentrations of the soil. It is necessary to pay attention to concentrations of heavy metals in crops in and near the area of potential soil contamination.

- Risk Assessment

The soil contamination in the P/P area was effectively assessed by exposure risk and agriculture risk.

- **Social Aspects**

- Establishing Cooperative Organization for Survey

It is quite important to establish a cooperation network as well as to organise the survey team. In the P/P, at the start of actual survey work, a cooperation network was established with staff of Probistip Municipality and local staffs of MAFWE by the strong support of the Mayor of Probistip.

- Participation of Local Residents to the Survey

During the P/P survey, it was organized for local residents to have opportunities to joining the actual survey. This was particularly effective for raising awareness of soil contamination and they could learn various aspects of the survey methods.

- Survey Considering Social Aspects

The social environmental survey should be conducted at the preliminary stage of study, so that the collected information can be used for planning and analysis of soil/groundwater survey.

- Risk Communication

Risk communication is very important for local residents to understand the potential risks caused by harmful substance and necessary counter-measures must be discussed among stakeholders.

- Organising Working Group

Through the course of implementation of the P/P, a working group was organised for management of the soil contamination survey, the Action Plan and the Master Plan, and fruitful discussions were attained in regular meetings.

- Workshop and Seminar

The workshops and seminars held during the P/P were very beneficial occasions for exchanging opinions and sharing information among all of the stakeholders. These were one of the main opportunities for disclosing the actual results of the P/P and risk communication to stakeholders.

2) Lessons of the Pilot Project

- **Technical Aspects**

-Method of Soil Survey

In a normal area of soil contamination, narrow down method of two stages seems to be enough for efficient evaluation of the contamination situation of the area. Survey plan, depending on the situation of land use, should be made to obtain better information on the soil contamination.

- Efficient Survey Work

Survey work must be conducted efficiently using GPS (Global Positioning System) and GIS (Geographical Information System).

- Natural Causes

Natural causes should be considered when soil has a high concentration of certain elements, which are not a result of human activity.

- Groundwater Survey

It is recommended to include the groundwater survey in parallel to the soil contamination survey, particularly, for the area where groundwater contamination is anticipated from topographic and hydrological features.

- Crops Survey

If there is potential of contamination of heavy metals in certain areas, crop surveys with similar amount of sampling to the soil survey should be planned over agricultural land from the beginning.

- Risk Assessment

Since risk assessment using the reference values of soil was very meaningful approach for understanding soil contamination, definition of soil contamination including reference value should

be discussed and established following EU policy of soil contamination.

- **Social Aspects**

- Establishment of Cooperative Organisation for Survey and Role of Local Municipality

To carry out a large scale soil/groundwater contamination survey, it is quite important to establish a cooperation network as well as to organise the survey team consisting of local municipality and central governmental institutions. The local municipality plays a key role for communication and risk communication between stakeholders, polluters and contamination survey team

- Responsibility of Contamination

The present government should accept responsibility of taking counter-measures of contamination caused during the former Yugoslavian age, and soil/groundwater contamination which may occur from now should be treated by the Polluter Pays Principle.

- Risk Communication

A polluter should keep information sharing with local administration and local people, and should maintain risk communication.

- Organising Working Group

In soil/groundwater contamination survey, it is important to organise a working group as an inter-ministry meeting consisting of staff in-charge of the soil/groundwater contamination.

- Workshop and Seminar

It is recommended to hold workshop or seminar in the future survey, particularly for a survey of large scale, at the end of major steps of each survey, for exchanging opinions and sharing up-dated information among stakeholders

c. Task - 3: Finding and Selection of Soil Contamination Sites

The characteristics of soil contamination in Macedonia show two features, namely known relatively extensive soil contamination, so-called "Hot Spots", and scattered soil contamination potentials in urban and industrial areas, a small scale contamination in the business places. The "Hot Spots" are generally characterised by large-scale potential of soil contamination associated with extensive air pollution (mainly dust), water contamination and groundwater contamination. Hence, the Hot Spot Survey of soil contamination is a relatively urgent matter, because large-scale impacts to human health and the environment by harmful substances are likely.

On the other hand, a small scale contamination of industrial places using harmful substances is generally characterised by a relatively small to medium scale potential of soil contamination. The

Inventory Survey should be implemented step-by-step after a list of the industrial places using harmful substances is developed and prioritisation of the sites.

The procedure of finding and selection of soil contamination sites and site investigation of both cases is described in Chapter 10.

d. Task - 4 : Prioritisation of Investigation Sites for Soil Contamination Surveys

After the List of the Hot Spot Survey and the results of the preliminary survey of Inventory Survey are completed, both survey results need to be evaluated for the planning of the next surveys. Then, priority is given to the contaminated areas.

1) Hot Spot Survey

The criteria of prioritisation of Hot Spot sites is described as below.

(Prioritisation of Hot Spot sites)

1) Result of the environmental risk assessment
   - Size of soil contamination area
   - Maximum and average concentrations of harmful substances
   - Size of influence area to downstream
2) Number of people influenced by soil contamination
3) Size of agricultural land and amount of agricultural crops, etc. influenced by soil contamination
4) Evidence of water and/or groundwater contamination with harmful substances
5) Other remarks

2) Inventory Survey

The criteria of prioritisation of Preliminary survey sites is described as below.

(Prioritisation of Preliminary survey sites)

1) Evidence of using harmful substances
   - Volume of harmful substances used
   - Period using harmful substances
2) Using harmful substances, but small quantity and/or short period
3) Business site generally using harmful substances (even if not reported.)
4) Other remarks

e. Task - 5: Soil Contamination Survey (Guideline) and Chemical Analysis (Official Analysis)

The Task 5 consists of the soil contamination survey and the chemical analysis. After establishing the Task 5, the soil contamination surveys in the whole area of Macedonia will be started in accordance with the priority established by Tasks 3 and 4. The results of the survey will be analysed in the procedure of the Task 6.

1) Soil Contamination Survey

The soil contamination survey method is developed by the WG-SCM at the same time as Tasks 1 to 3 and the draft is prepared. The draft is discussed by TAC and the soil contamination survey method is established and authorized. The soil contamination survey method consists of the Existing Data Analysis (called as Phase 1 Survey), General Survey (called as Phase 2-1 Survey) and Detailed Survey (called as Phase 2-2 Survey) as shown in Figure 9.10 and Box 9-5. The institute of soil contamination survey must be authorised and registered.

The institute authorised by MEPP conducts the soil contamination survey. In accordance with the guideline, the procedures of authorisation, registration, amendment and abolishment of soil contamination survey institute are conducted by MEPP based on capability of conducting the survey with enough accuracy and confidence.

2) Chemical Analysis

The chemical analysis included in the soil contamination survey consists of soil content analysis, soil elution analysis, water analysis and crop analysis. The methods of the official analysis of these are necessary to be established and the institute of chemical analysis must be authorised and registered.

The institute authorised by MEPP conducts the chemical analysis related to soil contamination. In accordance with the official analysis, the procedures of authorisation, registration, amendment and abolishment of chemical analysis institute are conducted by MEPP based on capability of conducting official chemical analysis with enough accuracy and confidence.

Box 9-5

Soil Contamination Survey Method

(1) Existing Data Analysis: Collection and analysis of data and information concerning usage of harmful substances in the site.

1. Whole area of Macedonia: Inventory survey (Monitoring survey).
2. Individual site: Prioritisation and list-up by "Checklist Method".
   Checklist: see Box 9- 6.

(2) General Survey: Surface soil survey and Groundwater survey using existing water wells.

1. Soil and water sampling and analyses of content and elution tests.
2. Confirmation of contaminated soil area of surface.
   General Survey
   Evaluation of General Survey

(3) Detailed Survey: Drilling survey.

1. Drilling, sampling and chemical analyses of content and elution.
2. Confirmation of contaminated soil area in three dimensions.
   Detailed Survey
   Evaluation of Detailed Survey

(4) Chemical Analysis: Soil (content, elution), surface water, groundwater, and Crops

(5) Analysis of the Survey Results: Soil and groundwater contamination mechanism and formulation of counter-measures.

(6) Risk Assessment: Risk analysis and assessment based on the land-use.

(7) Reporting of Soil Contamination Survey: Evaluation and Registration.
Reporting: Summary Report: see Table 9.2.

(8) Designation of Soil Contamination Site: Instruction (order) of counter-measures of soil contamination.

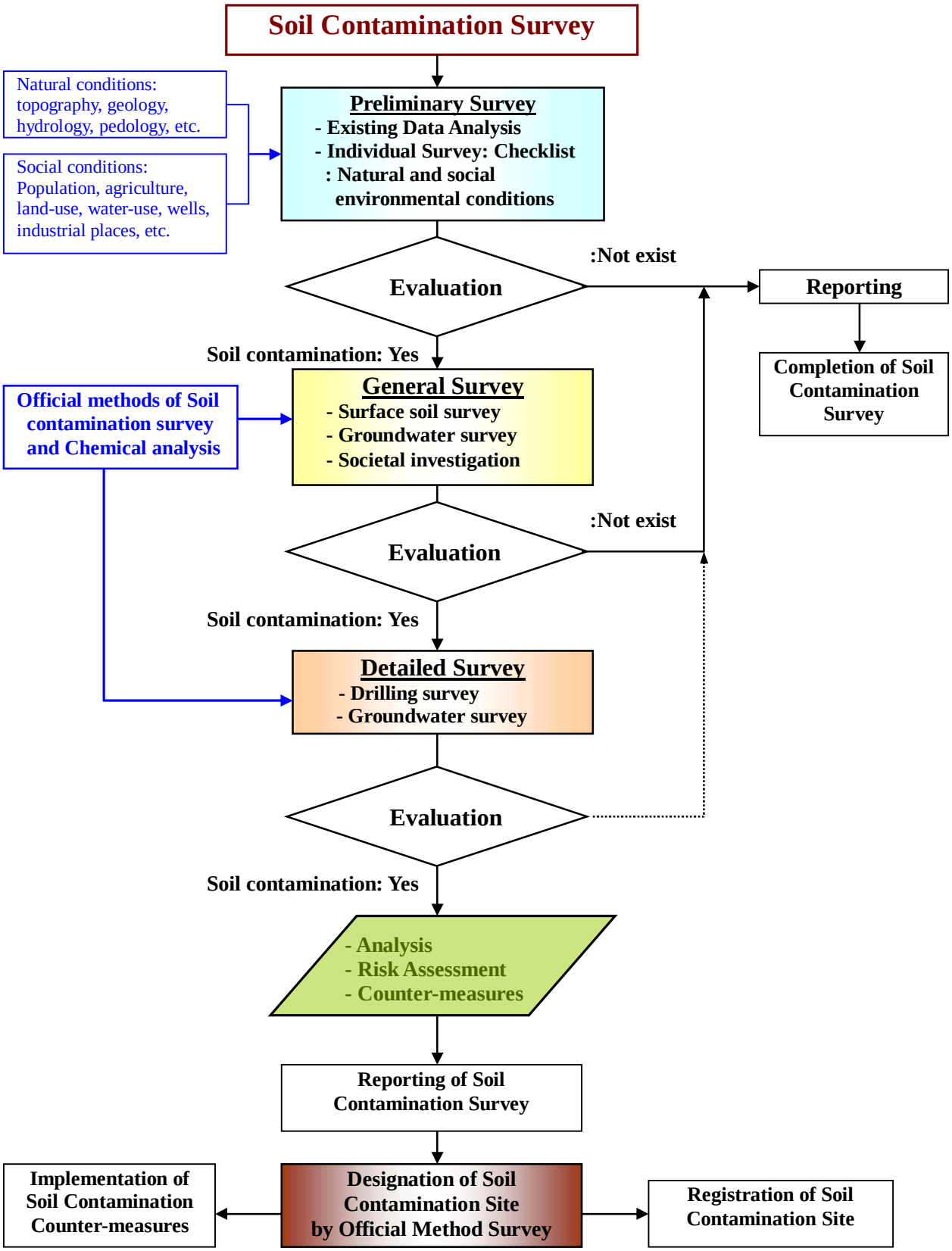


Figure 9.10 Flow of Soil Contamination Survey Method

Box 9 - 6

Outline of Checklist of Preliminary Survey for Soil Contamination (example) 1.

(1) General Information of the Site

Item - 1	Description	Point*
1. Name of firm		
2. Address, location		
3. Sector, type of business		
4. Number of employee		
5. Period of operation (year)		
6. Total area, area of factory, offices, etc.		
7. Production, etc.		
8. Water supply in the site: Drinking water, industrial water, water wells, etc.		
9. Others (maps, etc.)		

* point: Evaluation of using harmful substances in the objective site.
(Evaluation: 3+, 2+, +, 0)

(2) Natural Condition

Item - 2	Description	Point
1. Topographic features		
2. Geologic features - Lithology, structure, etc.		
3. Hydrological condition - Surface water, groundwater, etc.		
4. Vegetation		
5. Landscape, etc.		

(3) Environmental Condition

Item - 3	Description	Point
1. Drainage System: System, volume of waste water (m^3/d)		
2. Waste Water: Water treatment plant, quality and quality of waste water, etc.		
3. Solid Waste: Volume and quality, etc.		
4. Exhaust Gas: Volume, quality, etc.		
5. Monitoring Results of Surface Water		
6. Monitoring Results of Groundwater		
7. Records of Environmental Accidents, etc.		
8. Survey results: Soil, water, air, etc.		
9. ISO 14001, etc.		

(4) Usage of Substances, including Harmful Substances

Item - 4	Description	Point
1. Usage of Harmful Substances: Objectives, kind, quantity, period, etc.		
2. Production of Harmful Substances: Objectives, kind, quantity, period, etc.		
3. Storage of Harmful Substances: Objectives, kind, quantity, period, etc.		
4. Records of Usage of Harmful Substances		
5. Others		

Outline of Checklist of Preliminary Survey for Soil Contamination (example) 2.

(5) Social Condition

Item - 5	Description	Point
1. Administrative district		
2. Population		
3. Official facilities		
4. Urban and rural conditions		
5. Land-use		
6. Water-use,		
7. Natural and historical heritages		
8. Others		

f. Task - 6: Reporting of Soil Survey Results

An example of summary report of the results of soil contamination survey is given in Table 9.2.

Table 9.2 Summary Report of Soil Contamination Survey Results

Item	Description
1. Name	
2. Address	
3. Sector	
4. Reason for implementing survey	
5. Survey period	
6. Survey results	
a) Concentrations of each contaminant (Survey date, measurement method)	
b) Location of contamination (Diagram and detailed diagram within site)	
c) History of use of contaminants	
d) Reasons for selection of survey points	
e) Danger of impact on surrounding area	
7. Counter-measures (if contamination exists.)	
a) Method of counter-measures and reasons for selection	
b) Counter-measure period (planned)	
c) Monitoring framework	
8. Other matters (attach documents describing the state of contamination)	

Finally, soil contamination sites in whole area of Macedonia should be registered in the Soil Contamination Ledger as shown below.

- **Contents of Soil Contamination Ledger**
  - Registration number
  - Date of registration
  - Description of soil contamination
  - Mitigation plan of on the site
  - Reference documents (Report on Soil contamination Survey, Analytical Data, etc.)

g. Task - 7: Counter-measures Method of Soil Contamination

1) Procedure of Counter-measures for Soil and Groundwater Contamination

There are two types of counter-measures, namely temporary and permanent counter-measures. To the soil and groundwater contamination clarified by the General and the Detailed surveys, if permanent counter-measures can not be carried out immediately, temporary counter-measures should be carried out to reduce the impact of contamination on the surrounding environment.

The procedure of counter-measures is shown in Figure 9.11.

2) Temporary Counter-measures

Temporary counter-measures can be broadly divided into two counter-measures; one is to prevent intake of heavy metals by humans and the other is to prevent the spreading of contamination. The latter can be classified into three counter-measures as given below.

- Counter-measure to prevent contamination of groundwater and public water areas by contaminated soil.
- Counter-measure to prevent atmospheric dispersion of heavy metals.
- Counter-measure to prevent the spreading of contaminated groundwater.

Implementation of temporary counter-measures must be conducted choosing appropriate counter-measure by giving consideration to the circumstances of the surrounding area.

3) Permanent Counter-measures

The target of permanent counter-measures related to soil contamination by heavy metals, etc. is to ensure that infiltration of heavy metals by rainfall does not result in the spreading of contamination to the soil and groundwater to surrounding areas in the future. Although it is desirable that heavy metals are removed (separation of heavy metals, etc. or decomposition of compounds) from the contaminated soil, at least they should be separated from the surrounding environment.

The process of implementation of permanent counter-measure is shown below.

- Introduction of counter-measure methods for soil contamination.
  (For cases of Heavy metals)
  - Cutting off by excavation
  - Insolubilisation of heavy metals
  - Covering by fresh soil, asphalt, concrete, etc.
- Implementation of counter-measures for soil contamination.
- Confirmation of completion of counter-measures.

h. Task - 8: Monitoring Method of Soil Contamination

The purposes of monitoring work are to understand the condition of soil and groundwater contamination in the specific area, to understand the (unknown) regional soil and groundwater contamination and to confirm the completion of counter-measures.

9.3.4 Information Management on Soil Contamination

The information concerning soil contamination management generally consists of the following items.

- Official procedure of soil contamination survey, counter-measures and monitoring;
- Results of soil contamination survey, counter-measures and monitoring;
- Official registration of soil contamination sites;
- Official data base on soil contamination; and
- Others.

Information management on soil contamination is an important part of SCM for disclosing accurate information to the public at an appropriate time.

Disclosing information on soil contamination survey and counter-measures should be implemented by the method of risk communication which is described in Section 9.4.

Also, all the results of the soil contamination survey, counter-measures and monitoring should be officially recorded and managed by data base using GIS (Geographical Information System) in each ministry and office. Data and information of survey results in the P/P in Probistip were compiled as GIS data for a case study.

Case Study: GIS Data in the Pilot Project

The data concerning soil contamination collected in the P/P and actual situation in the whole area of Macedonia, as shown below, were compiled as GIS data.

- Content and elution values of 400m, 200m, 100m and 50m grids soil (Heavy metals)

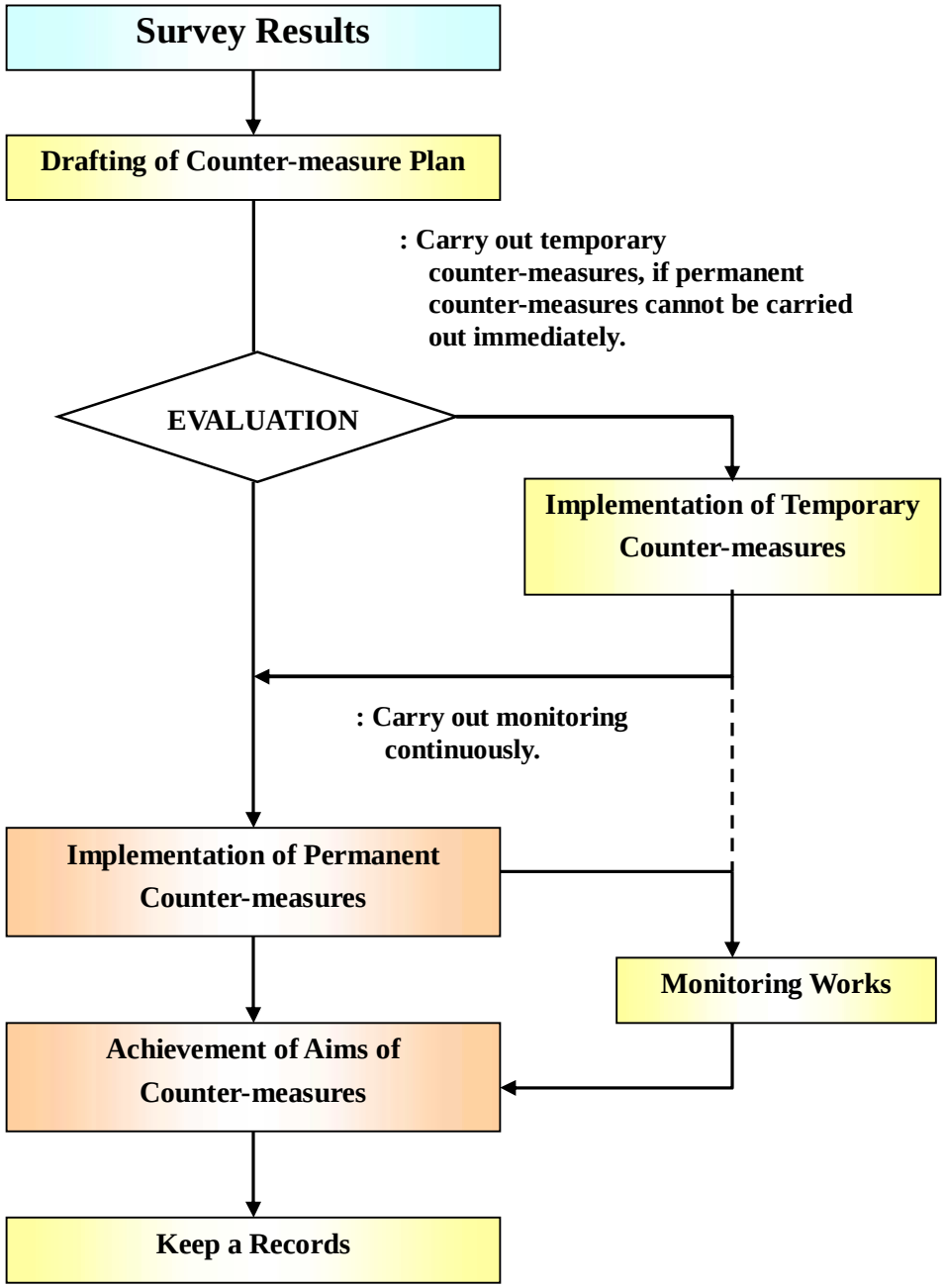


Figure 9.11 Procedure of Counter-measures for Soil/Groundwater Contamination

- Water quality of surface water and groundwater (Heavy metals)
- Factor analysis results and environmental risk distribution map
- Environmental data in and around mine areas of Macedonia

These soil surveys and data collections will be continuously carried out in future. It is desirable for the data and information obtained by the soil contamination surveys to be used for the inter-ministerial exchange of soil contamination information under the new framework of soil contamination management in Macedonia.

In case of compiling, analysing soil contamination data and inter-ministerial exchanging of them, GIS data base is likely to be most appropriate information system. The content of "GIS Data Base of Soil Contamination" is described in Section 9.5.

9.3.5 Financial Management Framework for Soil Contamination management

Since the preliminary survey of the Hot Spot and monitoring can be done with relatively low cost (calculated to be approximately Eur 280,000, Chapter 10 in the Main Report), these must be done by the regular state budget. The cost of these works should be allocated in the annual state budget of after 2008. Many counter-measures for soil contamination are expensive and the issue of funding mechanisms for the management of soil contamination is very important. It is essential to develop and agree a framework for the funding of counter-measures.

Many of the soil contamination management problems in Macedonia are historical, and the pollution was caused many years ago by state-run companies. Following the polluter pays principle, the liability for this contamination therefore lies mainly with the Government Ministries, and the Government funding of counter-measures is needed.

(1) Key Principles

The key principles for the development of the financial management framework for soil contamination management are:

- The affordability of counter-measures is very important related to soil contamination management because many technical counter-measures are very expensive. Affordability must be taken into account when planning counter-measures and planning financial mechanisms.
- The implementation of counter-measures will need to be taken on a step-by-step basis over a number of years, because of the measures are expensive.
- The prioritisation of soil contamination areas/hot spots is important so that the available finance is spent on the high priority areas that have the highest potential public health impacts.
- As part of the prioritisation, it is important that the most cost-effective counter-measures are implemented first.

- The budget of the Government/Ministries in Macedonia have many other priorities and at present soil contamination management is a low priority for budget expenditure. Firstly it is important to implement actions to raise the priority of soil contamination management so that the Government realises the need to allocate budgets to soil contamination management. Actions that should be taken to raise the priority of soil contamination management in the Government of Macedonia include:
  - Development of a Law on Soil Contamination Management. This will act as the main driver for improvement and clean-up.
  - Raising awareness of policy-makers in the Government and relevant Ministries of the importance of soil contamination management.
  - Development of a Master Plan on soil contamination management so that the Government is confident that the problems are being properly monitored and prioritised, which will give the Government confidence that the money will be spent properly on the main problems.
  - Development of the capacity of stakeholders in soil contamination management, including companies that would carry out the mitigation works, as well as the Ministries that will supervise the works. This development of capacity will give the Government confidence that the money will be spent properly.
  - Development of capacity on management of funding mechanisms on soil contamination management. This will give the Government confidence that the money will be administered property.

(2) Proposed Steps to the Master Plan related to Financial Management

The proposed steps to the Master Plan related to financial management are:

- Step 1 : Develop drivers for financial mechanisms/funding.
- Step 2 : Carry out monitoring works to identify problems and priorities for counter-measures.
- Step 3 : Allocate finance for soil contamination counter-measures.

In practice, Steps 1 and 2 would be carried out in parallel, as illustrated in Figure 9.12. These steps cover the aspects outlined in the principles above. The Government is unlikely to agree to allocation of future funds until the points in Step 1 and 2 are implemented, which will identify and highlight good reasons for the funding.

(3) Financing of Soil Contamination Management

The options for financing the cost for soil contamination are limited since these costs will not bring any return and or financial benefit in future. However, for the Government of Macedonia, the following options of raising funds for soil contamination management can be considered.

a. Regular State Budget

Considering the situation of Macedonia, it is very difficult to finance a significant amount from the budgets to the soil contamination management. However, since the three mines, namely Bucim, Sasa and Zletovo have recently started operation, producing crude ore, these mines are now operated under foreign funds and royalties are being paid to the Government of Macedonia against the production of the ores. A greater amount of the royalties could be allocated to the soil contamination management, however the amount of fund from this is considered to be far less than necessary at present.

b. Capital Grants/Long-term Loans from an Earmarked Environmental Investment Programme Budget

These programmes and funds are the usually main sources of state financing for public and private sector environmental investment, primarily in the form of capital grants and soft loans. The funds capacities to provide financial support for investment projects are determined by their available financial resources, and the revenues they receive from pollution fees and other earmarked charges. For the funding the costs of soil contamination management, the possibilities are limited, since no earmarked or dedicates fees or charges to be made to industries exist.

c. Bilateral Co-operation

Many countries, such as Western Europe, the USA and Japan, provide financial assistance and grants to the Balkan countries through bilateral financing institutions and or cooperation agreements. The EU, particularly EAR program, is potential option from which to seek financial aids. This option seems to be the most promising for funding of the costs of soil contamination management including grant and soft loan.

d. Capital Grants from European Union's Instruments for Structural Policies for Pre-Accession Countries (ISPA)

This is the European Union's principal mechanism for providing financial assistance for compliance-related investments in the accession countries. However, it is questionable whether it will apply to soil contamination management, and some joint funding by the government of Macedonia is likely to be an EU requirement.

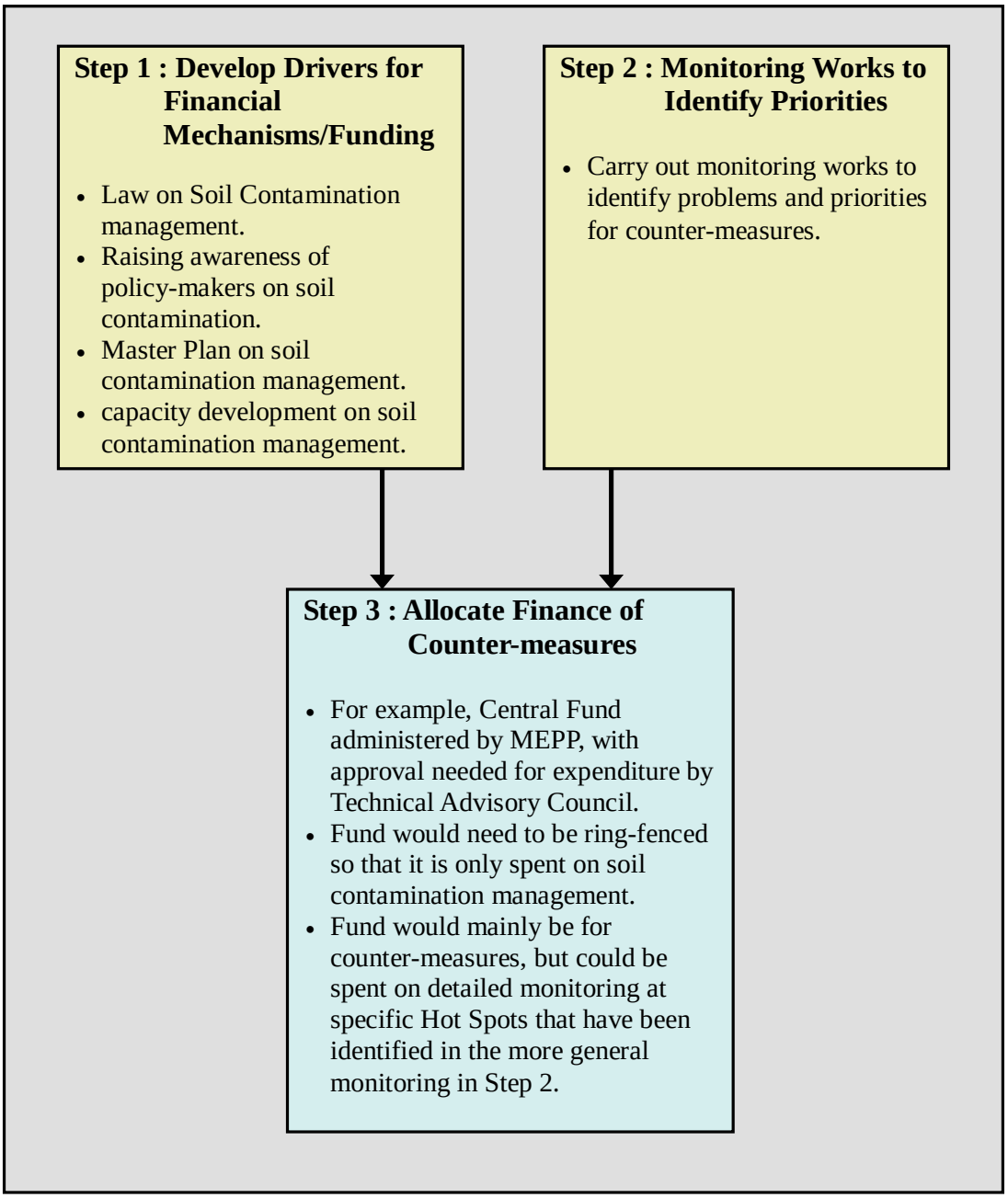


Figure 9.12 Proposed Steps on Financial Management

9.4 Society Level of Capacity Development on Soil Contamination Management

9.4.1 Present Condition at Society Level of Capacity Development on SCM

The society level of capacity development on SCM means the development of the environment and conditions necessary for demonstrating capabilities at the individual or organisational level, and the decision-making processes, etc. necessary for the formulation and implementation of policies, laws and strategies that are over and above any individual organisation.

The society level of capacity development also involves the creation and development of linkages between organisations, particularly ministries, with the aim of enhancing co-operation in the implementation of the Master Plan. This is particularly important for soil contamination management because this cuts across the scope of work of several ministries (e.g. MEPP, MAFWE, MoE and MoH).

Specifically, the society level of capacity development on SCM mainly consists of public awareness, social education concerning environmental aspects, risk communication, resident participation, NGOs, etc. The aim of capacity development at society level is to develop the foundation for changes in culture and working methods so that society and institutions fully understand and participate in improvement plans.

The overall responsibility for tasks to develop capacity, educate and raise awareness on SCM at society level will be with MEPP. The Technical Advisory Council also has an important role, because it will be strategically responsible for strengthening linkages between ministries and other stakeholder organisations.

It is essential that capacity development at society level is planned and implemented within the context of education and awareness-raising on a wider basis within overall environmental management and public health aspects. Apart from communication related to very specific soil contamination aspects or incidents, most education and awareness raising on soil contamination needs to be carried out within the wider context and plans on education/awareness raising on environmental aspects. This is because society will be more receptive to this wider approach.

The main components of capacity development at society level are:

- Public Awareness
- Social Education/Research/Training concerning Soil Environment
- Risk Communication
- Resident Participation
- Others

(1) Public Awareness

The level of public awareness is thought to be relatively low on SCM at present. Particularly, residents of Probistip in the Pilot Project area have very low awareness concerning harmful heavy metals, even if they generally know about soil contamination. Therefore, the residents do not understand the influence of harmful substances including heavy metals. This is clearly important because of the amount of agricultural activities in the area. It is necessary to raise awareness of the residents concerning the influence of harmful substances of heavy metals as well as risk assessment. However, this will need careful planning in Hot Spot areas such as Probistip, where the response of residents to awareness raising activities will be to immediately request solutions. A structured awareness-raising plan is needed, and must be linked to the timescales of actions for counter-measures.

(2) Social Education/Research/Training concerning Soil Environment

Although general public health aspects are well known by education, there is extremely low awareness about soil contamination management. Soil contamination is not included in school and social education. It is necessary to educate concerning the soil contamination as well as risk assessment. However, this education should be carried out within the wider context of education on environmental aspects, covering integrated topics such as water pollution, air pollution and solid waste. In addition, education should take into account linkages between these environmental management aspects and the socio-economic conditions in Macedonia.

The Ministry of Education and Science is an important stakeholder in relation to education on environmental management and soil contamination management.

(3) Risk Communication

Risk communication is important for the good mutual understanding among stakeholders. Particularly, for soil contamination it is necessary to get an understanding from the many relevant residents in the specific cases. At first, it is necessary for the staff of ministries and local staff of municipalities involved in soil contamination investigations to understand the function of the risk communication.

In general, the involvement of stakeholders throughout the measurement programme of soil contamination and implementation of counter-measures provides an understanding of the methods, knowledge of the findings, and consensus and agreement on the conclusions and recommendations for action. Therefore, the approach to consult and communicate with stakeholders will lead to sustainable implementation of the Master Plan and the Action Plans.

In addition, communication on the risks of agricultural activities on contaminated land will reduce the practices that take place and therefore reduce the potential impacts on public health.

As for the risk communication of soil/groundwater contamination of the P/P, the information disclosure to the local people has not yet done, because the counter-measures have not yet been agreed.

Although MAFWE is not a polluter itself, it has a duty to administrate agriculture land as an administrative organization at present, and, therefore, an obligation of information disclosure of the contamination attributes to MAFWE. It is necessary to hold a stakeholder meeting at the earliest occasion to notify stakeholders such as local people, farmers and etc. of the risks of soil contamination, groundwater and agriculture (crops) by harmful heavy metals and to discuss with them concerning counter-measures.

(4) Resident Participation

For the successful implementation of action plans, resident participation is important. For example, actions to carry out extensive investigation (such as in the Pilot Project) require approval from many residents to enter the areas in order to investigate the sites. The participation of residents is linked to the above points on awareness, education and risk communication because these components all encourage resident participation.

(5) Others

There are several NGOs in Macedonia, particularly an NGO concerning bio-diesel is well known. However, it is necessary to promote NGO activities because they can play an important role in capacity development at society level.

9.4.2 Plan at Society Level of Capacity Development on SCM

The present capacity at society level on SCM is thought to be low, so that it is necessary to develop this aspect in future. This section provides an outline plan for capacity development at society level in relation to soil contamination management.

Society Level of Capacity Development on SCM, particularly public awareness, should be written as a component of the Framework Law on SCM.

The set up of strong communication mechanisms is important because soil contamination management cuts across the scope of several Ministries and it will be essential to formalise communication. This will reduce the potential for repetition of work, increase effectiveness, and

keep the ministries focused on the overall priorities. In addition, it will be useful to increase the sharing of information and data.

The team in MEPP that is leading the implementation of the Master Plan will need to act as the focal point for communication and the sharing of good practices, and be proactive in these tasks. For example, activities could include the publication and distribution of informal email newsletters on soil contamination management, and the distribution of more formal reporting on progress in implementation of the Master Plan. These mechanisms will inform stakeholders of what actions are being taken by the different ministries and institutions.

The Technical Advisory Council will also play an important role in encouraging communication between ministries and other organisations on soil contamination management.

As capacity development of society level, it is necessary to make regulations on reporting results of survey and counter-measures of soil contamination, disclosing information based on the registration of soil contamination and stakeholder meeting following the adequate procedures of risk communication.

(1) Public Awareness

It will be important that a strategy for public awareness on soil contamination management is developed by MEPP, taking into account the roles of other Ministries and the municipalities. The strategy should be linked to, or part of, a wider strategy on overall awareness raising on environmental management.

It is essential that specific awareness-raising activities take account of the plans for actions and activities for change. Raising awareness about a particular issue, but then having no means to take action where change is necessary, is a mistake. Ideally, awareness raising activities take place at the same time as actions, and this encourages stakeholder participation.

General awareness raising is important to educate the public and other stakeholders about general environmental and soil contamination issues. Methods for general awareness raising include use of the media (newspapers, TV), posters and fliers, working meetings with community representatives, etc.

The Hot Spot Survey and Inventory Survey on soil contamination in whole area of the country will be commenced after responsibilities are established on soil contamination management as well as the Basic Law on SCM. The relevant ministries, including MEPP, MAFWE, MoE, MoH and MLSG, should announce officially the soil contamination survey results on a regular basis for the public awareness of soil contamination, provided that actions for counter-measures have been

planned and agreed.

(2) Social Education/Research/Training concerning Soil Environment

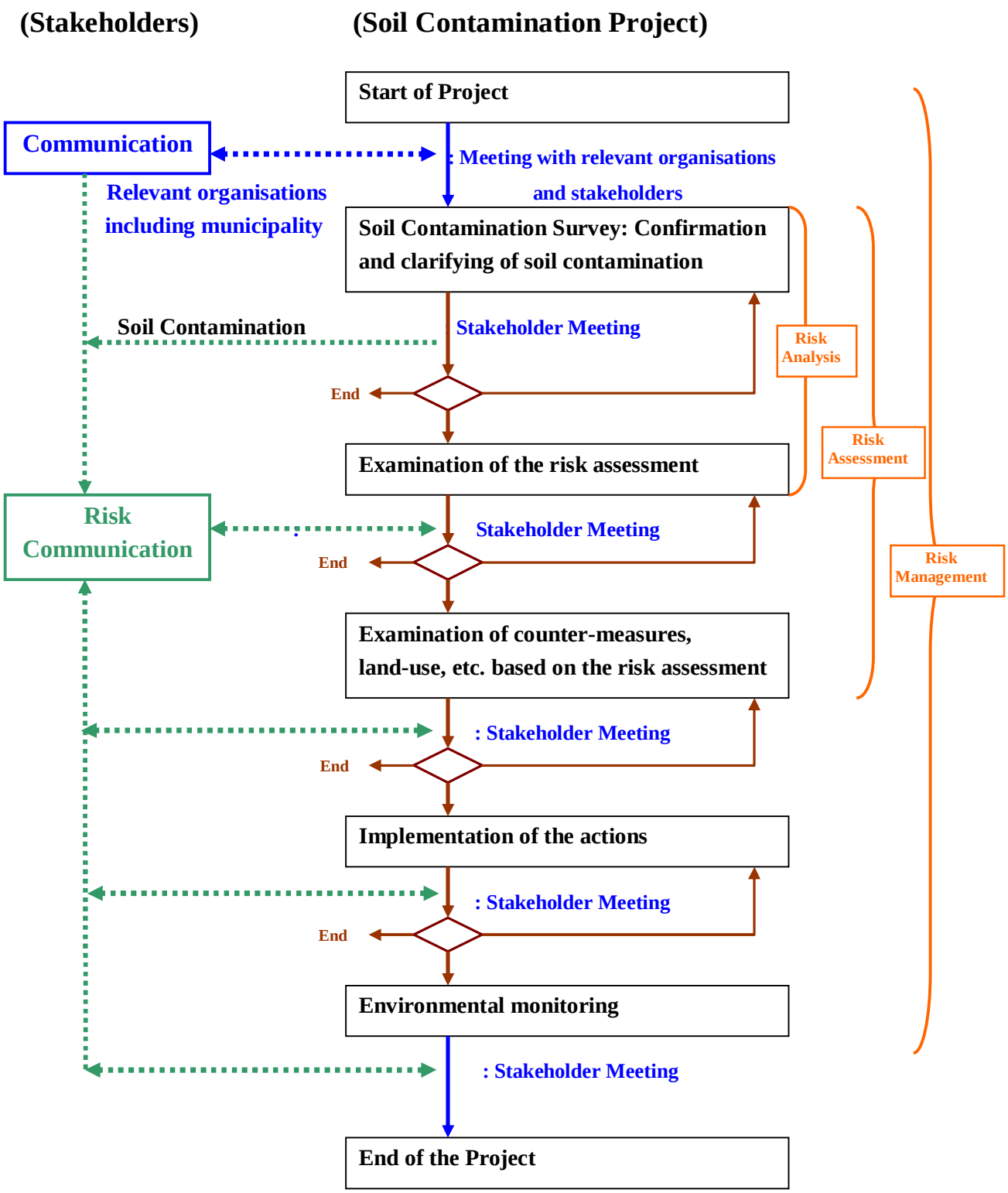
Environmental education and training, including soil contamination, etc., need to be promoted into the school education and social education. These educational components should be integrated into wider education on environmental management in general. MEPP should work with the Ministry of Education and Science to integrate environmental education into the school curriculum on a step-by-step basis.

(3) Risk Communication

At present, the level of awareness is low among communities, farmers and other stakeholders in Macedonia on soil contamination and its potential impacts. The implementation of improvements in soil contamination management needs to include aspects on raising awareness. Risk communication is an important aspect of soil contamination management, and involves the following:

- Provision of timely and accurate information to the community that lives and works in the area of potential soil contamination and to other relevant stakeholders.
- The main information specifies the areas of land that are contaminated and those areas that are not contaminated. It will therefore help to define the areas that are suitable for agricultural activities and the areas that present risks and therefore are not suitable for certain types of agriculture.
- In addition, during monitoring, the communication also provides information to the public and other stakeholders with an overview of the technical methods used in identifying soil contamination, which will give stakeholders confidence in the results and recommendations.
- The risk communication will also provide information on plans for measures to remediate soil contamination and plans to reduce the risk of future soil contamination incidents.

The activities and procedure related to risk communication during the soil contamination survey (the Pilot Project) are shown in Figure 9.13. The communication and risk communication among stakeholders are necessary throughout the implementation of the Master Plan from start to end. The risk communication must be continued from the early stage of clarifying the soil contamination until the last stage of environmental monitoring. Risk communication is a two-way process. The policy-making and decision-making stakeholders, such as the ministries and municipalities, should be communicating with the public, but also listening to the feedback and opinion of the public, and taking this into account in the development of applicable and affordable actions.



(Source: Risk Management Guideline (CAN/CSA Q850-97))

Figure 9.13 Procedure of Risk Communication

In particular, the relevant ministry (e.g. MEPP and MAFWE or MoE), and the relevant municipality in which a soil contamination survey project is located, have an important role and responsibility to organise and manage meetings of risk communication among the stakeholders. It is necessary to develop the capacity of experts for risk communication, particularly related to soil contamination management. The Pilot Project showed that municipality administrations are particularly important in risk communication because the public perception is that they have more access to, and trust in, the municipalities than with ministries.

It is important that risk communication, for example in results of contamination surveys, is not carried out until plans of actions for counter-measures have been developed and agreed by the relevant ministries and municipalities. Experience has shown that the public want to hear about planned actions when they are told about these types of environmental problems by the authorities. The cost of actions will need to be taken into account in development of action plans, so, as shown by the Pilot Project, there can be a delay between the time that monitoring results are known and the time that the results are communicated. The timing of communication is a particular concern to the relevant municipality.

a. Reaction to Environment Risk in the Pilot Project Area

Contamination of soil and groundwater were identified in the P/P area. The results of the risk assessment showed three types of relatively high level of risks confirmed as shown below.

1) Contamination of soil by harmful heavy metals; areas in and around Old/New Tailings Dams and Floatation (Dressing) Plant.
2) Contamination of groundwater by harmful heavy metals: western to southern part of the P/P area (groundwater is used for drinking).
3) Contamination of crop (wheat) by heavy metals: western to southern part of the P/P area.

For those serious risks, it is suggested to hold stakeholder meetings including local residents for disclosing the situation of contamination, learning existence of risk in the P/P area, recognizing risk, discussing risk mitigation, etc.

b. Short Term Suggestion for Risk Communication

For smooth implementation of soil contamination management in Macedonia, it is necessary for Macedonia to enact a ‘Basic Law on Soil Contamination Management’ as soon as possible. However, it will take a considerable time to accomplish adoption and enactment of the law. It is, therefore, necessary to consider temporary (short term) measures for soil contamination during the time before the enactment of the law.

Since at present there is no law to regulate soil contamination in Macedonia, it is suggested that the application of regulations widely accepted internationally such as TDI (Tolerable Daily Intake) of WHO's tolerable exposure amount. It is possible to conduct risk communication setting this value as a target value for risk mitigation.

c. Long Term Suggestion for Risk Communication

After the enactment of the "Basic Law on Soil contamination Management" in Macedonia, the risk communication can proceed according to the law.

Considering the results of the Pilot Project, new sites of contaminations of soil, groundwater and crops will be found elsewhere in Macedonia in future. In many cases, it will be necessary for polluters to take prompt action for disclosing information concerning the situation of contamination. Through a proper procedure of risk communication, the information of contamination should be shared and counter-measures should be discussed among the stakeholders including government organisations, municipalities and local residents.

(4) Resident Participation

Resident participation is connected with above mentioned risk communication, raising awareness and education. In cases of promotion of risk communication, resident participation also will be increased at the same time. The resident participation is an essential component in order to develop soil contamination management in Macedonia.

(5) Others

The development of NGOs has a close relation with the public awareness, risk communication and resident participation. Hence, the development of NGOs is one of good indicators concerning public awareness and resident participation. Communication with NGOs and encouraging their involvement in the planning of actions are important aspects of strengthening the NGOs network.

9.5 Organisation Level of Soil Contamination Management

9.5.1 Present Administrative Organisation for Soil Contamination Management

(1) MEPP

The MEPP has recently restructured and the organisation now includes a Department of Environment. This department has four divisions, including a Division on Waste and Soil. Responsibility for soil has therefore now been properly assigned, and the MEPP plans to recruit three positions in this divition in relation to soil.

The current structure of MEPP is provided in Figure 9.14. The structure of the Environment Agency (Administration of Environment) and the structure of the Sector for Environment (Department of Environment) are shown in Figures 9.15 and 9.16.

There are currently no official roles and responsibilities in relation to soil of the Division on Waste and Soil. Their current roles relate to waste, but there are plans to expand their roles into soil also.

(2) MAFWE

The main roles of the Ministry of Agriculture, Forestry and Water Economy (MAFWE) include agricultural policy, water resource management, agricultural land use, forestry, and rural development. The roles cover policy development and implementation, as well as inspection and monitoring activities (Figure 9.17).

The structure is regularly changed as the Ministry develops its structure to improve the efficiency of its activities and to manage the key aspects related to its remit, and there were some changes to personnel following the election in July 2006.

There are two main elements of the structure of the Ministry:

- The Organisational Units (Sectors), generally responsible for policy development and implementation.
- The Bodies within the Ministry (Inspectorates and Administrations), which are semi-autonomous and generally responsible for inspection and monitoring.

The relevant units/bodies in relation to soil contamination management are:

- Sector for Agriculture
- Sector for Financial Support to Agriculture and Rural Development
- Sector for International Co-operation and European Integration
- **State Agricultural Inspectorate**
- Water Economy Administration

There are some proposals being discussed for changes to the structure of MAFWE, but these still need to be approved. In addition, changes are being considered in the longer-term to the Law on Agricultural Land.

State Agricultural Inspectorate in MAFWE

The State Agricultural Inspectorate is a semi-autonomous organisation within MAFWE that carries out monitoring and inspection in relation to compliance with regulations on agriculture and land use.

The Inspectorate has been carrying out restructuring and recruitment. The new structure is illustrated in Figure 9.18 which provides information of the number of people in the future structure and the existing numbers (in brackets).

The nature of the work of the Inspectorate means that most of its 35 employees (as of May 2007) are located in regional offices (only 16 employees are located in Skopje). It is likely that a new Head of Sector will start at the Inspectorate in near future.

The Inspectorate is not organised into a structure that allows for a position of a specialist in soil. Such a position could potentially be within the sector that covers rural development.

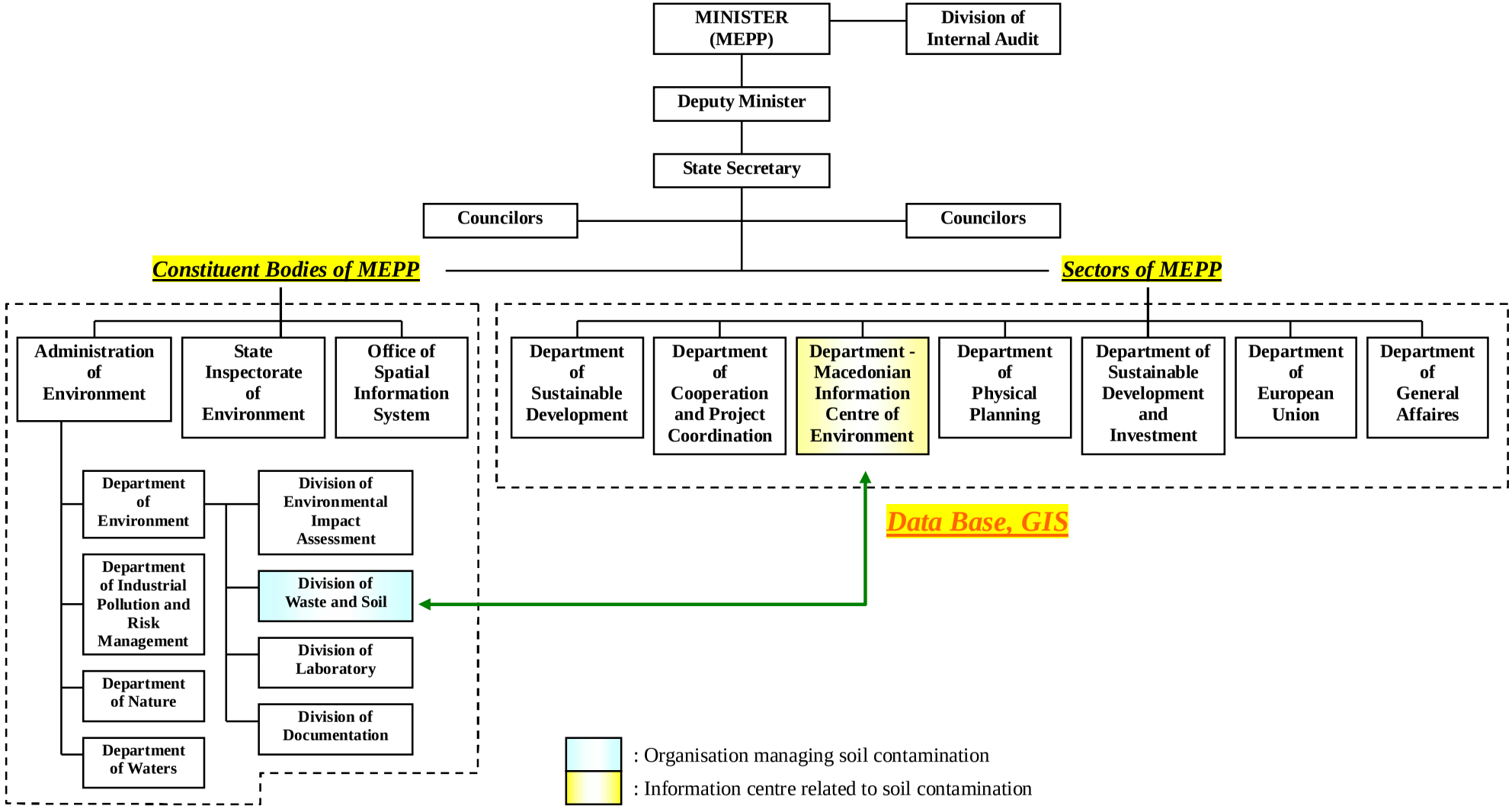
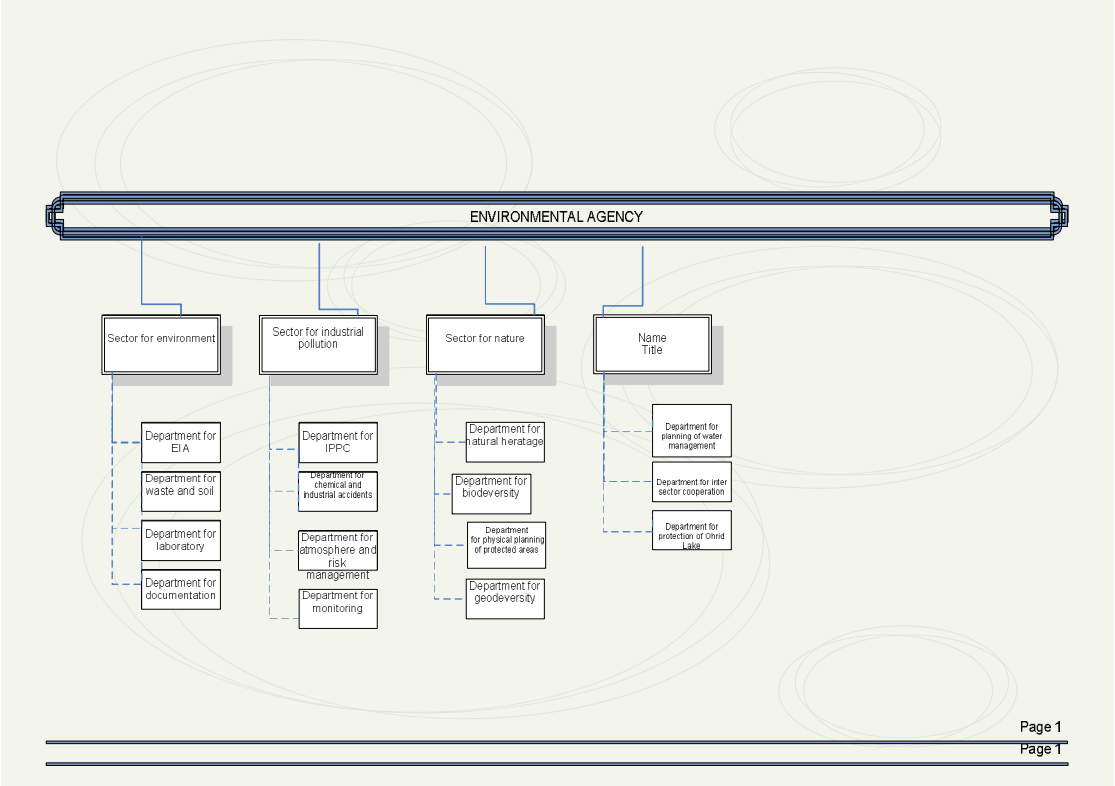
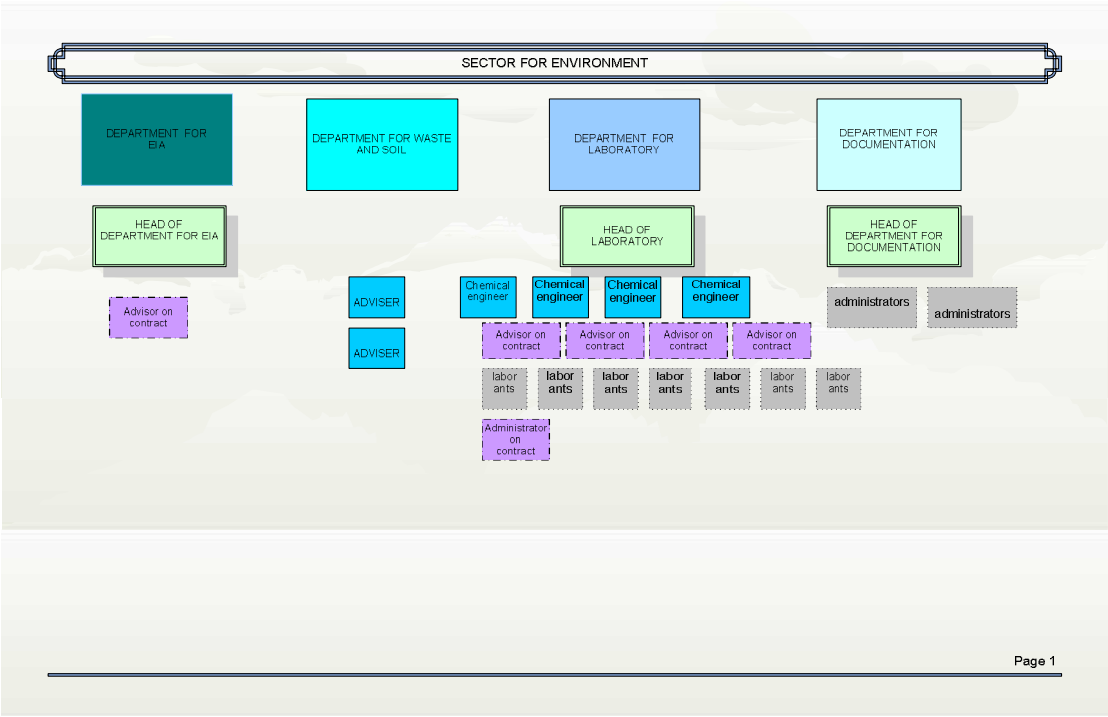


Figure 9.14 MEPP and MEIC - Organisational Structure (2007)



(From the Homepage of MEPP, 2007)

Figure 9.15 Current Organisation of the Environmental Agency of MEPP



(From the Homepage of MEPP, 2007)

Figure 9.16 Current Structure of the Sector for Environment in MEPP

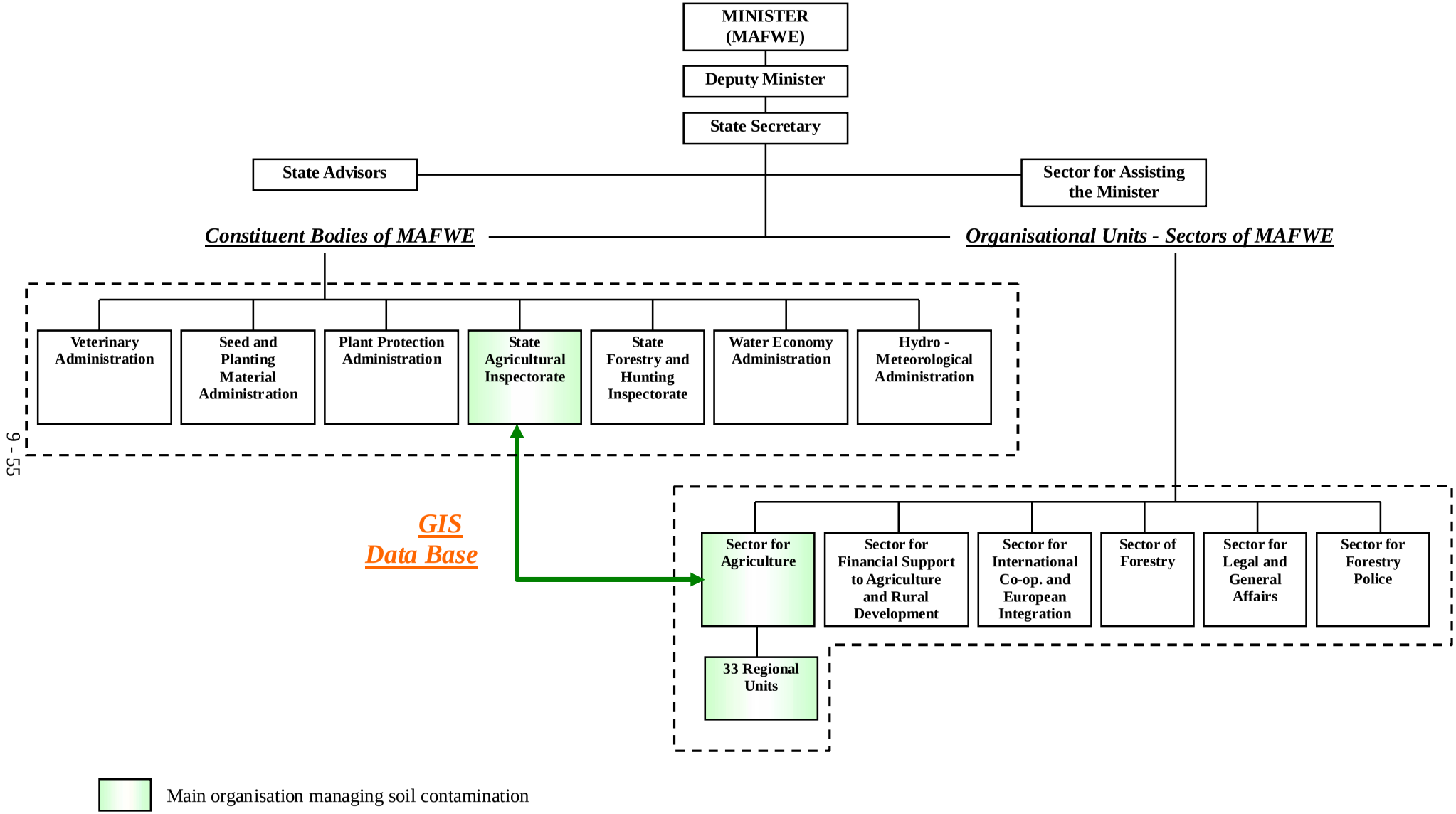


Figure 9.17 Ministry of Agriculture, Forestry and Water Economy (MAFWE) - Organisational Structure

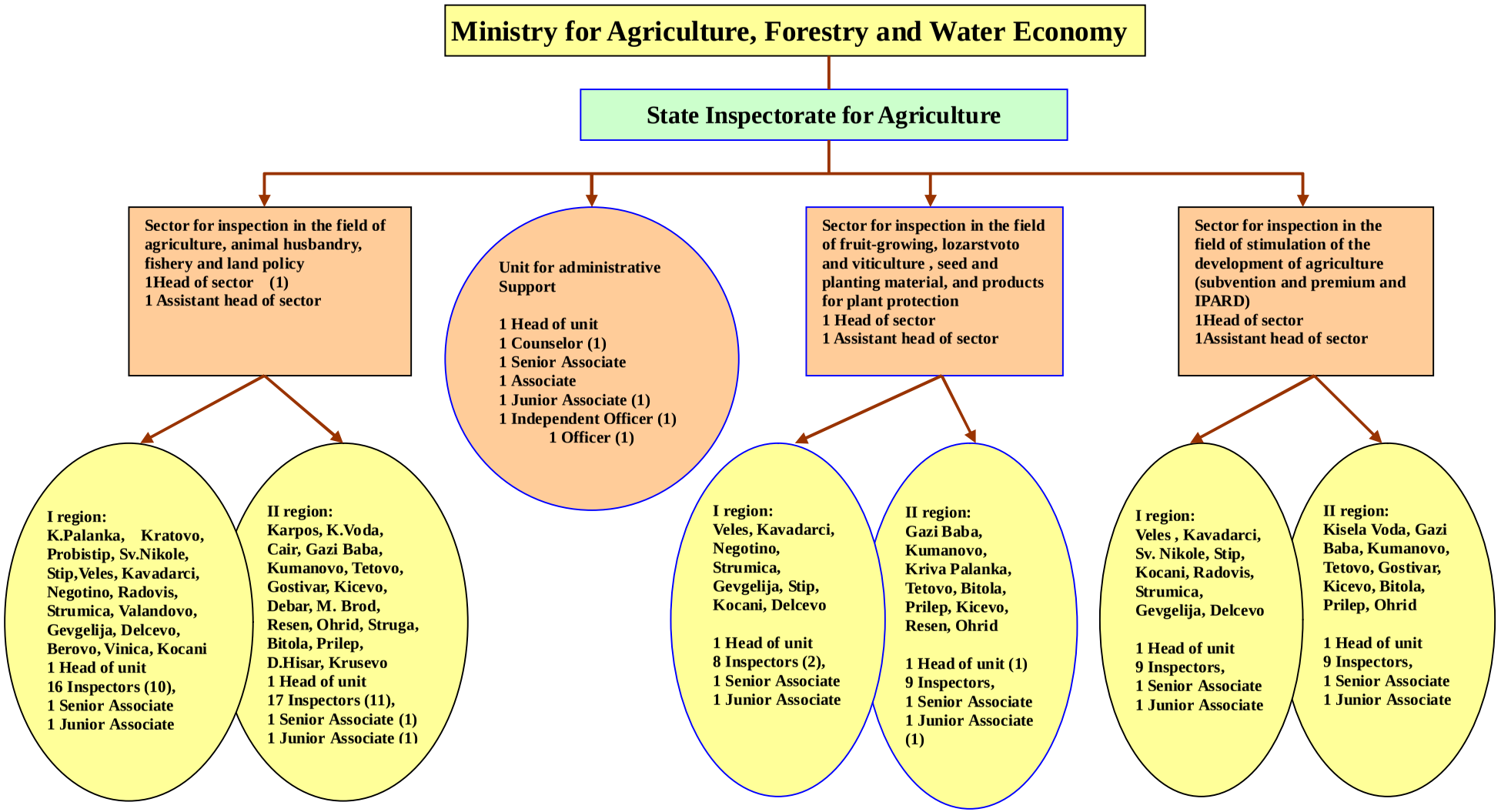


Figure 9.18 New Structure of State Agricultural Inspectorate (May, 2007)

(3) MoE

The Ministry of Economy has a mandate to develop the economy of Macedonia, and it has responsibilities including the following:

- Monitoring the situation of the commodities and services market and impact of the measures on the economic policy;
- Following the economic, structural and technical-technological developments and proposing measures for realization of the development and current economic policy in the sphere of production, trade, tourism, catering and craft;
- Following the ongoing material balances and providing the citizens with basic food products and other goods for wide consumption and of the enterprises with raw materials;
- Industrial ownership;
- Small and medium-sized enterprises and cooperative movement;
- Following international economic movements, as well as their impact on the economic relations of Macedonia;
- Foreign-trade working;
- Geological researches and exploitation of mineral raw materials;
- Energy policy;
- Implementation of general and technical norms, regulations and standards; and
- Oversight within its competencies and other activities stipulated by the Law.

The Ministry of Economy has 12 sectors, including a Sector for Mining Resources, which is the basis for policy, action and overall supervision of mining and geological activities. This sector has two departments, one on exploitation of mineral resources and one on GIS.

In addition, the Ministry of Economy has a State Inspectorate, with seven Inspectors and a Director. The Inspectors have very different roles and are therefore spread between the different sectors that have a need for inspection, including the Sector for Mining Resources. Two of the Inspectors cover mining activities, and monitor compliance with the Law on Mineral Resources. Activities include monitoring of the tailings dams, waste water, and cultivation of degraded land. Mining companies are required to have an operational plan that includes environmental management, and the Inspectors monitor their activities against these plans. The Inspectors work according to the Inspection Law and sub-laws.

The Inspectorate reports that it has strong communication with Inspectors from MEPP, working with MEPP Inspectors on a case-by-case basis as necessary.

9.5.2 Plan of Organisation Level of Capacity Development on SCM

Capacity development at organizational level is an essential component of the overall capacity

development. Capacity development at organizational level will be necessary to ensure the successful implementation of the Master Plan and implementation of improvements in soil contamination management on an ongoing and sustainable basis.

Capacity development at organizational level involves setting up and developing the organizational and management frameworks in relation to soil contamination management. This will include assignment and approval of a team responsible for soil contamination management, definition and agreement of roles and responsibilities, development of a strategy and procedures for the team responsible for soil contamination management, development and agreement of budgets, etc.

Specific tasks on capacity development at organizational level for the main ministries and other stakeholders are provided below.

(1) MEPP

The Ministry of Environment and Physical Planning (MEPP) will have overall responsibility for soil contamination management and implementation of the Master Plan (Figure 9.4). Therefore, capacity development at organizational level is particularly important for MEPP.

The following tasks will be necessary at MEPP, and these tasks will all contribute to the development of capacity at organizational level in MEPP:

- Official approval for MEPP to take overall responsibility for soil contamination management and implementation of the Master Plan.
- Definition and official agreement of the roles and responsibilities of MEPP in relation to soil contamination management.
- Official approval of the set up of the Division on Waste and Soil in MEPP.
- Definition and official agreement of the roles and responsibilities of the Divison on Waste and Soil, and roles and responsibilities of other sections (e.g. Macedonian Environmental Information Centre (MEIC)) in MEPP.
- Development and approval of a strategic plan for the Division on Waste and Soil, including agreement on recruitment plans and the division's budget.
- Recruitment of soil specialists into the Division on Waste and Soil in MEPP, and development and agreement of the terms of reference for the work of these specialists.
- Purchase of any necessary equipment, computers, other IT equipment, GIS software, etc, needed for the Division on Waste and Soil, but taking into account the systems already existing in the Macedonian Environmental Information Centre (MEIC) in MEPP.
- Construction of Database using GIS of Hot Spots survey and Inventory Survey in whole area of the Country.
- Set up of the Technical Advisory Council, which would be an independent body, but MEPP would take an organisational role in arranging the meetings, etc.

- Initiation of the implementation of the Master Plan and leadership in the ongoing implementation. Development of detailed task action plans and regularly reporting on progress in implementation.
- Consultation on the task action plans with relevant ministries and other stakeholders, and taking into account feedback to develop more applicable and practical plans.
- Planning and implementation of communication mechanisms with other stakeholders with respect to soil contamination management (e.g. through working meetings, email newsletters, etc), and via the Technical Advisory Council.
- Development of a database of relevant contacts on soil contamination management to facilitate communication with stakeholders.
- Act as a focal point for organisation of capacity development activities of individuals in soil contamination management.
- Set up linkages and communicate with municipalities in relation to soil contamination management.
- Set up linkages and communicate with laboratories and research institutions in relation to soil contamination management.
- Identify potential projects where applications for international donor funding for technical assistance will be beneficial (e.g. development of law on soil contamination management in line with developments of the EU legal framework on soil).
- Carry out reporting in line with national and international requirements through the Macedonian Environmental Information Centre (MEIC) in MEPP.

The above tasks will each contribute to the strengthening of MEPP at organizational level in relation to soil contamination management.

(2) MAFWE

Although MEPP takes overall responsibility in relation to soil contamination management and leadership in implementation of the Master Plan, MAFWE will still play an important role and must take responsibility for soil contamination management with respect to agricultural land (Figure 9.4).

The following tasks need to be carried out at MAFWE to develop the capacity at an organizational level in relation to soil contamination management:

- Assign official responsibility for soil contamination management related to agricultural land to a section in MAFWE.
- Develop roles and responsibilities for the team or individual responsible for soil contamination management related to agricultural land.
- Develop linkages and working relations with the relevant sections in MEPP, including the Division on Waste and Soil and the Macedonian Environmental Information Centre (MEIC).

- Attend the meetings of the Technical Advisory Council on Soil Contamination Management.
- Provide inputs and feedback on the task action plans developed by MEPP.
- Share information and data on soil contamination management with MEPP and other stakeholders so that overall planning of counter-measures can be prioritised.
- Examination of risk assessment between soil and plants, components and their concentration according to the Law (Article 31).
- Contribution to the construction of Database using GIS of Hot Spot survey and Inventory Survey in whole area of the Country (link with Database of MEPP).

The first step will be to appoint official responsibility for soil contamination management related to agricultural land to a section or individual in MAFWE. It is likely that this appointment should be within the State Agricultural Inspectorate (SAI) as the main management, and there will also be a role within the Sector of Agriculture in relation to enforcement of management.

The potential future structure of MAFWE is likely to include the Sector for Registration and Management of Agricultural Land. This could be another place in the Ministry where the role for SCM could be specified.

(3) MoE

The Ministry of Economy (MoE) will play an important role in relation to soil contamination management in mining areas. The following tasks will be important for developing the capacity of MoE at organizational level:

- Assign official responsibility for soil contamination management related to mining areas to a section or individual in MoE.
- Develop roles and responsibilities for the team or individual responsible for soil contamination management related to mining areas.
- Develop linkages and working relations with the relevant sections in MEPP, including the Division on Waste and Soil and the Macedonian Environmental Information Centre (MEIC).
- Carry out relevant actions for enforcement of the Law on Mineral Resources, linking with the Inspectorate of MoE, and also linking with MEPP in relation to the Law on Environment. This will include supervision of activities on Environmental Impact Assessments (EIA) as required, as well as monitoring of mining activities in relation to protection of the environment, as defined by the Law on Mineral Resources.
- Attend the meetings of the Technical Advisory Council on Soil Contamination Management.
- Provide inputs and feedback on the task action plans developed by MEPP.
- Share information and data on soil contamination management with MEPP and other stakeholders so that overall planning of counter-measures can be prioritised.
- Contribution to the construction of Database using GIS of Hot Spots survey and Inventory Survey in whole area of the Country (link with Database of MEPP).

(4) MoH

The Ministry of Health (MoH) will play an important role in relation to soil contamination management in relation to public health protection. The following tasks will be important for developing the capacity of MoH at organisational level:

- Assign official responsibility for soil contamination management related to public health protection to an individual in MoH.
- This individual should attend the meetings of the Technical Advisory Council on Soil Contamination Management.
- Develop roles and responsibilities for the individual responsible for soil contamination management in MoH.
- Develop linkages and working relations with the relevant sections in MEPP, including the Division on Waste and Soil and the Macedonian Environmental Information Centre (MEIC).
- Provide inputs and feedback on the task action plans developed by MEPP.
- Share information and data on soil contamination management with MEPP and other stakeholders so that overall planning of counter-measures can be prioritized.
- Contribution to activities related to risk assessment and development of standards.

(5) Municipalities

The municipalities will have an important role to play in soil contamination management, particularly those that have a high level of mining and other industrial activities within the area under their responsibility. It will be important for MEPP to regularly communicate with the municipalities and raise the profile of soil contamination management. It is important that the capacity of municipalities is developed to a level where they can identify potential problem areas in relation to soil contamination management and they will inform MEPP of these areas.

By the cooperative network of Probistip, field survey was proceeded smoothly with the help of exchanging information of the P/P area (survey area, land owner, history of tailings dam, communication, preparation of workshop and etc,.) and supplying a series of advice for field survey, space for desk works, etc.

In case of soil contamination survey over large area including the P/P (e.g. Hot Spot Survey), a local municipality may not take direct management of such survey work, instead, a local municipality plays a key role for communication and risk communication between stakeholder (local people), polluter and contamination survey team.

In case of relatively small size survey over independent factory and plant (e.g. Inventory Survey), a survey and soil contamination management should be directly conducted by the local municipality

as it would be considered to be most effective because it has very close relationship with operators. Local municipality, as with the case of large area survey mentioned above, should play an important role in communication among stakeholder (local people), polluter and contamination survey team.

In further surveys of soil contamination, as discussed above, local municipalities are expected to play a major role.

9.5.3 Construction of Information Management System of SCM

The data and information obtained by the soil contamination surveys should to be used for the inter-ministerial exchange of soil contamination information of MEPP, MAFWE, MoE etc. under the new framework of soil contamination management in Macedonia. In case of compiling of soil contamination data and inter-ministerial exchanging of them, GIS data base is likely to be most appropriate information system.

(1) Capacity Assessment of GIS Environment in each Ministry

a. MAFWE

Although MAFWE does not have a section of GIS, one expert of GIS is assigned in the Water Economy Administration. The GIS Expert is in charge of constructing GIS data base concerning information of water management and license applications of water rights. The present condition of this GIS works are as follows:

- Web GIS Server currently in use is system within the Ministry. Hence, the system is not for disclosure of official information to the outside.
- Although the section of IT administration exists in the Ministry, there are few technical experts and they have temporary employment. Hence, IT security is not enough at the present.
- There is not a specialised section of GIS in MAFWE, and the work capacity on GIS currently is full. Hence, requests of processing of GIS data from other sections cannot be carried out under the present work condition.

The main issue of the GIS system in MAFWE is thought to be lack of technical experts and understanding of specific GIS is important technology for MAFWE.

Consequently, in case of establishing GIS system for soil contamination management in MAFWE, new GIS system with an expert will be required.

b. MEPP

MEPP has the Office of Spatial Information System as GIS expertise section. The Office is operated and managed by three skilled GIS experts. The Office has data of Spatial Data Infrastructure (SDI) made by JICA Study in 2006, land use and land classification in the whole area of Macedonia.

In addition, the office has two projects concerning using environmentat data. The first is original Free Map Server "Map Discovery" and they are considering to open to public, but opening time is not determined. The second is registration into the Environmental Information Data Base of three years plan from 2008 by the advice of EU.

It can be said that MEPP are efficiently using GIS data and has existing capacity in term of organisation, manpower, planning, etc. in the Ministry.

c. MoE

MoE has specified office of GIS with three technical experts. The office is developing a data base of information concerning concessions of factories and mining activities hosting the information with Map Server at present.

They have no plan to disclose to the outside using network, such as Map Server, etc. at this moment. However, technical training for the GIS experts involves an educational programme implementing by GISDATA company, agency of ESRI (Environmental Systems Research Institute. Inc.).

Consequently, in case of establishing GIS system for soil contamination management in MoE, it is thought that additional GIS system of soil contamination could be incorporated into the existing GIS system by employing one extra technical expert.

(2) Concept of Inter-Ministerial Geographical Information System Environment

a. Integration of Data and Information Obtained by Soil Contamination Surveys

The data and information obtained by soil contamination surveys in each ministry should be managed by Geographical Information System (GIS). After detailed examination of the data and information at the Ministry where it was obtained, it should be transferred to the MEPP for integration into the central GIS as shown in Figure 9.19. The GIS data should also include other relevant catalogue information (meta-data).

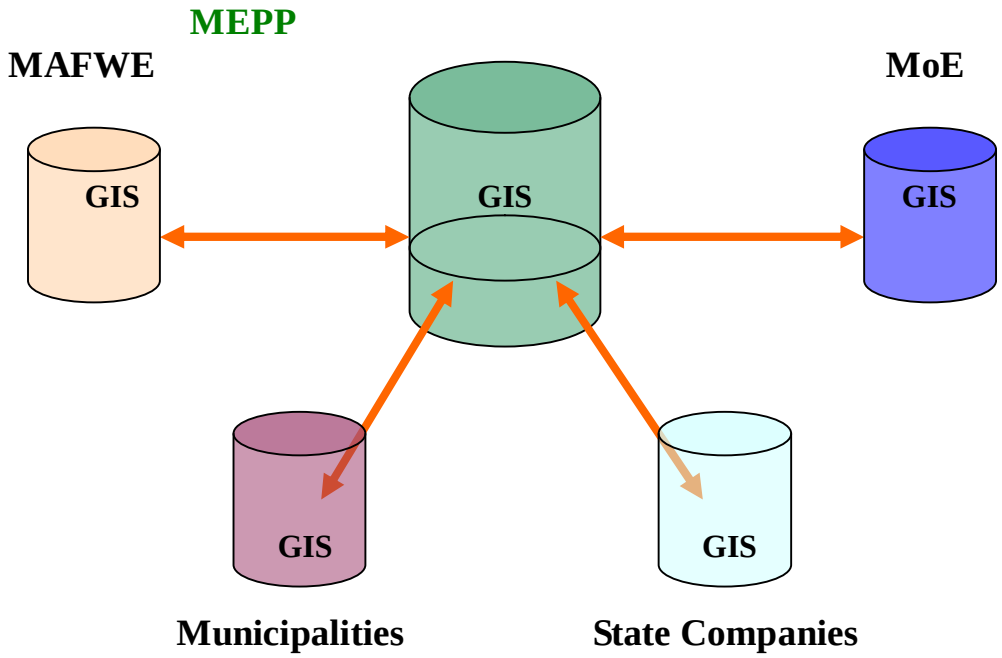


Figure 9.19 System Construction of Data Base for Soil Contamination Management

As MAFWE and MoE do not have GIS systems and manpower at present, the necessary hardware, software, manpower and appropriate budget as shown in Table 9.3 for management of GIS data base are required.

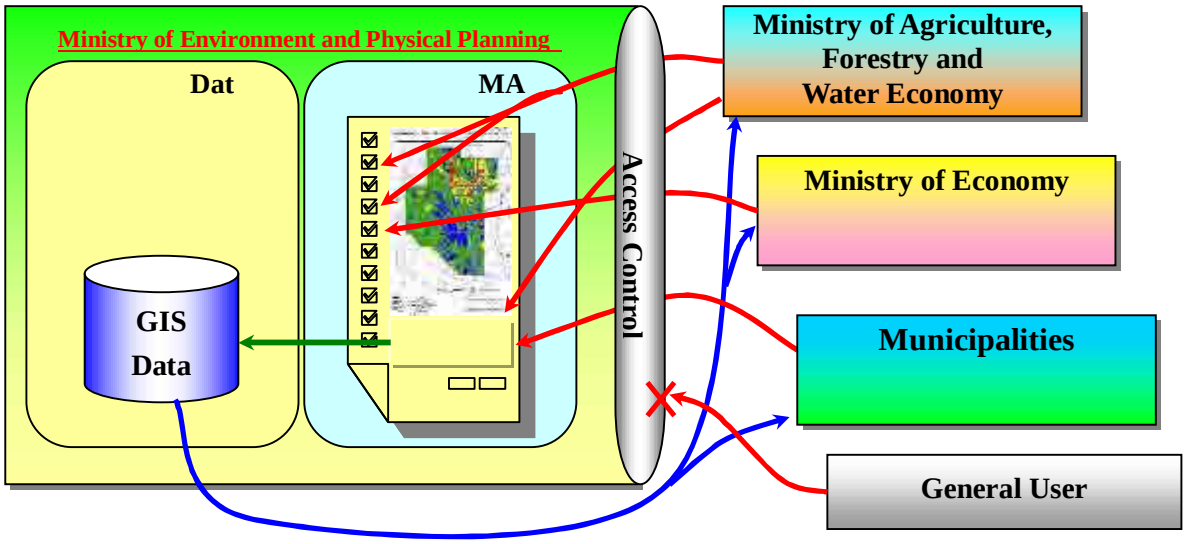
Table 9.3 Necessary Hardware, Software, Manpower and Budget for GIS Data Base

Items	Contents	Number	Unit Price (€)
1. Hardware	Windows PC	1 set	1,700
2. Software	Arc GIS	1 user	2,380
3. Manpower	GIS Experts	1 person	-
4. Training	Training Course	1 training	500

b. Data Reference System

MEPP is planning to construct the GIS reference system using Map Server, and there are reportedly no technical difficulties in inputting GIS data of the project (in case of the Pilot Project) into the Map Server of MEPP. Therefore, it is possible to store the final inter-ministerial system of GIS data base and refer GIS data in Map Server of MEPP.

The GIS system of the MEPP is assumed to have a function of referring and downloading permissible data and information by Map Server of MEPP as shown in Figure 9.20.



Access from Users to Map Server

Download from Data Server to Users

* MEPP holds data and other ministries are able to view on the Web browser and download the GIS data by Map Server.

Figure 9.20 Schematic of GIS Data Reference System

Stored data in MEPP should be accessible only to permissible users, including nominated person in MAFWE, MoE, Municipalities, etc. General users should not be given access to the Map Server of MEPP. Access control is done by Map Server or Web Server. Permissible users will be able to view any data by exchanging on the maps displayed on the Web browser. Also, GIS data as original data can be downloaded.

In case of operating this system, the following works are required:

- Data exchange works for input to Map Server of MEPP,
- Amending works of layout of display for input to Map Server of MEPP,
- Creating works of page for display of survey data, and
- Set up works for access right of survey data.

In relation to aspects such as the display on the Map Server, layout, such as setting up of displaying area, display method of symbols, selection of displaying data, etc., it is necessary to re-check these components depending on the system. For this work, relevant experts of MEPP and other Ministries of GIS should fully discuss to agree the layout of the display. Also, the level of disclosing information as well as the access right of disclosing data should be discussed and agreed

among Ministries.

The man/month of operating of this arrangement work of MEPP and other Ministries are estimated as shown in Table 9.4.

Table 9.4 Man/Month Required for Arrangement Work of Data Reference System

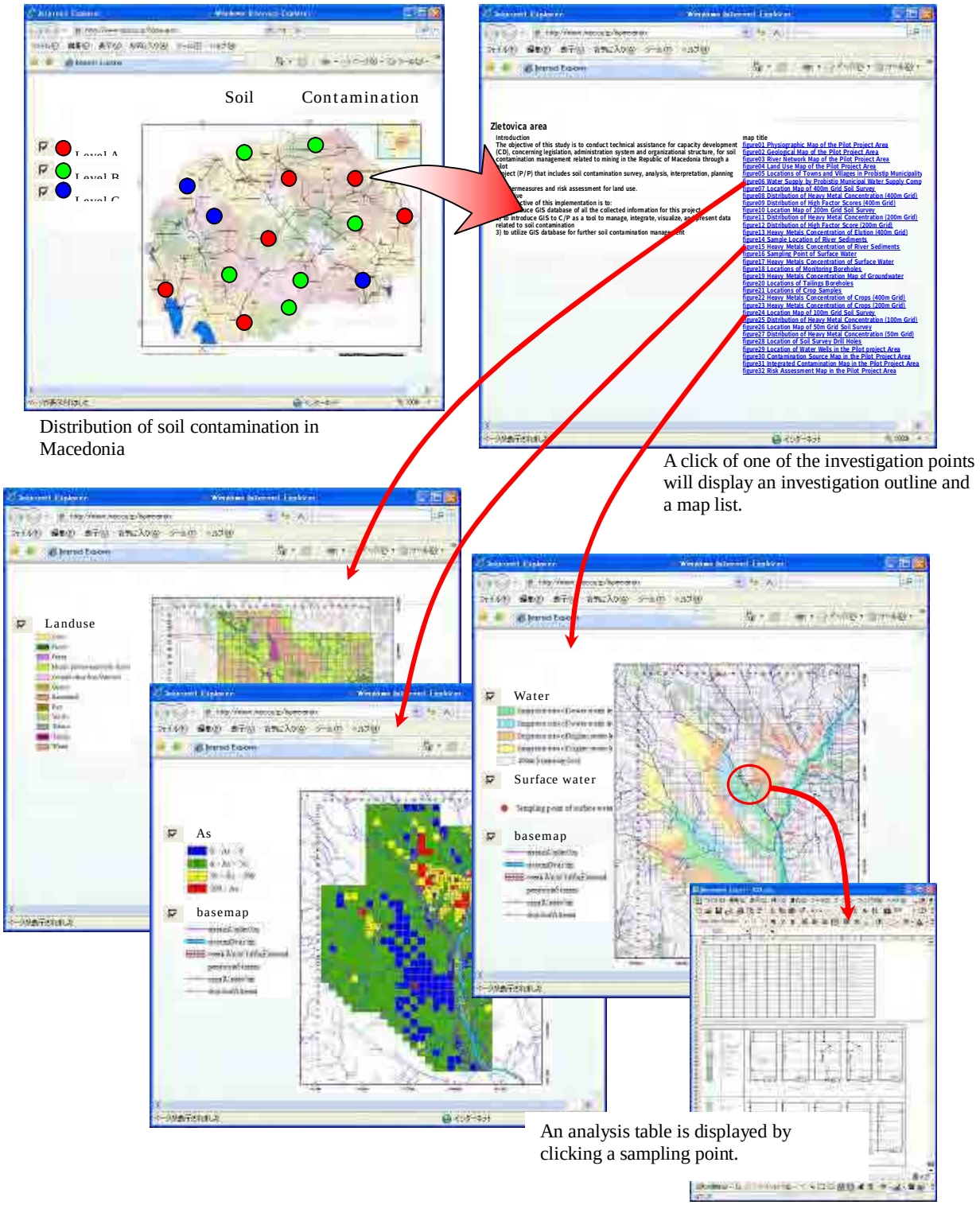
Items	MEPP	Relevant Other ministries
1. Data exchange works	3	1
2. Amending works of Layout	3	3
3. Compiling work for explanation pages of outline	1	2
4. Setting work for access right to the system	1	1

Basic Concepts of GIS Data Base reference system on Soil Contamination of the Pilot Project are shown in Figure 9.21.

Procedure of display on soil contamination area

At first, the Macedonian map showing the soil contamination condition throughout the country is displayed. After clicking at the investigated site, a view of thematic maps of each survey is displayed. Then, after clicking at one of the thematic maps, the Map Server is activated and displays survey results with tables and map related to soil contamination in the site.

In addition, some buttons for download of data are distributed in the page displaying outline of survey and it is possible to obtain the data of soil contamination of the site.



Distribution of soil contamination in Macedonia

A click of one of the investigation points will display an investigation outline and a map list.

An analysis table is displayed by clicking a sampling point.

Figure 9.21 Basic Concept of GIS Data Base Reference System on Soil Contamination

c. Handling of Data

In the case of using data being downloaded from Data Server, users need to check the restrictions concerning usage of data. Generally, the following restrictions for using the system after approval by users should apply:

- Copyright of data,
- Data should be used by individuals, or within the specified organisation, which download data,
- Commercial use of data is prohibited,
- Results and reports using the data should refer the source of data, and
- Amending of data is not allowed without approval of creator of data (i.e. relevant Ministry).

In addition, it is necessary to clarify the contents of disclosing data and information of the soil contamination.

9.5.4 Equipments and Materials for Soil Contamination Management

The following equipments and materials will be needed by the relevant stakeholder organisations in order to develop the capacity of individuals and in order to carry out their roles in the soil contamination management framework.

(1) Soil Contamination Survey

- Equipments for soil contamination survey
  - Field work: Topographic maps, GPS, field notes, measuring tape, wood spiles, colour paint, ruler, etc.
  - Soil sampling: Shovel, small scoop, cutter knife, plastic bags, colour index note, camera, etc.
- Equipments for soil drilling survey
  - Drilling machine and tools, pump, core box, submergible pump, open or closed bailer, colour index tape, camera, plastic bags, etc.
- Equipments for surface water survey
  - Water sampling: Water sampler, graduated cylinder, sampling (plastic or glass) bottles, camera, etc.
  - Flow measurement: Flow measuring meter, clock-timer, camera, shovel, measuring tape, topographic map, etc.
  - Water quality measurement: pH meter, electric conductivity (EC) meter, thermo-meter, etc.
- Equipments for groundwater survey (existing water wells, monitoring wells, water springs, etc.)

- Open bailer, closed bailer, submergible pump, sampling (plastic or glass) bottles, camera, etc.
- Water quality measurement: pH meter, electric conductivity (EC) meter, thermo-meter, etc.

- Equipments for crop survey
  - Topographic maps, GPS, field notes, measuring tape, wood spiles, plastic bags, camera, etc.
- Equipments for monitoring of water and groundwater
  - Open bailer, closed bailer, submergible pump, sampling (plastic or glass) bottles camera, etc.
  - Water quality measurement: pH meter, electric conductivity (EC) meter, thermo-meter, etc.

(2) Data Analysis and Construction of Data Base

- Equipments, etc. for GIS

- Hardware: PC, Web Server, Data Server, printer, colour scanner, etc.
- Software: GIS software, Map Server, etc.

9.6 Technical (Individual) Level of Capacity Development on Soil Contamination Management

9.6.1 Target of Technical (Individual) Level of Capacity Development on SCM

The target of technical (individual) level of capacity development on soil contamination management consists of individuals of following four organisations/bodies and shown in Figure 9.22.

- Relevant administrative offices of soil contamination management.
- Soil contamination investigation and measuring firms.
- Analytical and soil mechanical laboratories.
- Business firms using harmful substances (as objective sites of soil contamination survey).

Relevant administrative offices are composed of the central and local (regional) offices in MAFWE, MEPP, MoE, each municipality and State company, such as Hydro-system Zletovica. Relevant soil contamination investigation firms include soil investigation and measuring consultants, drilling company, civil engineering companies, construction companies, etc.

The contents on capacity development on SCM at technical (individual) level consists of the following items. In addition, technical contents required at each organisation/body are also shown in Figure 9.22.

- **Soil Contamination Survey**
  - Soil contamination survey method
  - Soil drilling survey method
  - Surface water survey method
  - Groundwater survey method
  - Crop survey method
  - Monitoring method of water and groundwater
  - Chemical analysis method, etc.
- **Data Analysis**
  - GIS
  - Distribution of soil contamination, mapping of concentrations
  - Soil and groundwater contamination mechanism
  - Risk assessment
  - Evaluation of soil contamination, etc.
- **Counter-measures for Soil Contamination**
  - Counter-measures method
  - Monitoring method for counter-measures, etc.
  - Soil mechanics for soil works
- **Management of information on soil contamination**
  - Construction of Data Base (using GIS)
  - Accessing and linkage of Data Bases among ministries, etc.

(1) Administrative Offices of SCM

Administrative offices, including MEPP, MAFWE, MoE, Municipalities and State Companies (if needed) require to have staff with technical knowledge and necessary experience of soil contamination survey, such as chemical and soil mechanical analyses, data analysis, soil contamination counter-measures, monitoring works and data base of soil contamination, in order to implement smooth management of soil contamination. Particularly, the soil contamination survey and information management using GIS needs to be familiarised to individuals related to the soil contamination management work. In addition, capacity development related to the development of the legal frameworks is needed.

(2) Investigation and Measurement Firms

Investigation and measurement firms, including consultants, drilling company, etc. require technical knowledge and necessary experience in soil contamination survey, such as chemical and soil mechanical analyses, data analysis, soil contamination counter-measures, monitoring works and part of data base of soil contamination.

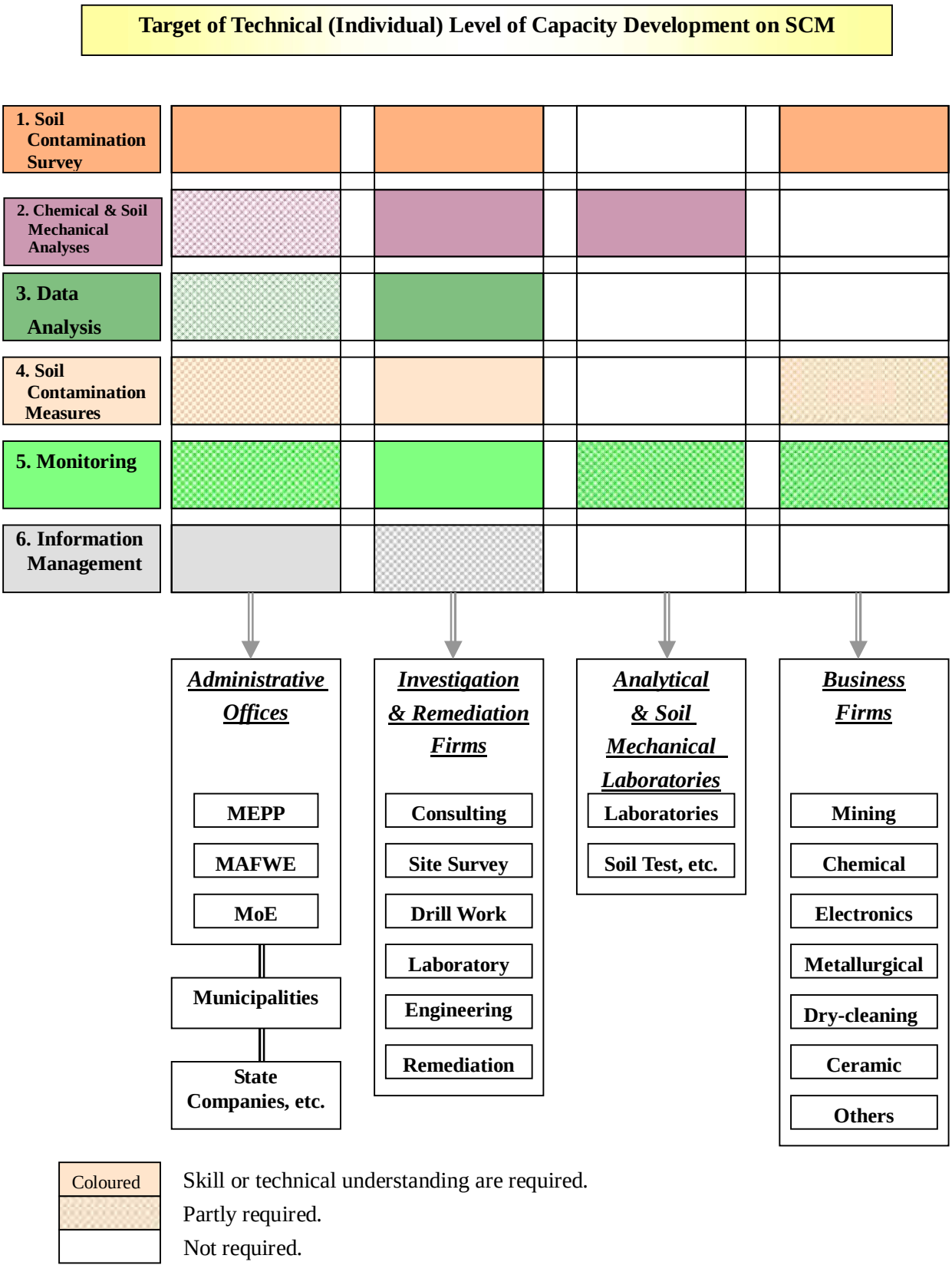


Figure 9.22 Target of Technical (Individual) Level of Capacity Development on SCM

(3) Analytical and Soil Mechanical Laboratories

Laboratories of chemical analysis and soil mechanics require general knowledge of soil/groundwater survey and monitoring in addition to the knowledge of their profession. Although the existing capacity of analytical laboratories varies in Macedonia, it is necessary to develop their capacity to certain standard level.

(4) Business Firms

Business firms that have used harmful substances in the past at processing factories and other sites are important stakeholders. Many of these sites will come under the main objectives of the soil contamination survey and subsequent implementation of counter-measures where needed. It is necessary to raise awareness and knowledge of these business farms in relation to soil contamination management, in particular regarding counter-measures of existing contamination and prevention of future contamination.

9.6.2 Training for Soil Contamination Management

Once responsibilities of the different Ministries have been approved in relation to soil contamination management, it will be important to carry out a detailed training depending on needs after capacity assessment of the individuals that are working in soil contamination management.

The MEPP should have the overall responsibility of acting as a focal point for capacity development, organisation of training, etc.

Training is likely to be needed in some of the following topics.

(1) Institutional / Legal Framework

- Training on development of legislation
- Training on enforcement of legislation

(2) Soil Contamination Survey

- Training for soil contamination survey
  - General survey method
  - Detailed survey method
  - Drilling survey method
  - Monitoring method of surface water and groundwater
  - Comprehensive analysis of survey results and counter-measures of soil contamination

Note: On-job-training of soil contamination survey, including General survey and Detailed

survey and monitoring survey methods, was carried out during the Pilot Project to staff of MAFWE, MEPP, HSZ, Probistip City and local staff of temporary employees. Part of counterparts, local staff of MAFWE and local staff of temporary employees are skilful technicians, therefore they are possible to be lecturer of soil contamination survey training course.

(3) Data Analysis

- GIS
  - GIS analytical method: ESRI (Environmental Systems Research Institute. Inc.) training course, etc.
- Risk assessment
  - Risk assessment method

(4) Management of Information on soil contamination

- Risk communication
  - Risk communication method, etc.

(5) Construction of Data Base

- Training on Data Base

CHAPTER 10 WORK PROGRAMME ON SURVEYS AND COUNTER-MEASURES OF SOIL CONTAMINATION IN THE WHOLE AREA OF MACEDONIA

CHAPTER 10 WORK PROGRAMME ON SURVEYS AND COUNTER-MEASURES OF SOIL CONTAMINATION IN THE WHOLE AREA OF MACEDONIA

10.1 General

The purposes of the work programme on surveys and counter-measures on soil contamination related to mining (heavy metals) is to propose the procedure of finding soil contamination sites by soil contamination survey in whole area of Macedonia and to consider appropriate counter-measures against the soil contamination of heavy metals. However, numerous soil contamination sites exist, not only large sites related to mining such as many of the "Hot Spots", but also many potential sites of soil contamination of heavy metals due to industrial activities, etc. in the whole area of Macedonia.

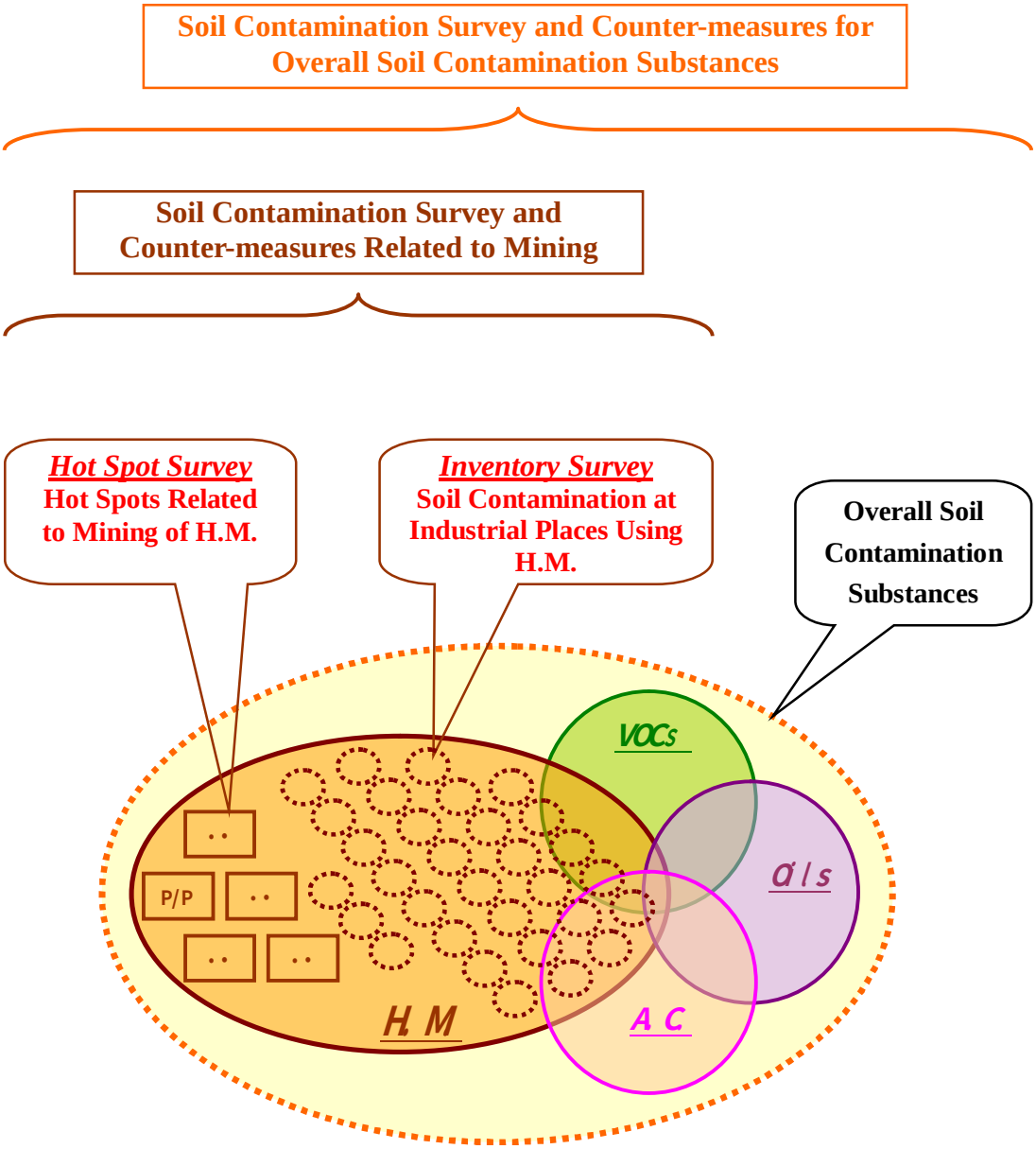
The concepts of soil contamination survey and counter-measures in the whole area of Macedonia, focused on the soil contamination management, are proposed in the Master Plan (Chapter 9). The survey consists of two types of soil contamination survey, namely Hot Spot Survey and Soil Contamination Inventory Survey.

The Scope of these surveys in the Study is limited to the heavy metals as shown in Figure 10.1, because the Study is related to mining.

10.1.1 Hot Spot Survey

Generally, the Hot Spot Survey sites related to mining are relatively large scale from mining pollution due to not only soil contamination but also air pollution and water/groundwater contamination. Although most of the mining sites are located in the countryside and mountain areas, direct and indirect risk to human health due to mining activities is likely to be relatively large, because several villages are usually located nearby and urban areas are located at the downstream of the mining sites. Also, agricultural lands are widely distributed surrounding the mining sites and downstream, hence direct and indirect agricultural risk is likely to be high.

On the other hand, the smelting factories are generally located near or in the urban and industrial areas, and they are characterised by composite pollutions of air, water/groundwater and soil in relatively extensive areas. Hence, the soil contamination survey and counter-measures in and around the smelting factories as Hot Spot Survey sites are mostly different from those of mining sites.



: Hot Spot Survey Sites

: Soil Contamination Inventory Survey Sites

VOCs : Volatile organic compounds

Oils : Oils and fats

A.C. : Agricultural chemicals

H.M. : Heavy metals

Figure 10.1 Holistic Scope of Soil Contamination Survey for Soil Contamination Management

10.1.2 Soil Contamination Inventory Survey

The targets of the Soil Contamination Inventory Survey mainly consist of industrial places that have used harmful substances which will be officially regulated by the Environmental Standard for Soil in the "Basic Law on Soil Contamination Management" or the provisional official survey method set up by MEPP, Working Group of Soil Contamination Management and Technical Advisory Council.

These industrial places are distributed in urban and industrial areas of the country, and the sites have the potential for soil contamination of heavy metals. Hence, it is necessary to check the presence of soil contamination in the sites.

The contents, procedure, and role of each of Hot Spot Survey and Inventory Survey and considerations of appropriate counter-measures related to heavy metals are described below.

10.2 Hot Spot Survey

The "Hot Spots" are generally characterised by large-scale potential of soil contamination associated with extensive air pollution (mainly dust) and water contamination, which can significantly affect to human health by harmful substances of heavy metals. Hence, the Hot Spot Survey of soil contamination is a relatively urgent matter.

Concerning the implementation cost of the Hot Spot Survey, the Hot Spot Survey should be implemented directly by the Government of Macedonia, because the Hot Spots have a large-scale potential for soil contamination and are mostly a result of negative heritages of soil contamination by the operation of national companies during the Former Yugoslav.

The procedure of finding and selection of soil contamination sites and site survey of the Hot Spots was shown in Figure 9.10 (in Chapter 9).

10.2.1 List-up of Hot Spot Survey Sites

UNEP and MEPP (2003) had selected 16 sites of the "Hot Spot" areas as large-scale soil contamination sources in Macedonia, and 11 sites are the "Hot Spot" related to the mining and smelting.

In this study, a total of 13 sites, including above 11 sites plus two mines, the Krstov Dol Mine (antimony) and the Rzhanovo Mine (nickel), are considered as the "Hot Spot" related to the mining and smelting.

10.2.2 Planning of Survey by Existing Data Analysis

The hot spots, 13 areas of soil contamination, are scattered in Macedonia as shown in Table 10.1 and Figure 2.3 (in Chapter 2). Most of soil contaminations of hot spots are generally derived from industrial wastes of mining and industrial activities according NEAP (1996), Filipovski (2003), UNEP (2006), etc. However, most of these hot spot areas have not been investigated in detail yet with the exception of some areas, including Zletovo Mine (Probistip), MHK-Zletovo (Veles). Therefore, it is necessary to carry out existing data analysis, selection and designation of hot spots and prioritisation of investigation sites.

MEPP needs to make a survey plan of data analysis of the Hot Spot, but the ministry has already started a part of the Hot Spot Survey under the assistance of UNEP.

The content of each Hot Spot Survey is shown below.

- Prioritisation
- Survey organisation
- Planning of soil survey, etc. (survey location, contents, quantity, etc.)
- Planning of agricultural land survey (crops survey, soil content and elution survey at same point of crops)
- Survey cost, etc.

In case that the agricultural lands exist in the survey area, the crops survey and soil survey are necessary in the area. The crops survey consists of grid survey of crops at 100m x 100m grid and soil content and elution surveys at the same point of crops.

Most of the mines and industrial companies as state companies were bankrupted and closed after the independence of Macedonia (1991). However, several mines and industrial companies have been privatised since or operated by other private companies. Since most of the polluters, which should pay for the survey and remediation fee, had already been lost, it is thought that the new government is obliged to take over the liabilities in order to prevent impacts of human health.

However, in the case that a newly established company operates a mine under the agreement with the relevant ministry, the investigation and remediation of soil contamination should be implemented by the company.

The list of Hot Spot Survey and evaluation should be discussed in the "Working Group of SCM (WG-SCM)", because most of the works of Hot Spot Survey involve members of working group.

10.2.3 Prioritisation of Hot Spots

Based on the results of desk assessment using the existing data and site visits given in the section of 2.3.2, each hot spot was assessed and priority rank was given as shown in Table 10.1. The following criterion were used for the prioritisation of hot spots.

Prioritisation of Hot Spot sites

1. Area of contamination
2. Intensity of contamination
3. Impact to human life
4. Topographic features
5. Influence to the lower stream area
6. Location of facilities, such as mine workings (underground or open pit), waste dump, dressing plant (flotation plant), tailings dam and smelter.

Because of the large contaminated area with agriculture land and elevated heavy metal concentrations such as Cu, Pb, Zn and Mn, together with groundwater contamination, the Zletovo Mine area is ranked as Priority 1. In the Zletovo Mine, the mine working site and flotation plant are located separately across the watershed. In addition, the flotation plan and tailings dams are located within town area of Probistip with a large area of agriculture land in the down stream area. These factors make the Zletovo Mine and Probistip area under serious environmental risk. Compared with the Zletovo Mine, environmental risk of the Sasa and Tranica Mines are not so large as this, since mine facilities, such as mine workings, flotation plant and tailings dam, are located within the narrow valley with small areas of agriculture land and scarce habitation.

Since the MHK Zletovo Smelter is located close to the residential area of Veles and the residential area seems to be extensively contaminated by heavy metals, an environmental risk and human health risk are significant. Environmental risks of soil contamination of other similar sites, such as Silmak Ferro-silicon Plant, Makstill Iron Steel Plant and Feni Industry Feron-nickel Smelter, are smaller than those of the MHK Zletovo Smelter because of the type of smelter, smelting mainly iron and nickel without sulphides in these sites. In these cases, environmental problems of air and fume must be of more concern rather than soil.

REK Bitola and REK Oslomej-EST are similar facilities consisting of thermal power plant with open pit lignite mine. In these cases, contamination of air generated by emission from the power plant and dust from open pit are main concerns for environmental impact.

10.2.4 Plan of Environmental Survey

A plan of the environmental survey was made to assess environmental impacts for each area, as shown in Table 10.2. Based on the experiences of the P/P, environmental survey of the each hot spot was planned for understanding the environmental situation of each site. The survey consists of grid soil survey, groundwater monitoring and crops survey. This is a preliminary survey and depending on the results of this, subsequent detailed survey must be conducted.

For grid soil survey, grid size was decided to be either 200 or 100m depending on the topographic situation and nature of the area. For the area such as MHK Zletovo, where soil survey is to be conducted in the residential area, 100m grid sampling is more suitable. While, for REK Bitola and REK Oslomej-ESM with a large area of potential contamination, most of which being occupied by agriculture land, 200m grid sampling is more suitable.

The number of monitoring well was decided considering the type of potential contamination area. The locations of wells are planed not only within the potential contamination area, but also upper stream and lower stream of potential contamination area. The cost includes 12 times sampling, once in a month through one whole year, and chemical analysis of them.

The crops analysis is included in the survey to understand heavy metal concentrations of agriculture products in the potential contamination area.

The duration of soil survey depends on the number of soil samples, ranging from a half month to two months for sampling, but monitoring of wells continues for one year, for understanding the variation of groundwater on monthly bases all through year.

The cost of environmental survey varies from 9,000 to 55,000 Euro depending on the each hot spot.

Table 10.1 Prioritisation of the Hot Spots

Level of Environmental Risk	No	Hot Spots	Municipality	Status of Operation	Environmental Liability	Concentration of Heavy Metals in Soil (mg/kg)		Influence to Downstream Area	Residential Area	Potential Area of Contamination (km^2)			Contamination Other Than Soil	Priority Rank
										Total Soil Contamination	Agricultural Land	Water/ Groundwater Contamination		
High	1	Zletovo mine (Pb and Zn)	Probistip	Operational since 2006	Macedonia, Zletovo Mine	As(209), Cd(14.8), Co(29), Cr(166), Cu(112), Ni(128), Pb(286), Zn(276), Mn(2,290)	Threshold values of the P/P area, this study	Bregalnica River	4 communities	39.5	37.5	76.1	dust, water, crops	1
	2	Sasa Mine (Pb and Zn)	Makedonska Kamenica	Operational since 2005	Macedonia, Sasa mine	Cd (16), Pb(4,300), Zn(1,800), Mn(2,000)	Near dump site	Makedonska Kamenica, Kalimansko Reservoir	2 villages	2.74	0.10	6.03	air, dust, water	6
	3	MHK Zletovo (Pb and Zn Smelter)	Veles	Closed (4yrs)	Due diligence	Cd (36), Pb(1,000), Zn(1,400)	Residential area near the smelter	Vardar River	Veles	6.76	1.38	12.17	dust, water	2
	4	Bucim Mine (Cu mine)	Radovis	Operational since 2005	Arbitrary	As (52), Cd (6.7), Cu (4,200),	The maximum values of 16 samples along Topolnicka and Madenska Rivers	Kriva Lakavica River	1 village	2.22	0.45	4.88	dust, water	3
Medium	5	Lojane Mine (Cr, As, Sb)	Lojane	Abandoned (32 yrs)	Macedonia	As(66), Cr(186), Cu(52), Ni(95), Zn(164), Mn (774)	Average of 7 samples	Railway and main high way	3 villages	1.61	0.23	4.38	dust, water	4
	6	Silmak ferro-silicon plant	Jegunovce	Dumpsite closed	Arbitrary	As(110), Cr(1,000), Ni(40)	Sample with the highest Cr Value	Vardar River	Jegunovce	1.59	0.28	2.70	air, dust, water	7
	7	Tranica Mine (Pb and Zn)	Kriva Palanka	Closed (>5 yrs), will be opened in near future	Macedonia	As(22), Cu(370), Ni(66), Pb(1,700), Zn(340), Mn(2,500)	The highest values from 7 samples, Filipovski (2003)	Kriva River, Kriva Planka	-	0.65	-	1.11	dust, water	5
	8	Makstil (Iron and steel plant)	Scopje	Operational	Makstil	Cu(31), Pb(31), Zn(21), Mn (728)	1 sample near Plant	Scopje, Vardar River	Scopje	6.24	0.39	9.51	air, dust, water	8
Low	9	Krstov Dol Mine (Sb)	Kliva Palanka	Closed (20yrs)	Macedonia	-	No analytical result found	Kriva Planka	1 village	0.28	0.01	0.48	dust, water	12
	10	REK Bitola (thermal power plant and lignite mine)	Bitola	Operational	REK Bitola	Cd(2), Pb(820), Zn(100)	1 sample	Cma River	1 village	7.91	1.40	10.3	air, dust, water	9
	11	REK Oslomej-ESM (thermal power plant and coal mine)	Kicevo	Operational	REK Oslomej	Cr(200), Cu(52), Ni(110), Pb(70), Zn(130), Mn(2,000)	1 sample	Rajaska River, Kicebo	3 villages	7.13	3.94	11.4	air, dust, water	10
	12	Feni Industry (ferro-nickel smelter)	Kavadarci	Operational	Feni Industry	Cr(225), Ni(198)	Average of 6 samples taken near plant	Cma River	1 village	2.36	1.94	4.01	air, dust, water	11
	13	Rzhanovo Mine (Ni)	Kavadarci	Operational	Rzhanovo Mine	-	No analytical result found	-	-	0.57	-	0.91	dust, water	13

Heavy metal concentrations in soil were taken from: Boev et al. (2005), European Agency of Reconstruction (2005a), Filipovski (2003), Serafimovski et al. (2005), , UNEP (2000)

Table 10.2 Environmental Survey of Hot Spots

Level of Environmental Risk	No	Hot Spots	Municipality	Environmental Liability	Potential Area of Contamination (km^2)			Priority Rank	Soil Survey			Monitoring Wells		Crop analysis		Total Cost (EUR)
					Total Soil Contamination	Agricultural Land	Water/ Groundwater Contamination		Grid Size	Soil Sampling (grids)	Cost Includes Chemical Analysis (EUR)	Monitoring Well Number of Holes	Monitoring Well Cost (EUR)	Number of Samples	Cost Includes Chemical Analysis (EUR)	
High	1	Zletovo mine (Pb and Zn)	Probistip	Macedonia, Zletovo Mine	39.5	37.5	76.1	1	-	-	-	-	-	-	-	-
	2	Sasa Mine (Pb and Zn)	Makedonska Kamenica	Macedonia, Sasa mine	2.74	0.10	6.03	6	200	69	4,110.00	6	8,760.00	3	180.00	13,050.00
	3	MHK Zletovo (Pb and Zn Smelter)	Veles	Due diligence	6.76	1.38	12.17	2	100	676	40,560.00	10	14,600.00	10	600.00	55,760.00
	4	Bucim Mine (Cu mine)	Radovis	Arbitrary	2.22	0.45	4.88	3	200	56	3,330.00	10	14,600.00	5	300.00	18,230.00
Medium	5	Lojane Mine (Cr, As, Sb)	Lojane	Macedonia	1.61	0.23	4.38	4	100	161	9,660.00	6	8,760.00	4	240.00	18,660.00
	6	Silmak ferro-silicon plant	Jegunovce	Arbitrary	1.59	0.28	2.70	7	100	40	2,385.00	6	8,760.00	4	240.00	11,385.00
	7	Tranica Mine (Pb and Zn)	Kriva Palanka	Macedonia	0.65	-	1.11	5	100	65	3,900.00	5	7,300.00	-	-	11,200.00
	8	Makstil (Iron and steel plant)	Scopje	Makstil	6.24	-	9.51	8	100	624	37,440.00	10	14,600.00	-	-	52,040.00
Low	9	Krstov Dol Mine (Sb)	Kliva Palanka	Macedonia	0.28	0.01	0.48	12	100	28	1,680.00	5	7,300.00	3	180.00	9,160.00
	10	REK Bitola (thermal power plant and lignite mine)	Bitola	REK Bitola	7.91	1.40	10.3	9	200	198	11,865.00	10	14,600.00	10	600.00	27,065.00
	11	REK Oslomej-ESM (thermal power plant and coal mine)	Kicevo	REK Oslomej	7.13	3.94	11.4	10	200	178	10,695.00	10	14,600.00	20	1,200.00	26,495.00
	12	Feni Industry (ferro-nickel smelter)	Kavadarci	Feni Industry	2.36	1.94	4.01	11	100	236	14,160.00	6	8,760.00	10	600.00	23,520.00
	13	Rzhanovo Mine (Ni)	Kavadarci	Rzhanovo Mine	0.57	-	0.91	13	100	57	3,420.00	5	7,300.00	-	-	10,720.00
															Total	277,285.00

10.2.5 Survey Organisation of Hot Spot Survey Sites

The organisation of the survey implementation is shown below.

- Planning and administration : MEPP
- Survey cost : MEPP
- Organisation of survey : MEPP, MAFWE (Agricultural lands), MoE (Mining lands)
- Co-operative organisation : Municipalities, MoH, etc.
- Surveyor : Contractor awarded bidding
- Technical Committee : Official organisation, municipalities, universities, institutes, etc.

The Hot Spot Survey should be conducted by the MEPP, because the survey covers large-scale contaminations, including air, water, groundwater and soil, and the influenced area of pollution generally exceeds the municipal administrative boundaries. Also, the survey areas include urban area and agricultural land in many cases. Hence, MEPP should organise a survey team to conduct each Hot Spot Survey, including MAFWE, MoE, MoH and relevant Municipalities as well as organising the Technical Committee.

(Roles of Municipalities)

The experiences, achievements and lessons of the P/P are very effective for planning and implementation of the Hot Spot Survey in the sites. In particular, each municipality has important roles, such as communication between Ministries (MEPP, MAFWE and MoE) and stakeholders, including local residents, industrial firms and other stakeholders, connected to the risk communication (Figure 10.2).

In addition, assistance of Municipalities is important for the field survey, guides, local labours for soil sampling, storage of drilling cores, urgent matters including medical care, rescue, etc.

10.2.6 Soil Contamination Survey Method of Hot Spot Survey Sites

The survey flow of soil contamination survey in Hot Spot Survey is shown in Figure 10.3. The soil contamination survey in the Inventory Survey also follows same survey flow.

The survey consists of existing data analysis, general survey, detailed survey, reporting of soil contamination survey and assessment of soil contamination sites. Finally, the soil contamination sites will be officially registered as a soil contamination site and counter-measures will be assessed in the next stage.

There are two types of Hot Spot Survey, namely rural area type and urban area type. The concept of each survey type is shown in Figure 10.4 and is tentatively described as below.

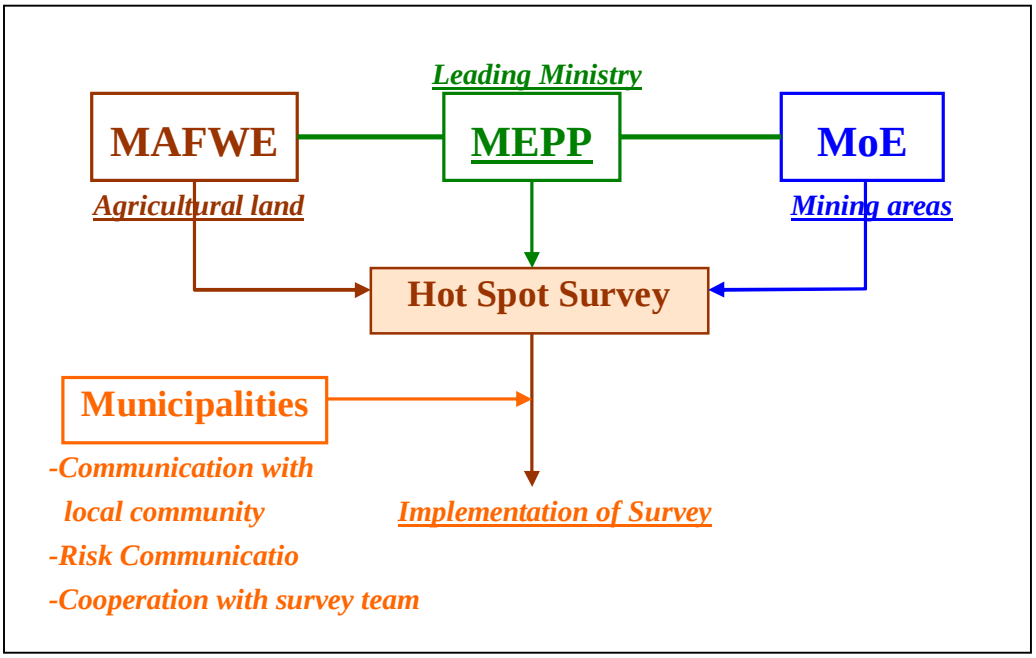


Figure 10.2 Organisation of the Hot Spot Survey and Role of Municipalities

(1) Hot Spot Survey Method in the Rural Area

The soil contamination survey in the Hot Spots in the rural area should be conducted following the official survey method to be regulated in the "Basic Law on Soil Contamination Management" or the provisional official survey method set up by MEPP, Working Group of Soil Contamination Management and Technical Advisory Council in MEPP. The results of the survey conducted by other soil contamination survey methods should not be regarded as official survey results.

The flow of soil contamination survey of Hot Spots is shown in Figure 10.4. The survey consists of existing data analysis, general survey, detailed survey, reporting of soil contamination survey and assessment of soil contamination sites. Finally, the soil contaminated sites will be officially registered as a soil contamination site and potential remedial counter-measures will be assessed in the next stage.

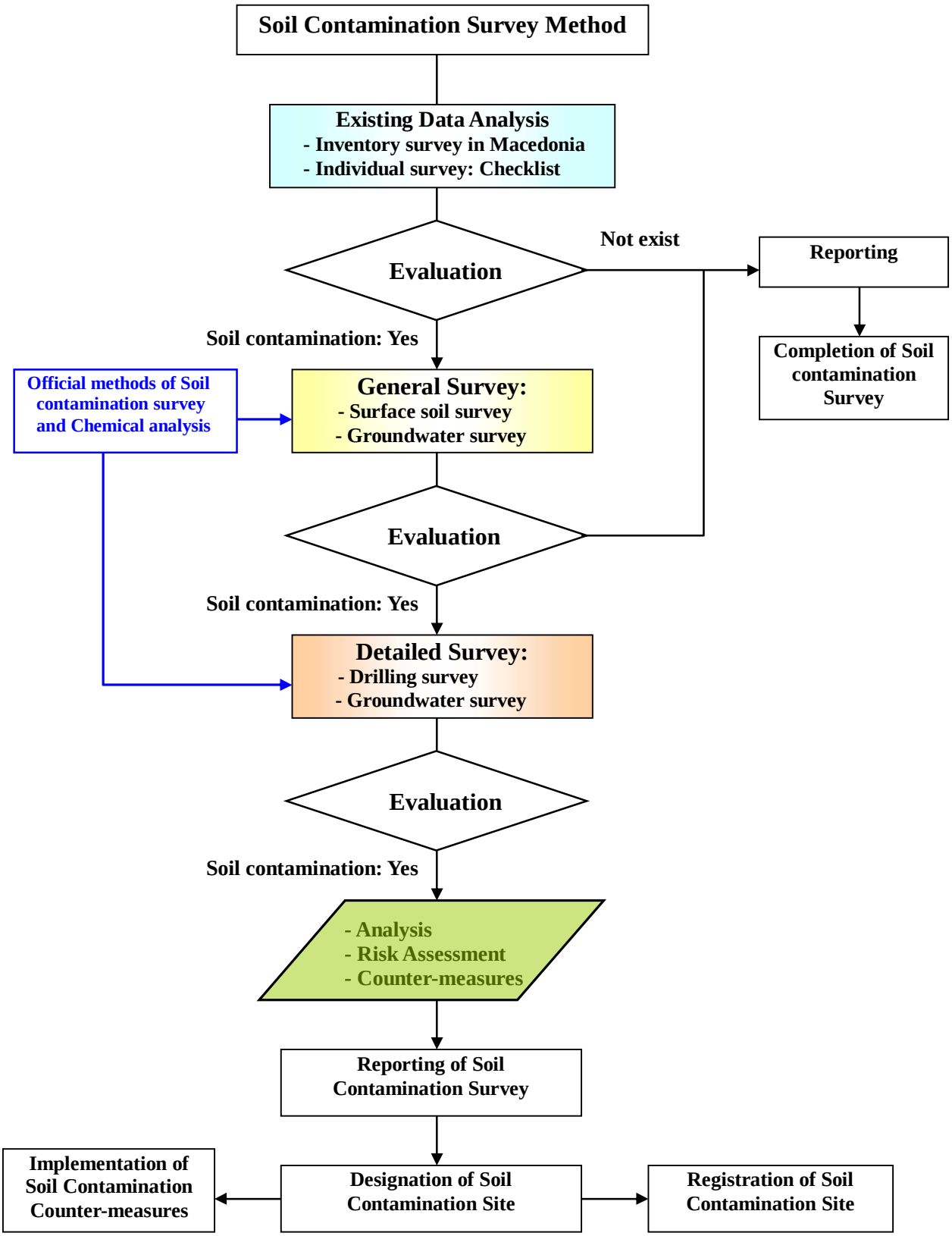


Figure 10.3 Survey Flow of Hot Spot Survey (Soil Contamination Survey Method)

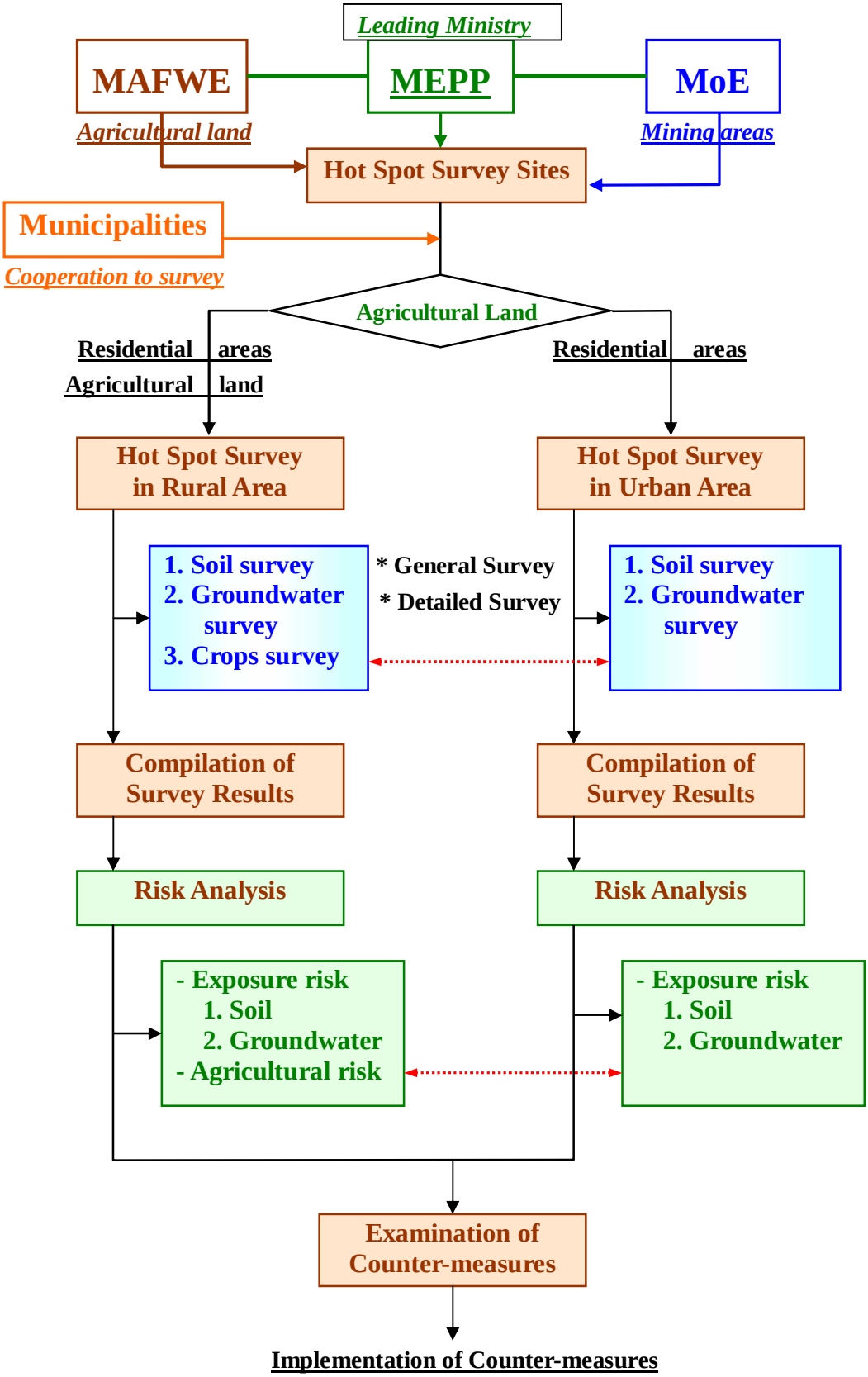


Figure 10.4 Concept of the Hot Spot Survey

The example of soil contamination method is shown in Box 10-1 based on the Institutional framework described in Chapter 9.

The hot spots of most of mining sites are located in the rural areas, consisting of agricultural land, pasture land, forest and scattered several villages. The size of the soil survey grid depends on land use, and normally 200m × 200m to 100m × 100m is recommended for the agricultural land. The locations of the drilling survey should be selected at the most contaminated spot and in the area showing typical features of soil contamination for understanding the vertical extension and soil contamination mechanism.

Concerning crops in agricultural land, it is recommended to carry out crop surveys, because it is possible that some crops could be contaminated by heavy metals through soil and dust. An example of crop survey is shown in Box 15-3 of Appendix – 15.

(2) Hot Spot Survey Method in the Urban Area

The soil contamination survey of the Hot Spot in the urban area also should be conducted by the official survey method. The flow and contents of soil contamination survey of Hot Spot is same as the survey in the rural areas The difference between urban areas and rural areas is only the size of soil survey grid, i.e. the grid size in the urban area, particularly residential area, is better to be 30m × 30m basis.

10.2.7 Examination of Survey Results

The MEPP should compile survey results as well as a Summary Report (Table 10.3) and this should be registered in the Division of Waste and Soils, MEPP.

After confirming soil contamination at the site, MEPP should organise Technical Committee including MEPP, MAFWE and MoE, as well as relevant Municipalities, for consideration of the following items.

- Present situation of soil and groundwater contamination in the site.
- Consideration of necessity of additional surveys in the site.
- Planning of counter-measures for soil and groundwater contamination.
- Organisation of counter-measures implementation.
- Budget for counter-measures, etc.
- Social consideration.
- Risk communication.

Box 10-1

Soil Contamination Survey Method (Draft)

(1) Existing Data Analysis: Collection and analysis of data and information concerning usage of harmful substances in the site.

1. Planning of soil contamination survey in the site
2. Official reporting of the contents and implementation plan of soil contamination survey to the Administrative Office.

(2) General Survey: Surface soil survey and Groundwater survey using existing water wells.

1. Soil and water sampling and analyses of content and elution tests.
2. Confirmation of contaminated soil area of surface dimension.
3. Official chemical analysis method.

General Survey : see Box 15-1 in Appendix − 15.

(3) Detailed Survey: Drilling survey.

1. Drilling sampling and analyses of content and elution tests.
2. Confirmation of contaminated soil area in 3 dimensions.
3. Official chemical analysis method

Detailed Survey : see Box 15-2 in Appendix − 15.

(4) Crop Survey: Sampling and chemical analysis of Crops.

1. Official sampling method.
2. Official chemical analysis method

Crop Survey : see Box 15-3 in Appendix − 15.

(5) Risk Assessment: Risk analysis and assessment based on the land-use.

(6) Reporting of Soil Contamination Survey: Evaluation and Registration.

1. The results of soil contamination survey are reported to the Administrative Office.

Reporting: Summary Report: see Table 10.3.

(7) Designation of Soil Contamination Site: Instruction (order) of counter-measures of soil contamination.

Table 10.3 Summary Report of Soil Contamination Survey Results

Item	Description
1. Name	
2. Address	
3. Sector	
4. Reason for implementing survey	
5. Survey period	
6. Survey results	
a) Concentration of each contaminant (Survey date, measurement method)	
b) Location of contamination (Diagram and detailed diagram within site)	
c) History of use of contaminants	
d) Reasons for selection of survey points	
e) Danger of impact on surrounding area	
7. Remediation measures (if contamination exists.)	
a) Method of remediation measures and reasons for selection	
b) Remediation measure period (planned)	
c) Monitoring framework	
8. Other matters (attach documents describing the state of contamination)	

10.2.8 Organisation of Counter-measures Implementation

The organisation of counter-measures implementation is shown below.

- Planning of counter-measures : MEPP
- Cost of counter-measures : MEPP
- Organisation of counter-measures implementation : MEPP, MAFWE (Agricultural lands), MoE (mining area)
- Co-operative organisation : Municipalities, etc.
- Work builder : Contractor (by Tender)
- Establishment of Technical Committee : Each organisation, relevant municipalities, universities, institutes, etc.

Assistance of Municipalities is needed for the field survey, risk communication, monitoring works, etc.

10.2.9 Survey Cost of the Hot Spot Survey

Although the survey budget for the soil contamination survey should be paid by polluter based on Polluter Pays Principle, the present government take on the responsibility of soil contamination management, because the Hot Spots were caused by national companies of the Former Yugoslav and these companies generally no longer exist.

A plan of the environmental survey was made to assess the environmental impact for each area, as shown in Table 10.2. Based on the experiences of the P/P, the environmental survey of each hot spot should be made for understanding the environmental situation. The survey should consist of grid soil survey and groundwater monitoring.

The number of monitoring well should be decided considering the type of potential contamination area. The wells should be located not only within the potential contaminated area, but also the upper stream and lower stream of potential contaminated area. The cost should include 12 times sampling, once in a month through one whole year, and chemical analysis.

The duration of soil survey depends on the number of samples, ranging from a half month to two months, but the survey of monitoring wells should continue for one year, for understanding the variation of groundwater on a monthly bases all through the year.

The cost of the environmental survey will be about 9,000 to 55,000 Euro depending on each hot spot.

10.3 Soil Contamination Inventory Survey in the Whole Area of Macedonia

The Soil Contamination Inventory Survey aims to find soil contaminated sites other than the Hot Spot sites in the whole area of Macedonia. After finding the sites that have the potential for soil contamination, the sites should be listed and prioritised based on the scale of environmental risk due to harmful substances (i.e. heavy metals) as shown in Table 10.1 for the Hot Spots.

The next steps of the Inventory Survey would be the same content and flow to the Hot Spot Survey.

10.3.1 Targets of the Soil Contamination Inventory Survey

The targets of the Soil Contamination Inventory Survey mainly consist of industrial places using harmful substances as shown in Figure 10.5. Industrial places using harmful substances are distributed in urban and industrial areas of the country. Since most of industrial places are officially registered in the MoE and MEPP in the past and present, it should be easy to list those industrial places that use relatively high amount of harmful substances. In the case of the Inventory Survey, the survey area should be basically limited within the area of industrial places.

On the other hand, other industrial places, using relatively few harmful substances, are unlikely to be officially registered in many cases. Hence, all of the industrial places in the past and present need to be checked with respect to the evidence of using harmful substances by questionnaire and interview surveys as a preliminary survey of the Inventory Survey. A more detailed procedure of the Inventory Survey of industrial places and preliminary survey is shown in Figures 10.6.and10.7.

The management and budget for the Inventory Survey should be managed by MEPP. The evaluation of the Inventory Survey should be discussed in the "Working Group of SCM", because most of works of the Inventory Survey involve members of the working group.

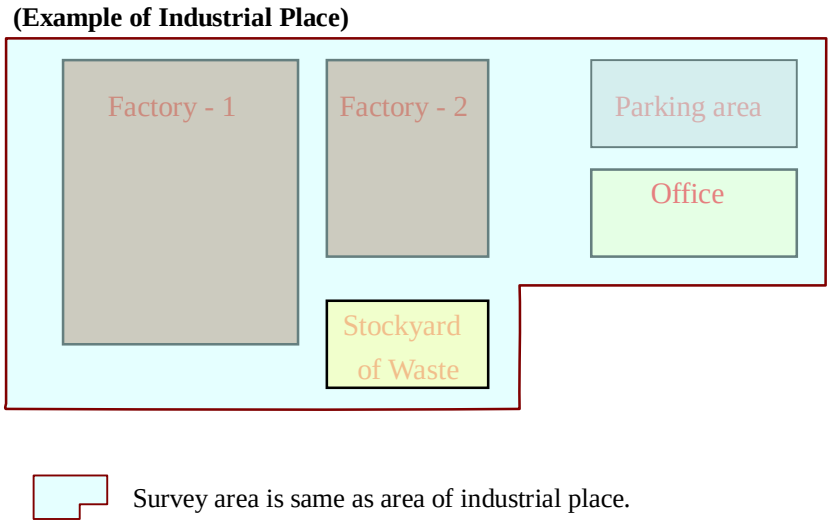


Figure 10.5 Example of the Survey Area at the Industrial Place

10.3.2 Organisation of the Soil Contamination Inventory Survey

The organisation of implementation of the Inventory Survey is shown in Figure 10.6 and described below.

- Planning and Administration : MEPP
- Survey cost : MEPP (Delivered to the Municipalities)
- Organisation of Survey : Municipalities under the MEPP
- Co-operative organisation : MAFWE (Agricultural lands), MoE (Mining area), MoH, etc.
- Surveyor : Contract Company by bidding
- Technical Committee : Official organisation, municipalities, universities, institutes, etc.

The experiences of the P/P are relevant to the development of the survey method and results, etc. The municipalities should conduct the Inventory Survey under the support and management of the MEPP. MEPP needs to provide instructions concerning the survey concept and methods of the Inventory Survey, such as survey methods, data analysis, soil contamination management, etc. to the staff of each municipality in advance.

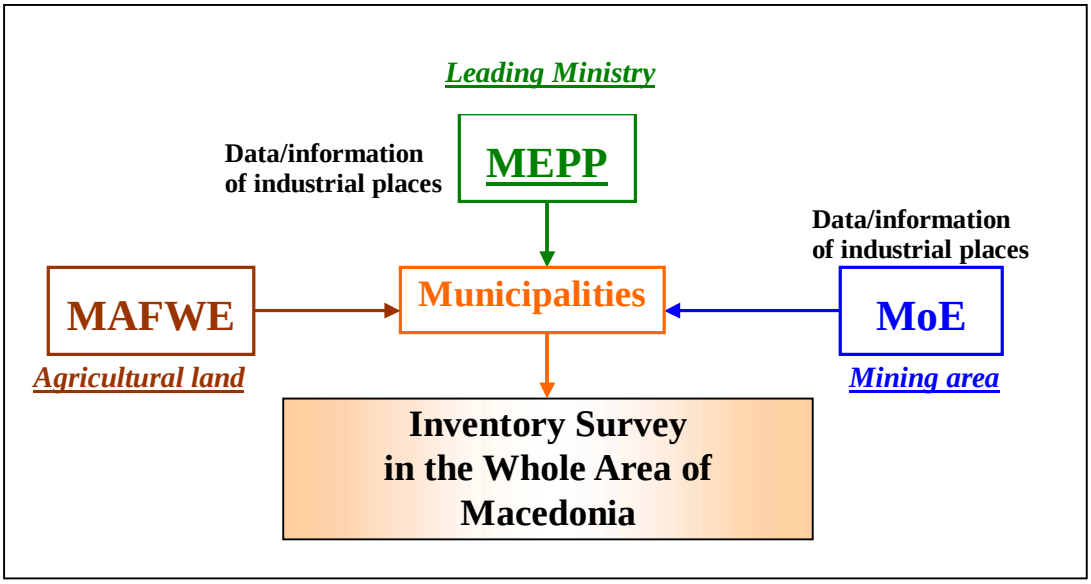


Figure 10.6 Organisation of Implementation of the Inventory Survey

(Roles of Municipalities)

The experiences, achievements and lessons of the P/P are very relevant for planning and implementation of the Inventory Survey in the whole area of Macedonia. Each Municipality should manage the survey and conduct the field works and risk communication between the owner of industrial places and stakeholders, including local residents, and other stakeholders as shown in Figure 10.7.

Most of the Municipalities have already made the Local Environmental Action Plan (LEAP) under the advice of MEPP, hence the awareness of each municipality is thought to be relatively high.

10.3.3 Survey Method of the Soil Contamination Inventory Survey

The flow of soil contamination survey of the Soil Contamination Inventory Survey is shown in Figure 10.7. The survey consists of Preliminary Survey at each industrial place, evaluation of soil and groundwater contamination, registration of the potential site of soil contamination. The Inventory Survey should be terminated at registration of potential site of soil contamination.

However, in the case of soil contamination being confirmed at the site by the Inventory Survey, the procedure of the next step of soil contamination survey will be the same as that of the Hot Spot Survey. The reason why the Inventory Survey will be terminated at the registration of potential site of soil contamination after the Preliminary Survey is due to expenses of survey, i.e. the expenses of Inventory Survey should be paid by the MEPP, but the expenses of the next step survey should be paid by the polluter based on the Polluter Pays Principal.

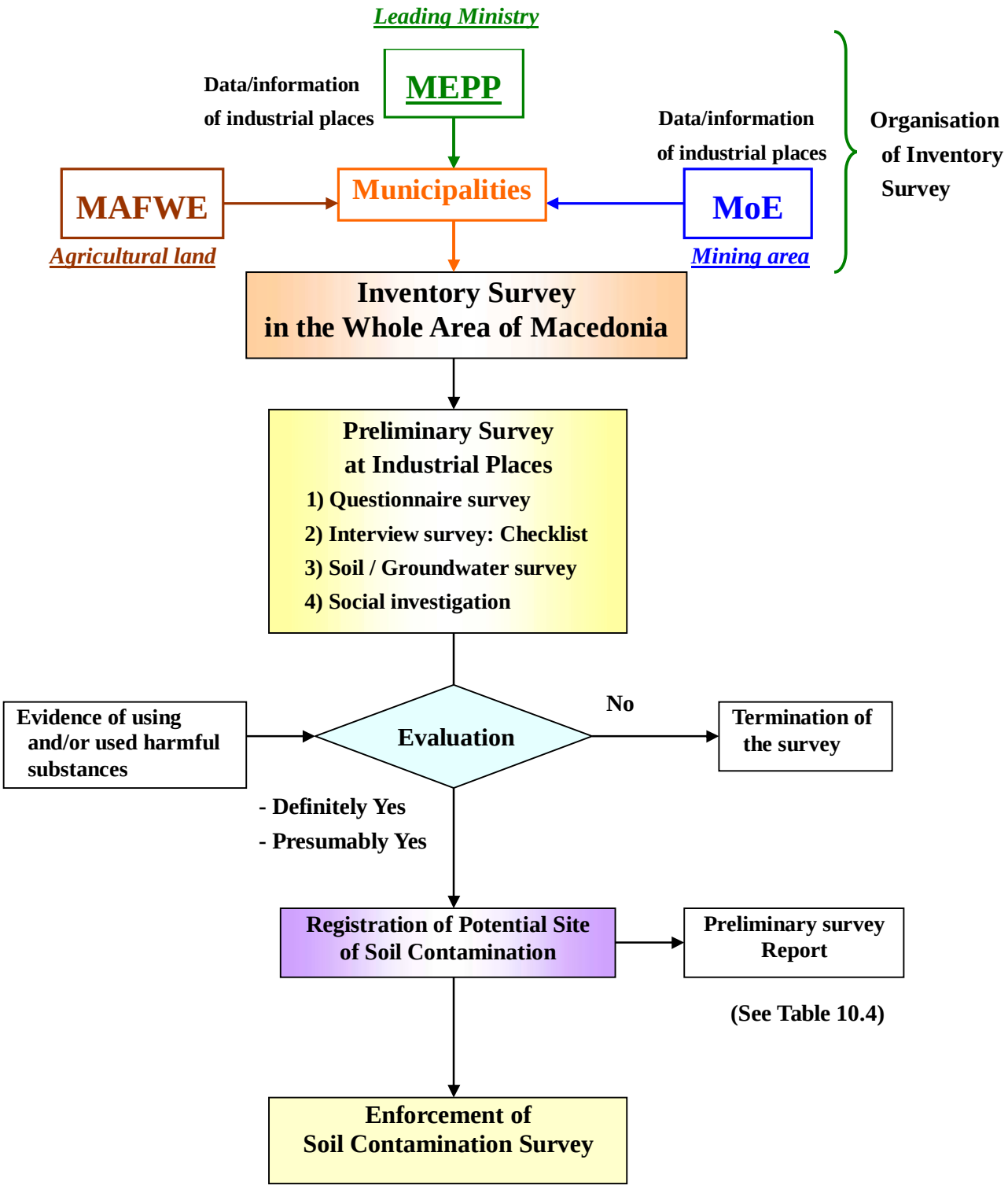


Figure 10.7 Procedure of Inventory Survey of Industrial Places in Whole Area of Macedonia

The MEPP needs to make a survey plan of the Inventry Survey by data analysis of the Inventory Survey site.. The content of the Inventory Survey is shown below.

- Objective sites of the survey : Objective sites are industrial places which had used harmful substances in the past and/or are using harmful substances at present.
- Existing Data Analysis : History of usage of harmful substances in the site (used substances, used places, purpose of use, used amount, used period, condition of discharge as waste, etc.).
  (MEPP and MoE have some of the data of harmful substances being used.)
- Preliminary Survey :
  1. Soil survey: Sampling of four points at the locations of substances being used.
     Sampling depth: 0~30cm
  2. If there are water wells at the objective site, or water wells located in the downstream of groundwater flow from the site, the water sampling of well and chemical analysis should be done.
- Compilation of survey results.

The following contents of the Inventory Survey are suggested.

- Prioritisation of the General and Detailed Survey.
- Survey organisation of the General and Detailed Survey.
- Planning of the General and Detailed Survey, etc. (Survey location, contents, quantity, etc.).
- Planning survey of agricultural land (Crops survey, soil content and elution survey at same point of crops).
- Survey cost, etc.
- Official advice/order of the Detailed Survey to the polluter (Industrial places).

If the agricultural lands exist in the survey area, the crops survey and soil survey are necessary at the site. However, most of the industrial places do not have agricultural land at the site.

In case that there are agricultural lands around the industrial places, the objective area for the Inventory Survey is limited within the industrial site. If intensive contamination of soil and groundwater is found in the site, the soil and groundwater surveys covering outside of the site are planned in the survey of the next step based on the results of the Inventory Survey.

The survey of next step does not belong to the Inventory Survey. However, the soil and groundwater survey methods for outside of the industrial places are basically same as the Hot Spot Survey.

10.3.4 Prioritisation of Survey Sites for Soil Contamination Survey

After the Preliminary survey, the site should be evaluated whether further investigation of soil contamination is required or not (Table 10.4). If the results of the evaluation suggest that there are many contamination sites, where the next step survey is necessary, even in a municipality, it is better to put priority rank.

The criteria of prioritisation of Preliminary Survey sites for the next step survey is shown below.

Prioritisation of Preliminary Survey Sites for the Next Step Survey

1) Evidence of Using harmful substances
   - Using volume of harmful substances
   - Period using harmful substances
2) Using harmful substances, but small quantity and/or short period
3) Industrial sites of generally using harmful substances (even if not reported)
4) Other remarks

10.3.5 Examination of the Soil Contamination Inventory Survey

Organisations of the Inventory Survey, including MEPP and Municipalities, and MAFWE and MoE as cooperative organisations, should carry out the following tasks based on technical comments of the Technical Committee.

- Assessment of soil and groundwater contamination
  1) Soil Survey result
  2) Groundwater Survey result
- Planning of Detailed Survey
- Organising survey implementation
- Fund for survey cost, etc.

All of the results of preliminary surveys in the whole area of Macedonia should be reported and officially registered. An example of the reporting form of the Preliminary survey results of industrial site is shown in Table 10.4.

Table 10.4 Preliminary Survey Report of Industrial Site

(Site No. SK - 0001) (example)

Item	Description
1. Name	
2. Address	
3. Sector	
4. Reason for preliminary survey	
5. Survey period	
6. Survey results	
a) Records of using and/or used harmful substances (Location, volume, period, frequency, etc.)	
b) History of using of harmful substances	
c) Records of incidents in the past (Location, volume, period, frequency, etc.)	
7. Records of investigation of water/soil.	
8. Other matters (Record of operation, site map, etc.)	
Evaluation: Further investigation	Yes / No

10.3.6 Planning of the General and Detailed Surveys

The General and Detailed Surveys are carried out based on the results of the Inventory Survey.

On the survey expenses, the owner of industrial place should pay the survey cost based on the Polluter Pays Principal. Therefore, the staff of each municipality should explain the details concerning the survey results of the Inventory Survey, plan of the General and Detailed Surveys, survey cost, etc. to the owner of industrial place, and order the implementation of the General and Detailed Surveys to the owner of industrial place as soon as possible.

The contents of the General and Detailed Surveys are shown below.

- Soil Survey
  - 1) Grid Survey : 1 point / (30m×30m)
    : Depth：0~30cm
  - 2) Drilling Survey : Drilling points are decided at sites of relatively high soil contamination。
    : Boring depth: 5m, soil core sampling, groundwater sampling and chemical analysis
- Planning survey of agricultural land : Crops survey, soil content and elution survey at same point of crops
- Planning of Detailed Survey : Location, contents, survey amount, etc.

- Organisation of survey implementation
- Funding of survey cost, etc.

In case that the agricultural lands exist in the survey area, the crops survey and soil survey should be carry out in the site. The crops survey consists of the grid survey of 100m x 100m grid and soil content and elution survey at the same point of crops.

10.3.7 Organisation for Implementation of the General and Detailed Surveys

The organisation for implementation of the General and Detailed Surveys is shown below.

- Planning and Administration : MEPP, Municipalities
- Survey cost : Owner of the industrial site
- Organisation of Survey : Municipalities under the MEPP
- Co-operative organisation : MAFWE (Agricultural lands), MoE (Mining area), MoH, etc.
- Surveyor : Contract Company by bidding
- Technical Committee : Official organisation, municipalities, universities, institutes, etc.

The experiences of the P/P are helpful for deciding the survey method and assessing the result, and the Municipality should be involved in the field survey, risk communication, etc.

The polluter should pay the cost for the soil contamination survey based on the Polluter Pays Principle.

10.3.8 Examination of the General and Detailed Surveys

The organisations of Inventor Survey, including MEPP and Municipalities, and MAFWE and MoE as relevant organisations, should implement the following items based on technical comments of the Technical Advisory Council.

- Assessment of soil and groundwater contamination
    1) Soil Survey result
    2) Groundwater Survey result
- Planning of counter-measures : Locations, procedure, contents, amount, etc.
- Organising implementation for the counter-measures
- Funding for counter-measures, etc.

10.4 Work Programme of Counter-measures for Soil Contamination in the Whole Area of Macedonia

10.4.1 Organisation of Counter-measures Implementation

The organisations of counter-measures implementation is shown below.

- Planning of counter-measures : MEPP, Municipalities
- Cost of counter-measures : Hot Spot -The government of Macedonia
  : Industrial Site -Owner of the site
- Organisation of counter-measures implementation : MEPP, MAFWE (agricultural lands), MoE (mining area)
- Co-operative organisation : Municipalities, etc.
- Work builder : Contractor (by Tender)
- Technical Committee : Official organisation, municipalities, universities, institutes, etc.

The experience of the P/P is relevant to the implementation of counter-measures and the Municipality should be involved in the counter-measure works, risk communication, etc.

10.4.2 Procedure of Counter-measures for Soil and Groundwater Contamination

There are two types of counter-measures, namely temporary and permanent counter-measures. The differences between them are shown below.

- Temporary Counter-measures : In the case of permanent counter-measure can not be carried out immediately, temporary counter-measure is conducted to mitigate risks of human health and to prevent spreading of contamination to the surrounding environment.
-Permanent Counter-measures : It is conducted to prevent the spreading of contamination to the soil and groundwater to surrounding area in the future.

If the General and Detailed Surveys of the Hot Spot Survey and the Inventory Survey indicate soil and groundwater contamination with urgent matters (e.g. intense soil contamination, contamination of groundwater for drinking, etc.), except for cases where it is possible to carry out the permanent counter-measures immediately, the temporary counter-measures should be carried out to prevent impact of contamination on the surrounding environment. The procedure of both types of counter-measures is shown in Figure 10.8 and their details are described below.

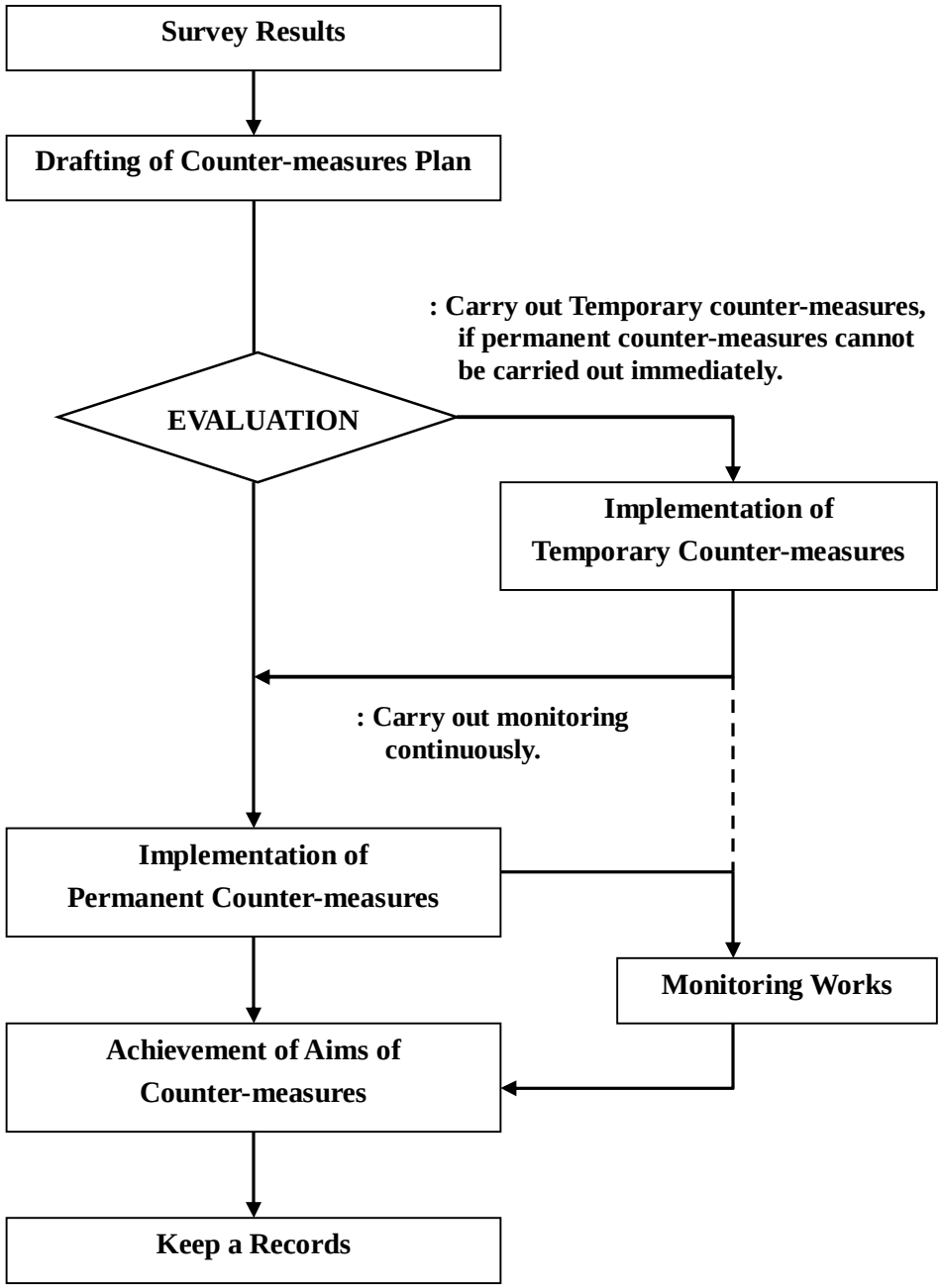


Figure 10.8 Procedure of Counter-measures for Soil/Groundwater Contamination

(1) Temporary Counter-measures

The temporary counter-measures can be broadly divided into two counter-measures; one is to prevent intake of heavy metals by humans and the other is to prevent the spreading of contamination. The latter can be classified into three counter-measures as given below.

- Counter-measure to prevent contamination of public water areas and groundwater by contaminated soil.
- Counter-measure to prevent atmospheric dispersion of heavy metals.
- Counter-measure to prevent the spreading of contaminated groundwater.

Implementation of temporary counter-measures must be conducted choosing appropriate counter-measure by giving consideration to the circumstances of the surrounding area.

The classification of the temporary counter-measures is shown in Figure 10.9.

(2) Permanent Counter-measures

The target of the permanent counter-measures related to soil contamination by heavy metals, etc. is to ensure that infiltration of heavy metals by rainfall does not result in the spreading of contamination to the soil and groundwater to surrounding areas in the future. Although it is desirable that heavy metals are removed (separation of heavy metals, etc. or decomposition of compounds) from the contaminated soil, at least they should be separated from the surrounding environment.

The classification of the permanent counter-measures for heavy metals, etc. is shown in Figure 10.10.

The process of implementation of the permanent counter-measure is shown below.

- Introduction of counter-measure methods for soil contamination.
  (For cases of Heavy metals)
  - Cutting off by excavation
  - Insolubilisation of heavy metals
  - Covering by fresh soil, asphalt, concrete, etc.
- Implementation of counter-measures for soil contamination.
- Confirmation of completion of counter-measures.

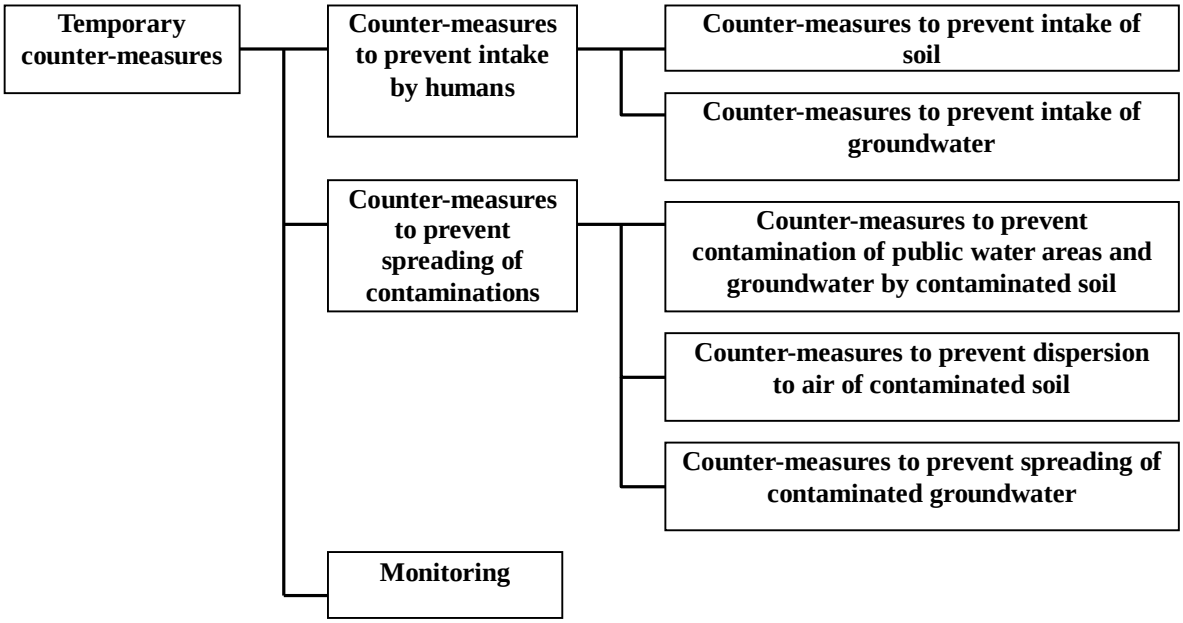


Figure 10.9 Temporary counter-measures for Heavy Metals, etc.

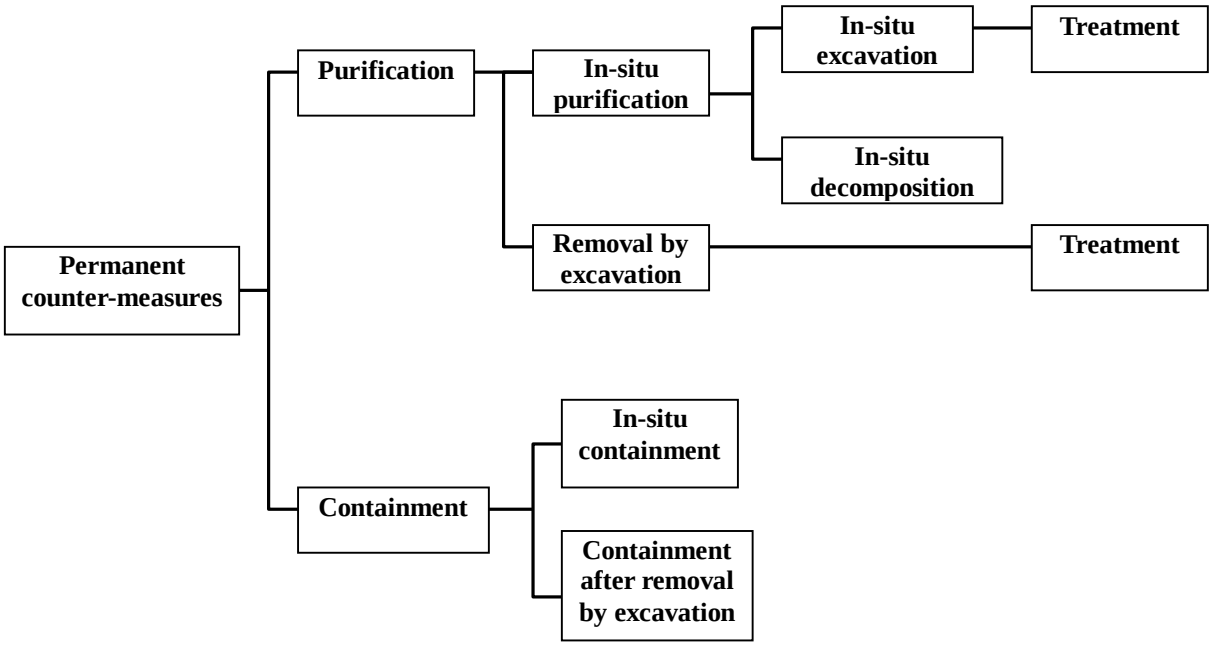


Figure 10.10 Permanent Counter-measures for Heavy Metals, etc.

10.5 Monitoring Method of Soil Contamination

There are two cases of situation of monitoring of soil contamination in the site; one is contaminated soil located in the unsaturation zone over the groundwater table and the other is contaminated soil located in the saturation zone, on and under the groundwater table.

10.5.1 Soil Contamination in Unsaturation Zone

In case of contaminated soil located in the unsaturation zone over the groundwater table, the monitoring works of soil can be carried out during the implementation of counter-measures by the direct sampling of soil in the site for the confirmation of soil contamination.

10.5.2 Soil Contamination in Saturation Zone

In the case of the contaminated soil located in the saturation zone, monitoring of soil is conducted using the groundwater as an indicator of soil contamination. The monitoring work must be done for three times; during soil contamination survey, at the implementation of counter-measures and after the counter-measures for checking the condition of soil contamination in and surrounding the site. The recommended monitoring method is to use groundwater well (or piezometers in tailings dam). It is possible to use existing water wells and/or investigation drill holes (change them to monitoring wells). The monitoring wells should be located in the upstream and downstream of groundwater flow from the contaminated soil.

PART IV

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 11 CONCLUSIONS AND RECOMMRNDATIONS

CHAPTER 11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

The results of the soil, groundwater and crops surveys and risk assessment conducted in the Pilot Project (P/P) revealed that contamination of soil, groundwater and crop by heavy metals exist in the P/P area. The zones of contaminated soil occur over the surrounding area of the tailings dams and along the Kiselica, Koritnica and Zletovska Rivers. The water samples of groundwater survey showed high concentration of heavy metals greater than the Standard of Drinking Water and Water Quality Standard of Macedonia for most of the well and springs, and more than half of the wells/springs are still used as a source of drinking water by the local residents. The crop survey of 2006 showed that 36% of the collected wheat samples have Pb concentration exceeding the standard value, and a scattered distribution of these samples suggests relatively high agriculture risk in the whole area of agriculture land.

The Master Plan (M/P) was formulated based on the P/P. The purposes of the M/P are to develop capacity for soil contamination management related to mining for improving the environment in Macedonia and to facilitate the process of independently driving forward the sustainable system of soil contamination management after this study.

11.1.1 Institution Level of Capacity Development on Soil Contamination Management

On the legal framework of soil contamination management in Macedonia, the MEPP should take an initiative of soil contamination management and establish the "Basic Law on Soil Contamination Management" as the leading ministry. The institutional framework and roles of the soil contamination management in each ministry are:

(1) Ministry of Environment and Physical Planning (MEPP) : Taking the initiative of Soil Contamination Management and in charge of soil contamination management of urban, industrial/ commercial areas.
(2) Ministry of Agriculture、Forestry and Water Economy (MAFWE): Taking charge of soil contamination management of agricultural land.
(3) Ministry of Economy (MoE): Taking charge of soil contamination management of mining area.
(4) Ministry of Health (MoH): Taking charge of improvement of conservation of public health and environmental risk assessment.
(5) Local Municipality: Taking charge of implementation of soil contamination management at sites within their areas of their responsibility, with the support of the relevant ministries.

During the period until adoption of the Basic Law of soil contamination management, the process of provisional institution system is required. The contents and framework of the provisional period on soil contamination management are basically similar to those after the establishment of the Basic Law.

11.1.2 Society Level of Capacity Development on Soil Contamination Management

The main components of capacity development at society level are public awareness, social education/research/training concerning soil environment, risk communication and resident participation. Particularly, risk communication is important and a procedure of risk communication should be included in the Basic Law of soil contamination management.

11.1.3 Organisation Level of Capacity Development on Soil Contamination Management

Capacity Development at organisational level will be necessary to ensure the successful implementation of the M/P and implementation of improvements in Soil Contamination Management on an ongoing and sustainable basis and to make clear tasks for the ministries and other stakeholders.

11.1.4 Technical (Individual) Level of Capacity Development on Soil Contamination Management

The contents of technical (individual) level on capacity development of soil contamination management consist of (1) Soil Contamination Survey, (2) Data Analysis, (3) Counter-measures for Soil Contamination and (4) Management of Information on soil contamination.

The soil contamination survey in the whole area of Macedonia consists of two types of soil contamination survey, namely Hot Spot Survey and Soil Contamination Inventory Survey. The "Hot Spots" are generally characterised by large-scale potential of soil contamination associated with extensive air pollution (mainly dust) and water contamination, which can significantly affect human health by harmful substances of heavy metals. Hence, the Hot Spot Survey of soil contamination is a relatively urgent matter. The Soil Contamination Inventory Survey is to find soil contaminated sites other than the Hot Spot sites in the whole area of Macedonia. After finding the sites of potential soil contamination, the sites are listed and prioritised based on the scale of environmental risk due to harmful substances (i.e. heavy metals). MEPP needs to instruct the survey concept of the Inventory Survey, such as survey methods, data analysis, soil contamination management, etc. to the staff of each municipality in advance.

11.2 Recommendations

11.2.1 Urgent Counter-measures

In the P/P area, the following counter-measures should be taken urgently.

(1) Water from most of the wells/springs of villages in the P/P area has high concentrations of arsenic (As), cobalt (Co), nickel (Ni) and lead (Pb), exceeding the Standard of Drinking Water according to the results of preliminary study using AAS. It is a serious health problem that the water is used for drinking by local residents in half of villages of the P/P area. It is necessary to conduct chemical analysis of the well/springs water at the accredited laboratory (MoH) to confirm the situation of water quality. If the water is confirmed to be contaminated, the counter-measure should be taken immediately to prevent the local residents to use water for drinking and other sources of water supply must be prepared. For taking actions for this problem, it is necessary, at appropriate time, to disclose the actual situation through a proper way of risk communication to the local residents for sharing information, raising awareness and discussing immediate counter-measures.

(2) Finding the scattered distribution of the wheat with high Pb concentration exceeding the Standard Value over the P/P area suggests relatively high agricultural risk and cultivation of wheat must be carefully considered in the P/P area. The yearly variation of heavy metals in wheat found during the P/P suggest that continuous monitoring of wheat with increasing number of samples is necessary to confirm this. After monitoring, proper actions such as changing agricultural product from wheat to something else should be considered.

(3) The tailings dams of TD-I and TD-II are classified as Exposure Risk Level 5. Because they are located close to the residential area and the risk to human health is high, an urgent counter-measure for reducing high risk is necessary. As an urgent counter-measure, either removing tailing material or covering the surface of tailings dam and constructing retaining walls on the west side of the tailings dam should be considered immediately.

11.2.2 Recommendations

Further recommendations are given below.

(1) Recommendation on Soil Contamination Surveys

a. It is recommended to include groundwater survey in parallel to soil contamination survey, when planning soil contamination survey. Particularly, for the area where groundwater contamination is anticipated from topographic and hydrological features and wells are used for drinking water, soil/groundwater survey should be conducted promptly.

b. Crops survey should be included in soil contamination survey of the agriculture area with potential of heavy metal contamination.

c. The "Hot Spots" , most of which are related to minig activities, are generally characterised by large-scale potential of soil contamination and could significantly affect human health by harmful substances of heavy metals. Hence, the soil contamination survey of “Hot Spots” should be implemented as soon as possible.

(2) Recommendation on Counter-measures

The following remedial counter-measures are proposed in the P/P area for the mitigation of the risk of heavy metal contamination.

- **Priority No.1 –** Tailings dam I and II (proposed as the urgent counter-measures)
- **Priority No. 2 -** Tailings dams TD-IV and TD-V: covering by uncontaminated soil with re-vegetation/re-forestation, retaining walls along the foot of the dike and ditches/culverts for collecting seepage water from the tailings, and water treatment, protection of dust-blowing.
- **Priority No. 3 -** Middle stream of the Zletovska River: removing tailings, tailings should be returned to the new tailings dam.
- **Priority No. 4 -** Lower stream of the Koritnica River: sand controlled dam to stop the rock fragment and gravels with high heavy metal concentrations, install culverts and water treatment.
- **Priority No. 5 -** Lower stream of the Kiselica River: removing tailings; tailings should be returned to the new tailings dam.

(3) Recommendation for Institutional and Organizational Levels

- MEPP should take the initiative as the leading ministry responsible for soil contamination management and needs to develop the Basic Law on Soil Contamination Management and necessary ministerial ordinances, etc.
- It is recommended that recruitment is carried out as soon as possible into the Division on Waste and Soil in MEPP so that it can kick-start the implementation of the Master Plan.
- MAFWE should formalise the role on soil contamination management in agricultural areas in the new Sector for Registration and Management of Agricultural Land.
- Linkages between Ministries are essential, and the Technical Advisory Council consisting of the members from the related ministries, organizations and institutes will need to be set up as soon as possible.

- Financial mechanisms will need to be planned in detail for funding soil contamination management, particularly counter-measures.

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