Manual for the Survey, Excavation and Related Issues regarding Agricultural Chemicals Stored Underground.

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Agricultural Chemicals Control Office, Soil Environment Management Division, Environmental Management Bureau, MOE

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1. Outline and Objectives of the Manual

The Stockholm Convention on Persistent Organic Pollutants (hereafter, called “Stockholm Convention”) adopted on 22 May, 2001 requires each country to prohibit the manufacture and use of persistent organic pollutants (hereafter, called ”POPs”), the proper environmental control of inventories and proper disposal of wastes. Of all 12 chemicals covered by the Stockholm Convention at present, 6 chemicals, such as DDT, have already been registered as polluting agricultural chemicals in Japan. Use of agricultural chemicals containing these compounds were regulated 20-30 years ago, and their registrations gradually became invalid. So now it is prohibited to sell them according to the Agricultural Chemicals Regulation Law (Law No.82 enforced in 1948), article 9, section 2 and prohibited to use them according to article 11.

On the other hand, waste agricultural chemicals of organochlorine pesticides (BHC, DDT, aldrin, dieldrin and endrin) were put into concrete receptacles or the like and then stored underground under the advice and with the support of the Ministry of Agriculture, Forestry and Fisheries in 1965-75, and properly treatment as POPs waste according to the Stockholm Convention is required for their excavation and disposal. However, as treatment technology for hazardous substances in organochlorine pesticides was not satisfactorily established for adoption by the Stockholm Convention, work instructions and notices for survey, excavation and storage to check the existence of contamination caused by agricultural chemicals stored underground were provided as temporary response. in a tentative manual in December 2001,

Subsequently, investigations of treatment technology for POPs agricultural chemicals was promoted and outcomes were provided, and the conditions for the proper treatment of agricultural chemicals stored underground in Japan have been prepared through the following events:

1) Ratification of the Stockholm Convention obliging signatory nations to environmentally control the inventories of POPs chemicals and to treat the waste (17 May, 2004),

2) Conduct of “Final disposal project of agricultural chemicals stored underground” to promote treatment of agricultural chemicals stored underground by the Ministry of Agriculture, Forestry and Fisheries (two years after fiscal year 2004. Since fiscal year 2006, planned treatment of agricultural chemicals stored underground has been promoted by local governments and supported by subsidies.)

3) Publication technical information (“Technical notices regarding treatment of POPs wasted agricultural chemicals”) for disposal of agricultural chemicals stored underground published by Waste Management and Recycling Department, MOE (Issue No. Kan-San-Hai 041012002, notice by Director of Office of Waste Disposal Management, Industrial waste Management Division, Waste Management and Recycling Department, Minister’s Secretariat, MOE on 12 October, 2004. Hereafter, called “technical notice”.).

In response to changes in the situation, “Amendment of tentative manual for survey and excavation of agricultural chemicals stored underground” (Issue No. Kan-Sui-Do 050330001, noticed by Director of

Water Environment Management Division, Environment Management Bureau, MOE. Hereafter, called “amended manual”, issued on 30 March, 2005), in which contents of “Tentative manual for survey and excavation of agricultural chemicals stored underground” established in fiscal year 2001 were renewed and expanded, was published by the Water Environment Management Division, Environment Management Bureau, (previous name) MOE

Recently, this manual was finally completed through investigation by a working group for treatment technology of POPs agricultural chemicals (chairman: Professor Osami Nakasugi, Professor of Institute for Studies of the Global Environment, Sofia University) based on information provided after publication of the amended manual.

The main revision points of this manual are that measures for handling contaminated soil were added in response to actual treatment situation at sites where agricultural chemicals stored underground have already been treated, referring to measures adopted by the Soil Contamination Countermeasures Law.

Specifically, as a site having a large amount of contaminated soil (exceeding the existing soil contamination guideline value relative to agricultural chemicals stored underground) was found, countermeasures against the risk of handling the contaminated soil from the surrounding area of the target storage site were also provided from the viewpoint of the impact on human health. This was done in response to countermeasures applied by the Soil Contamination Countermeasures Law in which contamination risk is considered through contaminant content in soil and contaminant dissolution concentration from soil, and then countermeasures are provided. As the concept of soil contamination guideline value (content value) and elimination treatment guideline value were introduced as the judgment criteria, promotion of an adequate survey and excavation techniques in accordance with this manual is expected.

In some cases, it may be difficult to conduct these actions in accordance with this manual. In those cases, it is important to request advice from experienced, educated persons and local governments to establish a specific investigation plan, to conduct it and to retain records. Please note this.

2. Summary and persons responsible

2.1 Summary of the manual

2.1.1 Target agricultural chemicals

Target agricultural chemicals covered in this manual are basically agricultural chemicals containing seven chemicals (hereafter called “POPs agricultural chemicals”) DDT, aldrin, dieldrin, endrin, chlordane and heptachlor, which were registered in Japan as all target chemicals of the Stockholm Convention, as well as BHC, which was previously a target of the treatment of agricultural chemicals stored underground.

Agricultural chemicals are sometimes formulated by combining various agricultural components. Accordingly, some formulated products may contain several components, except for POPs chemicals, even though they are considered POPs agricultural chemicals.* Moreover, as arsenic agents and some organic phosphorus products are prohibited for use at the stage of initiation of storing underground, organic phosphorus products, such as parathion, and agricultural chemicals containing mercury, copper and arsenic, are also potentially stored underground together with them. These agricultural chemicals should be also considered when reviewing countermeasures against agricultural chemicals stored underground. A list of POPs agricultural chemicals is shown in Attachment 1, which indicates a total of 70 types of agricultural chemical contents that are contained together. (Names of POPs agricultural chemicals are referred to in Attachment 2.) In this manual, these contents stored simultaneously are taken into consideration, where necessary. Physico-chemical properties and toxicities of seven chemicals, such as DDT, with agricultural chemical contents contained in POPs agricultural chemicals (hereafter called “POPs chemicals) are shown in Attachment 3. As the handling of mercury agents and arsenic agents is different from that of other agricultural chemicals, special consideration is required Especially when soil and groundwater are contaminated with mercury or arsenic, the Soil Contamination Countermeasure Law and the Water Pollution Prevention Law may be applied and then compliance with them is required.

As DDT and other chemicals used as insect/pest protection products which are not registered may be potentially stored, they should also be treated in accordance with this manual.

*Note of translation: agricultural chemical products which contain POPs components are regarded as “POPs agricultural chemicals)

2.1.2 Flow of survey, excavation, storage and treatment

Flow of survey, excavation, storage and treatment work of agricultural chemicals stored underground is shown in Figure 2.1. Technical notices regarding treatment of POPs wasted agricultural chemicals were published by the Waste Management and Recycling Department of MOE, and proper treatment of agricultural chemicals stored underground should be promoted based on the notices, considering priority

of treatment methods responding to local conditions.

The Ministry of Agriculture, Forestry and Fisheries supports planned treatment of agricultural chemicals stored underground conducted by local governments by using a menu of subsidies(for food safety and relief).

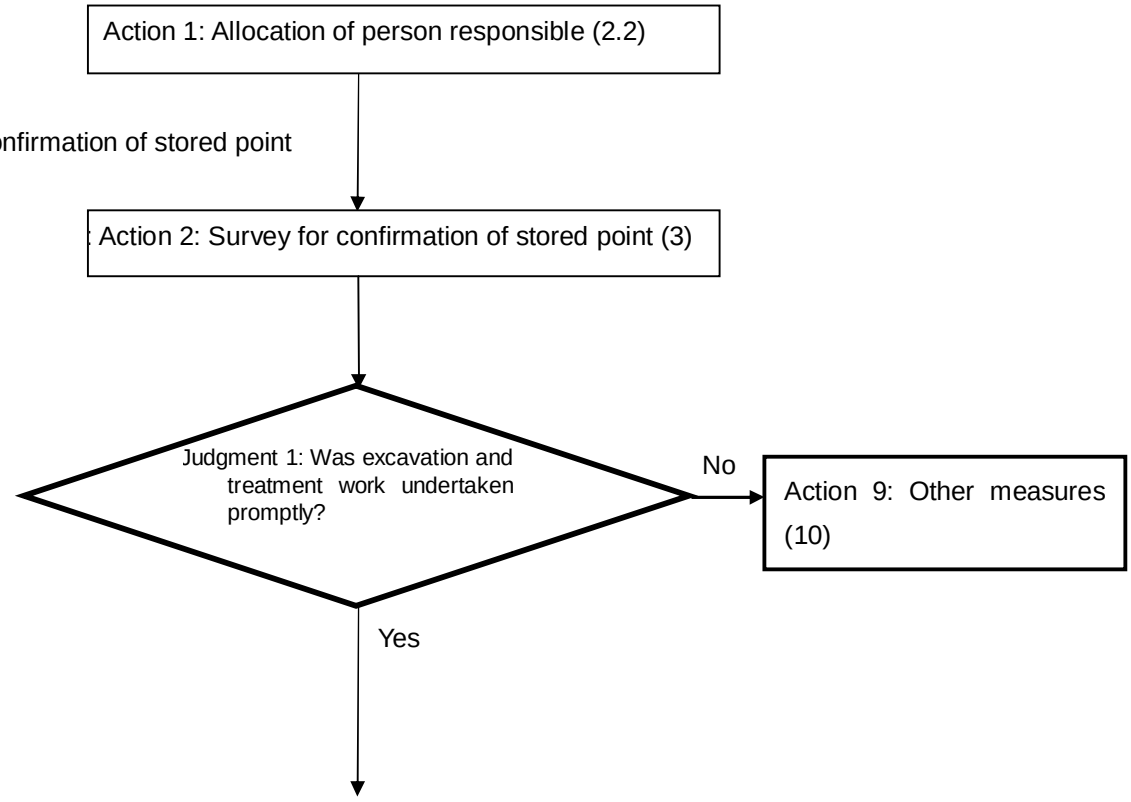
2.2 Allocation of persons responsible (Action 1)

When the survey, excavation and storage are conducted in accordance with this manual, local government or agricultural cooperatives are likely to become the project implementing bodies. The project implementing body should allocate a person responsible for the project.

The person responsible not only plans and records according to this manual but also completes administrative procedures necessary to conduct the project and coordinate the actions of associated organizations, the site owner and neighboring residents.

It is important to conduct the project with the advice of experienced, educated persons (including industrial doctors), and local government departments of agriculture and forestry, the environment and waste control.

a) Allocation of person responsible



b) Survey for confirmation of stored point

c) Survey for determination of target excavation area

Action 3: Determination of target excavation area (Survey for checking surrounding environment) (5)

d) Preparation for excavation

Action 4: Preparation for excavation (6)
Establishment of work plan and preparation of storage containers and storage place, etc.

e) Excavation

Action 5: Excavation and recovery work (7.1)
Excavation and removing of upper layer and contacting part of stored agricultural chemicals, Recovery of agricultural chemicals, removing lower layer and side walls, Recovery of contaminated soil, Refill, etc.

Action 6: Safety control and prevention of environmental pollution during works (7.2), Safety of workers, Isolation from surrounding area, etc.

Action 7: Monitoring of surrounding environment (8)

On finding an abnormal condition, work is suspended.

f) Storage

Control during storage (9)
Clarification of person responsible, suitable storage, periodical monitoring during storage, etc.

g) Treatment

uitable control in accordance with “Technical notices regarding POPs wasted agricultural chemicals treatment”

Figure 2.1 Flow of survey, excavation and storage of agricultural chemicals

3. Survey for confirmation of stored point (Action 2)

3.1 Summary of survey for confirmation of stored point

To identify accurate position of stored chemicals (horizontal broadening, depth, etc.), survey for confirmation of burial point is conducted. This survey is composed of the following 4 stages:

① Documents review
② Establishment of survey plan
③ Conduct of survey
④ Reporting of survey result and its review

3.1.1 Objective

When doing an environmental survey, excavation, and recovery work without identification of the accurate location, environmental pollution may be caused by POPs agricultural chemicals triggered by the destruction of their container. The objective of the survey for the confirmation of the storage site is to identify the accurate location and the surrounding area (horizontal broadening, depth, etc.) of agricultural chemicals at an accuracy of at least 50 cm to 1m

3.1.2 Procedure of survey for confirmation of storage site

To overview stored point, documents review, hearing survey and site reconnaissance are firstly conducted. Subsequently, to identify the storage site and the target location accurately, conducting a survey by means of non-destructive methods (physical survey method enabling person on the ground to survey underground condition without excavation by means of sensor or the like (underground radar survey) or survey by means of less destructive sensing bar, etc.) is adopted, considering the accuracy of existing drawing and uncertainty of previous records and memory of persons who stored the chemicals.

3.2 Document review

By this document review, not only an overview of the storage site and the understanding of basic information for suitable sensing survey on the next stage but also the storage site and its contents are understood. This is done by reviewing the documents recording the location of the agricultural chemicals and hearing from relevant persons having previous information regarding the site condition. These actions are taken to grasp the existence of environmental pollution caused by leakage of agricultural chemicals stored underground into the surrounding environment. Documents regarding the geological condition and hydrology of the groundwater are also collected.

The information regarding the amount of agricultural chemicals stored underground and types stored are collected by a document review that is provided to estimate the condition of agricultural chemicals stored underground (horizontal spreading, depth, shape, etc.).

3.2.1 Conduct of documents review

(1) Review items and method

Items and method for documents review are shown as follows.

a) Storage site

Storage sites are found through looking at drawings and hearings, and then they are described on an existing plan view. In some cases, the locations of roads or buildings as reference points may be different from previous information, so that the storage site should be accurately described on the current plan view by checking both the previous and current plan views. Furthermore, it should also be noted that the location of the storage site may be changed under a road or building because of subsequent modification of the road, building construction, or the like.

b) Type of stored chemicals

The type of stored chemicals should be grasped based on the records of the storage site and are generally classified into two types: large-scale collective sites (over 3 tons of agricultural chemical per location) and small-scale scattered sites (approximately 300 g per location). In most cases of the large-scale collective type, a concrete receptacle is provided and storage containers (such as drums) filled with POPs agricultural chemical are stored in it. As for small-scale scattered sites, various types are observed: Holes for storage are provided and then a PVC sheet is applied to directly pack in the POPs agricultural chemicals, solidifies them by means of mortar, etc. In the case of small-scale scattered sites, the number of storage sites and their locations should be checked not to overlook other stored chemicals.

Through a document review, container conditions (unopened or not used), as well as the condition of the agricultural chemicals in the site, depth of storage site, etc. should be reviewed in advance, if possible.

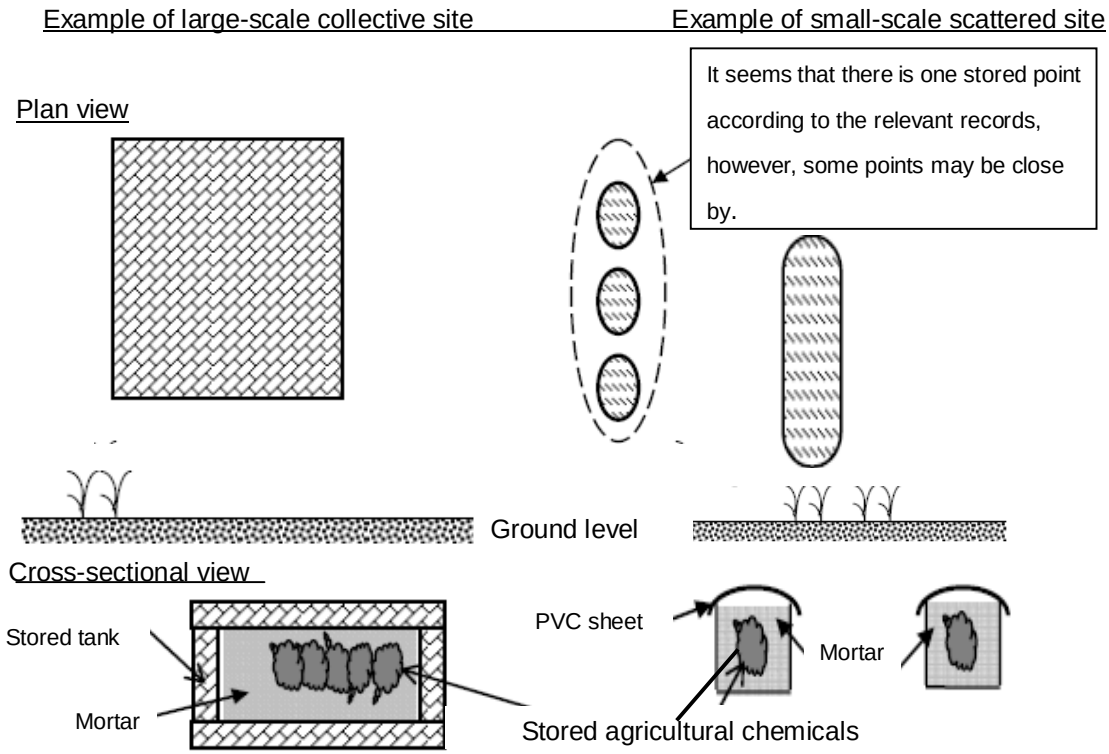


Figure 3.1 Typical examples of agricultural chemicals stored underground

c) Stored contents

The type of agricultural chemicals and the amount for each specification or for each type of container should be grasped based on storage records, if possible. It is expected to be able to find the name of the products of all agricultural contents.

Mercury contained in agricultural chemicals such as DDT and mercury mixed formulations or arsenic contained may also be in agricultural chemicals. When mercury or arsenic is found, it is important to check for them. The regulation of the Soil Contamination Countermeasures Law is potentially applied to the following cases; 1) When a treatment facility is specified, and 2) When the soil near agricultural chemicals stored in the underground site are contaminated with mercury or arsenic. In some cases, these are not recorded as mercury or arsenic and then their existence should be checked at the

excavation stage (Refer to “(Reference) Notices for selection of treatment facility of POPs agricultural chemical containing mercury or arsenic” when mercury or arsenic is contained in agricultural chemicals stored underground.).

When liquid agricultural chemicals in a glass container are stored, the container should be handled so as not to damage it on recovery. In that case, its existence should be verified by checking with an experienced, educated person.

d) Land use of surrounding area

Current land use of the surrounding area of the storage site should be reviewed. Whether there is any potential area, such as farmland, residential area or school, impacted by the leakage of agricultural chemicals should be checked, and the geographical relationship between it and the storage site should be reviewed.

e) Hydro-geological conditions

When table water is located near the storage site, its distribution and use (such as intake for water supply, fishery use, etc.) must be checked.

When an existing well (including agricultural use) is located near the storage site, its distribution, use (especially, for drinking) and structure, such as depth of water intake, are also reviewed. Especially in the case of drinking water use, more detailed conditions should be clearly understood.

Geological conditions near the storage site have a significant effect on the mobility of leaked contaminants, so that soil properties such as sand or clay should be checked underground as well as at the surface. For this purpose, information concerning previous civil engineering and well construction near the site is collected. Moreover, when a groundwater monitoring well is provided near the stored point, stratum near there should be checked by core sampling or the like.

(2) Check of special conditions and restrictions regarding excavation

To clarify the issue regarding excavation and treatment of agricultural chemical, the following items are reviewed:

a) Is a building or road located over and/or near stored point and used regularly?
b) Is the structure potentially harmed by evacuation of the agricultural chemicals located over and/or near the storage site?

(3) Review of survey results

These survey results are reviewed and the following contents are retained as records.

a) Summary of survey

Summary of person responsible, date, implementation organization and results should be recorded.

b) Results and method regarding conditions near the storage site, condition, contents and types of agricultural chemicals stored underground, surrounding land use, hydro-geological condition near the site are recorded. Plan view of the site and site photos are also attached.

3.3 Establishment of survey plan (Refer to Attachment 4)

Location and type of storage site is estimated according to “3.2 Documents review”, and survey method applicable to the condition of the site is selected. Subsequently, an appropriate survey plan is established. Difference of stored types (Figure 3.1) should be considered for review.

3.3.1 Estimation of location and type of stored point

When only “3.2 document review” is conducted, a survey utilizing a nondestructive method should be conducted because it is difficult to accurately locate the storage site due to uncertain information through existing imprecise drawings, previous incomplete records and unclear memory of the person who stored it originally. (When it is difficult to excavate promptly for reasons such as building, road, etc. over or near the storage site , a survey can be extended to the start of the excavation stage.)

As for the conduct of the survey, location and type of storage site should be estimated in advance according to the results of “3.2 document review.”This estimation is very important for the establishment of the survey plan and has a significant effect on performance of the survey, so that information, as much as possible, should be accurately collected.

3.3.2 Review of survey method

Appropriate survey method should be selected, based on estimation results of the location of the storage site and the storage type. Underground radar sensing, electromagnetic sensing and magnetic sensing are generally used for the survey of stored materials. Especially for large-scale material at a large stored site, electric sensing, reflection method earthquake sensing, surface wave sensing and gravity sensing may be utilized (Refer to Attachment 5 for physical sensing method). For sandy soil, it is also effective to sense stored material by sticking a “sensing bar,” such as a bamboo bar, slender bar, etc., into the ground.

3.3.3 Establishment of survey plan

On survey of the stored material, an axis or grid for the base of the survey should be set out.

These lines are generally called “traverse lines”. The procedure for survey planning and notices for setting direction and interval of traverse lines are shown as follows:

(1) Rough survey and detailed survey

When the extent of the diffusion of the stored material is grasped in advance, a detailed survey may be first conducted without a rough survey. When the location of the storage site is uncertain, a rough survey should be conducted by setting relatively larger survey area at first, then a detailed survey should be conducted based on the results to focus on the potential location of the point.

(2) Direction of distribution of stored material and direction of traverse lines

For stored material sensing, two perpendicular traverse lines shown in Figure 3.2.1 (traverse line ① and ②) are used. When the location of stored material is found, an efficient survey can be conducted by the following procedure: 1) first setting traverse line ① perpendicular to the direction of the long axis, 2) estimating high storage site potential area, and 3) setting traverse line ② perpendicular to traverse line ① near the estimated area for sensing survey. When the direction of distribution of stored material is uncertain, the stored point should be surveyed based on a predetermined survey area without setting a priority.

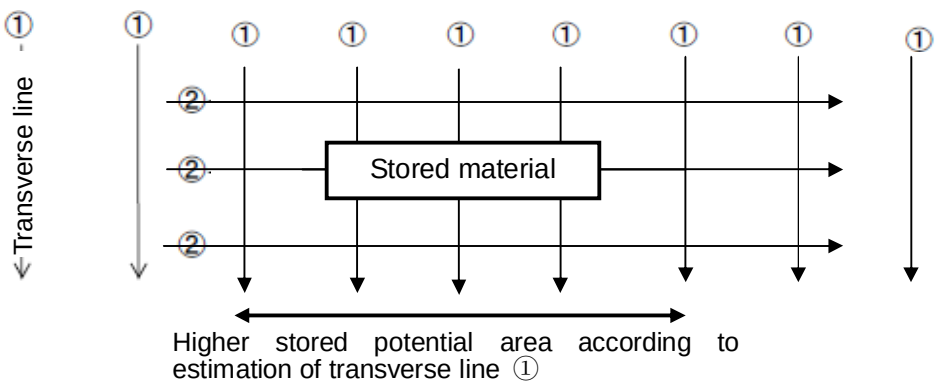
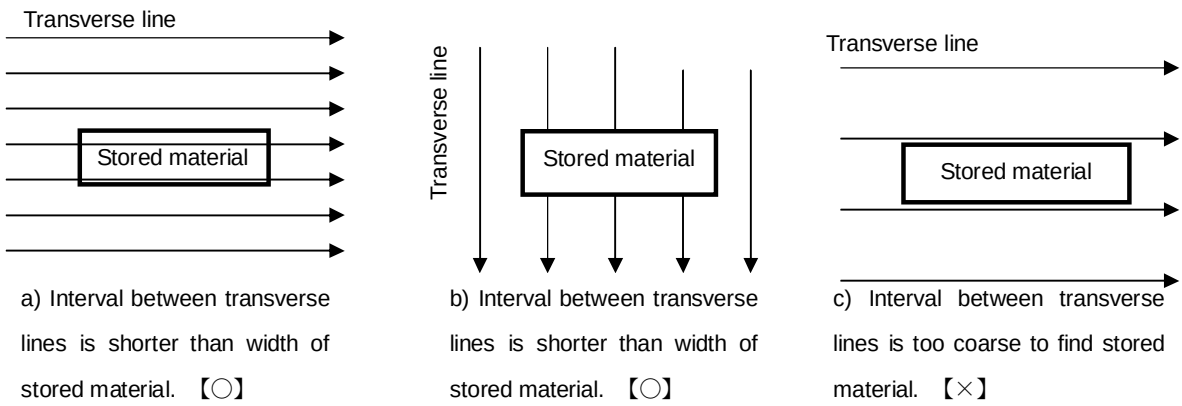


Figure 3.2.1: Directions of distribution and traverse line of agricultural chemicals stored underground (Preliminary survey)

(3) Interval of traverse lines

Rough survey is conducted as shown in Figure 3.2.2, considering size of estimated stored material, interval of the stored points and stored type such as large-scale collective storage or small-scale scattered storage, etc. Specifically, to avoid overlooking the stored material not in contact with the traverse lines (See Figure 3.2.2 c)), the lines should be arranged to contact the stored material by narrowing down the traverse lines (See Figure 3, 2.2 a)) and/or changing the direction of traverse lines (See Figure 3.2.2 b)). In the case of a detailed survey, traverse lines should be set to cover the overall projected material area by considering the properties of the survey method and the width area of the

sensing survey.



a) Interval between transverse lines is shorter than width of stored material. 【○】

b) Interval between transverse lines is shorter than width of stored material. 【○】

c) Interval between transverse lines is too coarse to find stored material. 【×】

Figure 3.2.2: Size and interval of traverse lines of agricultural chemicals stored underground (Preliminary survey)

3.4 Conduct of survey

Survey is conducted at the site according to the survey plan established by “3.3 Establishment of survey plan”.

For on-site measurement, the following points should be noted.

(1) Observation of site condition

For on-site measurement, the site condition should be observed again from the viewpoint of physical sensing survey. The observation results may become a good reference for interpretation of physical sensing results. For example, trace of excavation and refill may be estimated through the irregularity of land surface, color and property of soil, vegetation, etc.

(2) Survey for setting traverse lines

To easily and certainly identify a wider area of stored material upon excavation, a fixed reference point (line) should be determined and the position of the coordinates of the traverse line should be clarified.

(3) On-site analysis and additional measurement

If on-site analysis is possible, the estimated area of stored material should be marked at the site (marking), based on the results and it should be measured. If necessary, additional measurements and a trial boring hole should be made based on the on-site analysis results to obtain more precise survey results.

3.5 Review of survey results and confirmation

Survey results should be edited as a plan view showing the relationship between the reference points and the storage site to use during excavation work. If possible, the location of the estimated area should be marked at the site by wooden stakes, painted marks, or the like, for subsequent survey and excavation.

The location of the storage site is estimated based on document review and survey results. Data on the survey results should be analyzed by subcontractor in charge, and a plan view should be made to overlay with the current state map. Then, it should be checked by the person who originally stored the chemicals to reconfirm information related to the storage type and the estimate condition. If any part for the estimation of the storage site is left unclear, a part of the estimated area should be excavated for testing with close care not to damage agricultural chemicals stored underground to check for the existence of other stored material.

4. Determination of excavation period

Excavation and treatment of agricultural chemicals stored underground is conducted based on “3. Survey for confirmation of stored point” (Action 2). The period is judged by prioritizing the condition of the storage site (land use in the ground, land use of the surrounding area, leakage into the surrounding environment, etc.), the condition of other storage sites and necessary costs, etc.

When the storage site is clarified,“5. Determination of contamination area (Survey for checking surrounding environment)” (Action 3) should be promptly conducted and excavation and treatment of the stored material should proceed quickly. When there are several storage locations at the site, excavation and treatment work should proceed after determining their priority, by considering each situation.

In some cases, there may be a structure over or near agricultural chemicals stored underground and it may be more cost effective to excavate and recover the agricultural chemicals after removing the structure by maintaining its condition with necessary pollution prevention measures, rather than excavation and recovery of the agricultural chemicals before removing the structure. Accordingly, a survey plan should be determined in response to the relevant local situation. When excavation and treatment work is not initiated promptly (estimated as within one year), a response according to “10. Response in the case of no early excavation and treatment of agricultural chemicals stored underground” (Action 9) is needed to prevent environmental pollution caused by the agricultural chemicals stored underground.

5. Determination of contamination area (Survey for checking surrounding environment) (Action 3)

When surrounding soil is contaminated by leaking agricultural chemicals from stored material, the contaminated soil may also be excavated. Accordingly, to check for the existence of agricultural chemical leakage to the surrounding environment at the storage site estimated based on the results of “3. Survey for confirmation of storage site” (Action 2), samples from soil and groundwater surrounding the storage site are taken and analyzed. Following the results of the analysis, the area judged as contaminated by leakage is targeted for excavation and other countermeasures.

5.1 Objective

Treatment of agricultural chemicals stored underground, container, stored tank, etc. (PVC sheet, concrete receptacle, etc.) as well as agricultural chemicals at the storage site should be treated in principle. In addition, when leakage to the surrounding environment is found, contaminated soil should be also treated in response to the concentration of POPs chemicals or the like. Accordingly, to judge the existence of leakage to the surrounding environment and to clarify the excavation target area (contaminated area by agricultural chemicals stored underground and leakage), a survey for checking the surrounding environment (soil and groundwater sampling and analysis at the point where existence of agricultural chemicals stored underground was confirmed.) should be conducted.

5.2 Determination scheme of contamination area (Survey for checking surrounding environment)

For suitable evaluation of the existence of leaks into the surrounding environment from the storage site of agricultural chemicals, sampling near the site is expected. On the other hand, as sampling and well installation near the storage site may cause destruction of the stored material, caution should be used for determination of the survey point. In this way, information, such as the surrounding environment, estimated by the results of “3. Survey for confirmation of stored point” (Action 2) should be rechecked in advance (Action 3-1), the target area of the survey for checking surrounding environment and survey point should be reviewed to establish the survey plan (Action 3-2).

Subsequently, a primary survey is conducted according to the survey plan (Action 3-3) and the existence of leakage is judged (Action 3-4). When leaking is found, a secondary survey should be conducted by adding sampling points to confirm the details of the leakage area (Action 3-5).

This work flow is shown in Figure 5.1. As an installed groundwater monitoring well may be utilized for “8. Monitoring of surrounding environment” (Action 7) after being used for a survey to check the surrounding environment; its shape and location should be determined considering long-term use.

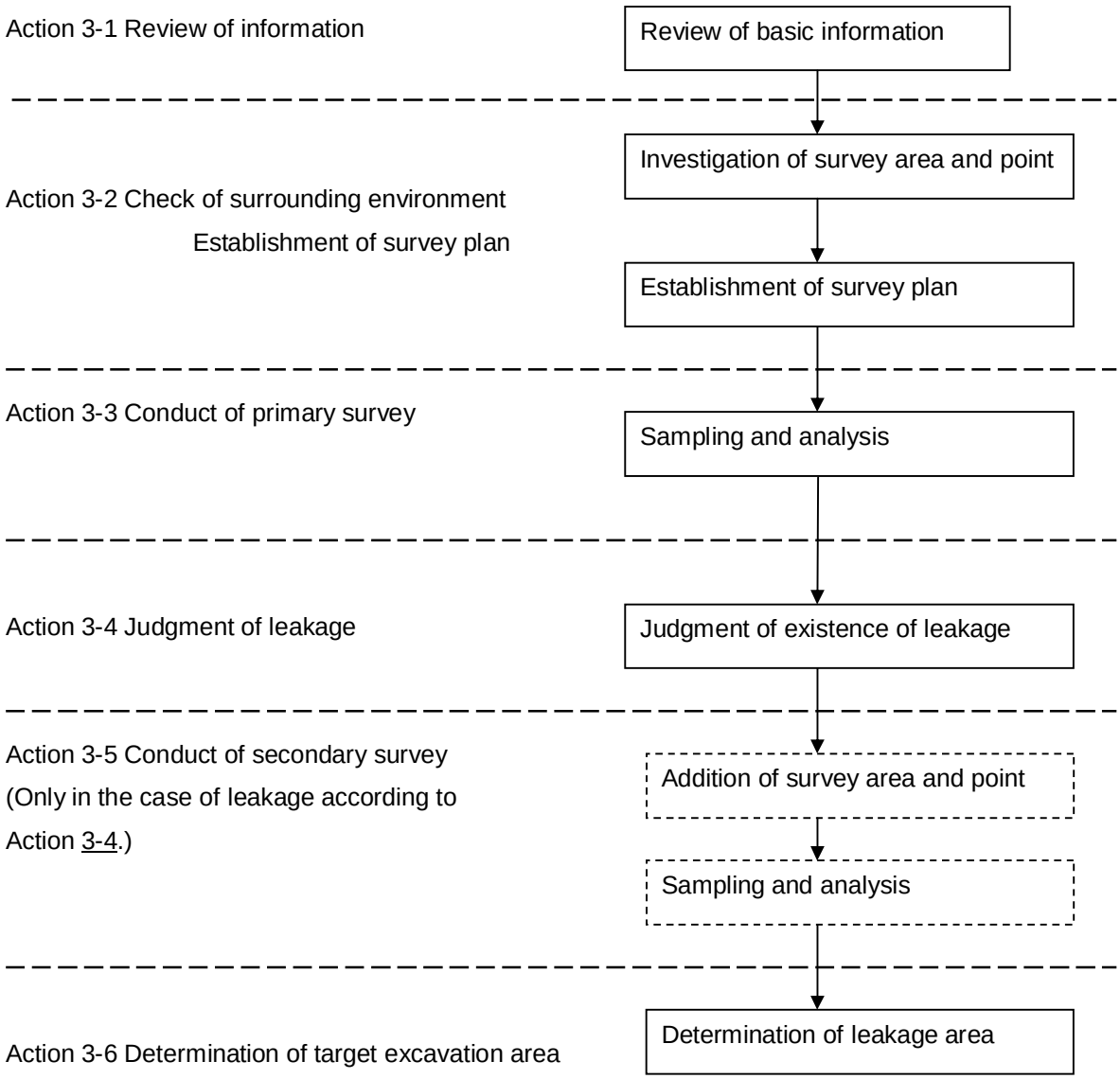


Figure 5.1: Flow of survey for determination of contamination area and determination of judgment

5.3 Recheck of basic information (Action 3-1)

With regard to the determination of the excavation target area, information regarding the following items should be assessed in advance and rechecked in addition to the location of the storage site estimated based on the results of “3. Survey for confirmation of stored point” (Action 2) to use to determine the target area for the survey for checking the surrounding environment and sampling point.

(1) Geology of surrounding area

(2) Estimated depth of stored material

(3) Groundwater level and direction

(4) Surrounding land use

5.4 Establishment of survey plan for checking surrounding environment (Action 3-2)

(1) Review of survey target area and survey points

Survey target area is determined based on rechecked basic information (Action 3-1) and then specific survey points are set. As less mobility in the soil is estimated based on the general property of POPs chemicals, survey points are determined on a basic condition of setting within approximately 10 cm, considering the property of the soil and the direction of groundwater flow. When the flow rate of groundwater is fast and/or agricultural chemicals stored underground may contact groundwater, the survey area should be expanded because pollution caused by leakage may be expanded. In addition, surrounding businesses and residents consuming the groundwater should be listed in the well control book.

(2) Concept of survey method

Leakage condition check consists of two methods of simplified analysis near the site and laboratory analysis of the sample carried from the site at a chemical analysis laboratory. As agricultural chemicals other than POPs chemicals contained in the agricultural chemicals stored underground may leak, the leakage condition can be understood by monitoring these chemicals. Especially when agricultural chemicals containing mercury or arsenic may be stored, these should be listed in the target chemicals. Chloride ion, electric conductivity (EC) and pH are indicators of potential artificial pollution, so that they should be added to survey items as necessary.

Simplified analysis is a low-cost and easy method for finding symptoms for the existence of pollution caused by agricultural chemicals stored underground. However, laboratory analysis is needed to identify contaminants and to understand their concentration.

Accordingly, leakage conditions should be effectively grasped and suitably appropriate utilization should be made of these items and methods.

a) Simplified analysis (Analysis of pH, electric conductivity and chloride ion as basic items, and heavy metals as supplementary items)

Generally, analysis of pH, electric conductivity and chloride ion in groundwater sampled can be conducted by mobile measurement equipment brought to the site. In the case of higher concentrations, hazardous chemicals, such as heavy metals, can be measured by means of simplified analysis, such as testing paper, so that these contents contained in the agricultural chemicals may be analyzed.

When an abnormal value for pH, electric conductivity or chloride ion is found, laboratory analysis of

the groundwater of the point should be conducted again.

b) Laboratory analysis (Analysis of POPs chemicals, mercury, arsenic, thiram and organic phosphorus contained as agricultural contents)

To fully appreciate contamination by POPs agricultural chemicals, soil is sampled and carried to chemical analysis laboratories for analysis. The sample is analyzed according to the method shown in Attachment 6. In some cases, mercury, arsenic, thiram and organic phosphorus (parathion, methylparathion, methyldimethone, EPN) whose environmental quality standards are set for soil and groundwater, or heavy metals such as copper are contained in agricultural chemicals stored underground, then these contents should also be analyzed.

(3) Concept of sampling point for analysis

a) Soil surrounding stored point

From four perpendicular directions crossing each other at the central stored agricultural chemical site, two samples of half of the stored depth and 50cm ~ 1m under the bottom of the agricultural chemical are taken together (See Figure 5.2). Eight samples of four directions by two samples are the basic method, and the number of samples may be changed in response to the size and shape of the storage site. One place or more of the upper part of the site is also sampled.

The above measure is applied to even small-scale sites where the stored amount is 300 kg or less. When stored material is scattered over several locations, mixed samples taken at several points may be needed to analyze them to reduce the number of analysis samples. Whether or not mixing or separate analysis can be judged in response to storage, soil, and groundwater conditions, at least one point per square of 5m×5m should be sampled, in principle. In the case of an uneven shape of the stored material, the same sampling point is also set.

b) Groundwater surrounding the storage site

As groundwater flow near the storage site is too complex to easily assess, groundwater monitoring wells (an existing well suitable for monitoring is also applicable.) are provided near four points around the site to sample and analyze groundwater. When there is no existing suitable well, a groundwater monitoring well is made by boring a hole. When there is spring water nearby, a sample from it is also applicable. In the case of small-scale scattered locations, it may be difficult to set the monitoring point because of number of agricultural chemicals. In that case, a sample should be taken to assess pollution conditions by looking at several points as one area and installing a monitoring well near that area.

When an existing well is located near the storage site, it should be sampled because it may be impacted by use for drinking, irrigation, etc.

When contamination is found in surrounding soil by the existence of leakage shown in section 5.6, several monitoring wells need to be bored to grasp the contaminated area. These are selected from contaminated wells located at the edge of the area after the contamination area is determined through a secondary soil survey, as shown in section 5.7. For the selection of a monitoring well, a drinking water well is the top priority.

5.5 Conduct of primary survey (Action 3-3): Survey for checking existence of contamination area

(1) Soil sampling

At the point set according to the survey plan (Action 3-2), soil is sampled by excavation by backhoe or soil detection stick (if shallow). In the case of storage site at 5m or more in depth, soil is sampled by rotary-type boring excavation, considering the amount necessary for analysis. Caution should be taken not to expand pollution by leakage or blow-off.

(2) Groundwater sampling

At the point set according to the survey plan (Action 3-2), groundwater is sampled. When surveys of the geological condition (stratum distribution, soil properties, etc.), the groundwater level and the sampling of groundwater are first conducted at the site through a borehole survey, sufficient caution should be taken not to lead to increased pollution caused by boring into the groundwater aquifer.

(3) Analysis of sample

When a sample is not analyzed at the site, it is retained in the specified manner and carried to a chemical analysis laboratory. Sampling point and date are recorded for each sample.
The analysis is conducted according to the concept of the survey method (Action 3-2).

5.6 Judgment of existence of contamination (Action 3-4)

Analysis of the results of samples (soil and groundwater) given by primary survey (Action 3-3) and "List of values according to environmental management guideline regarding agricultural and associated chemicals" (hereafter, called "guideline values") shown in Attachment 7, are compared to make an evaluation. (Soil is evaluated as soil concentration guideline value (dissolution amount) and soil concentration guideline value (content amount)). When analysis results of the soil and groundwater quality near the storage site exceed the guideline value, it should be assumed that "there is leakage to the surrounding environment." A secondary survey for the part judged to be leaking (Action 3-5) is conducted to determine the contaminated area. The guideline values for environmental water quality and soil concentration shown in Attachment 7 are provided for reference to check for the existence of contamination caused by agricultural chemicals stored underground, not for the evaluation of the safety of an agricultural area and public water.

5.7 Conduct of secondary survey: Survey for checking contamination area (Action 3-5)

The sampling and analysis method applied for the survey for checking the contamination area is based on the primary survey (Action 3-3). When a survey point is added, the setting concept is shown, as follows, following the reason why the contamination area may be limited to the area surrounding the stored material, not the whole site.

(1) When contaminated sample is found

Survey point is arranged and then a sample is taken according to the following procedure (Refer to Figure 5.2.).

a) Approximately 1 meter out and under points from the survey point where the contaminated sample is found in four directions surrounding the storage site are rechecked.
b) When contamination is found as the result of the recheck, further 0.5~1m outer and under points from the rechecked points are additionally checked.
c) The soil above the storage site is also analyzed.
d) By repeating the procedures of a) and b), the block where contamination is confirmed is determined.
e) The area within the place closest to the storage site where contamination is not found is determined as the contamination area. (When it is requested to assess the detailed contamination area, survey points can be increased at the midpoint of the place where contamination is found and the rechecked point.)

(2) When contamination is found in groundwater samples

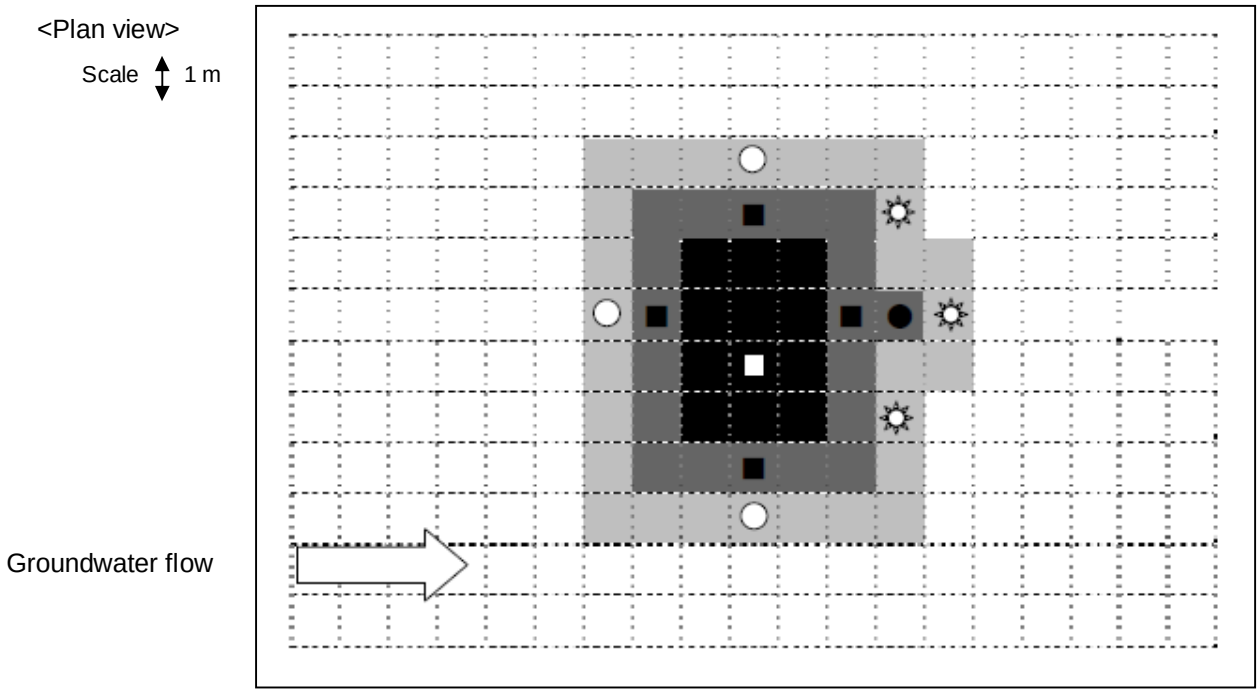
Groundwater is sampled at existing wells mainly for drinking, located downstream from the well where contamination is found, considering the flow direction of groundwater. When contamination is found, measures necessary for stopping the use of the existing well should be promptly taken. When mercury or arsenic contamination is found, continuous monitoring (survey for the surrounding block of contaminated wells and regular monitoring surveys) according to the Water Pollution Control Law, should be conducted.

5.8 Determination of target area for excavation and other treatment: Determination of contamination area and specific countermeasure (Action 3-6)

To clarify the contents of the excavation and other treatment, the target area of actual agricultural chemicals stored underground to be excavated needs to be determined.

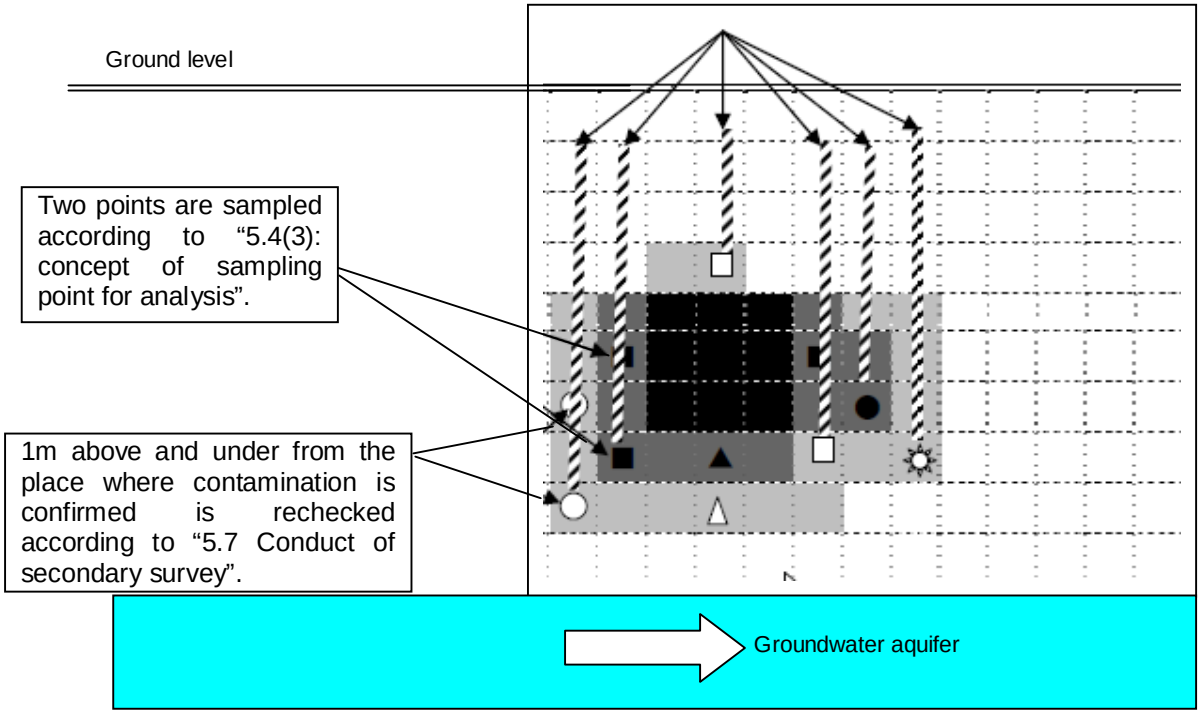
Basically, in the case of “no leakage.” agricultural chemicals stored underground and surrounding soil contacting it during excavation are targeted. In the case of “leakage”, the excavation target area is determined based on the results of a secondary survey (Refer to Figure 5.2: Conceptual view for grasping contamination area by means of survey for checking surrounding environment).

The handling method for soil surrounding agricultural chemicals stored underground is determined in response to the concentration of POPs in the soil and groundwater sampled by primary and secondary surveys, and then the excavation target area is determined. The flow of the assessment and specific measures taken for surrounding soil are shown in Figure 5.3 and Table 5.1, respectively.



Excavation survey by means of boring holes or backhoe or by other means

<Cross-sectional view>



■□	: Primary survey (Action 3-3)
●○	: Secondary survey (Action 3-5)
✷✪	: Additional survey to secondary survey (Action 3-5)
▲△	: After-excavation survey (Refer to Action 5, 7.1.6, p40.)

	Part where agricultural chemical or others is stored
	Contaminated soil with contact or leakage
	Potentially contaminated Soil

"□", "○", " ✪", "△" means non-contamination, and "■", "●", "✷", "▲" means contamination.

Figure 5.2: Conceptual view for grasping contamination area by means of survey for checking surrounding environment

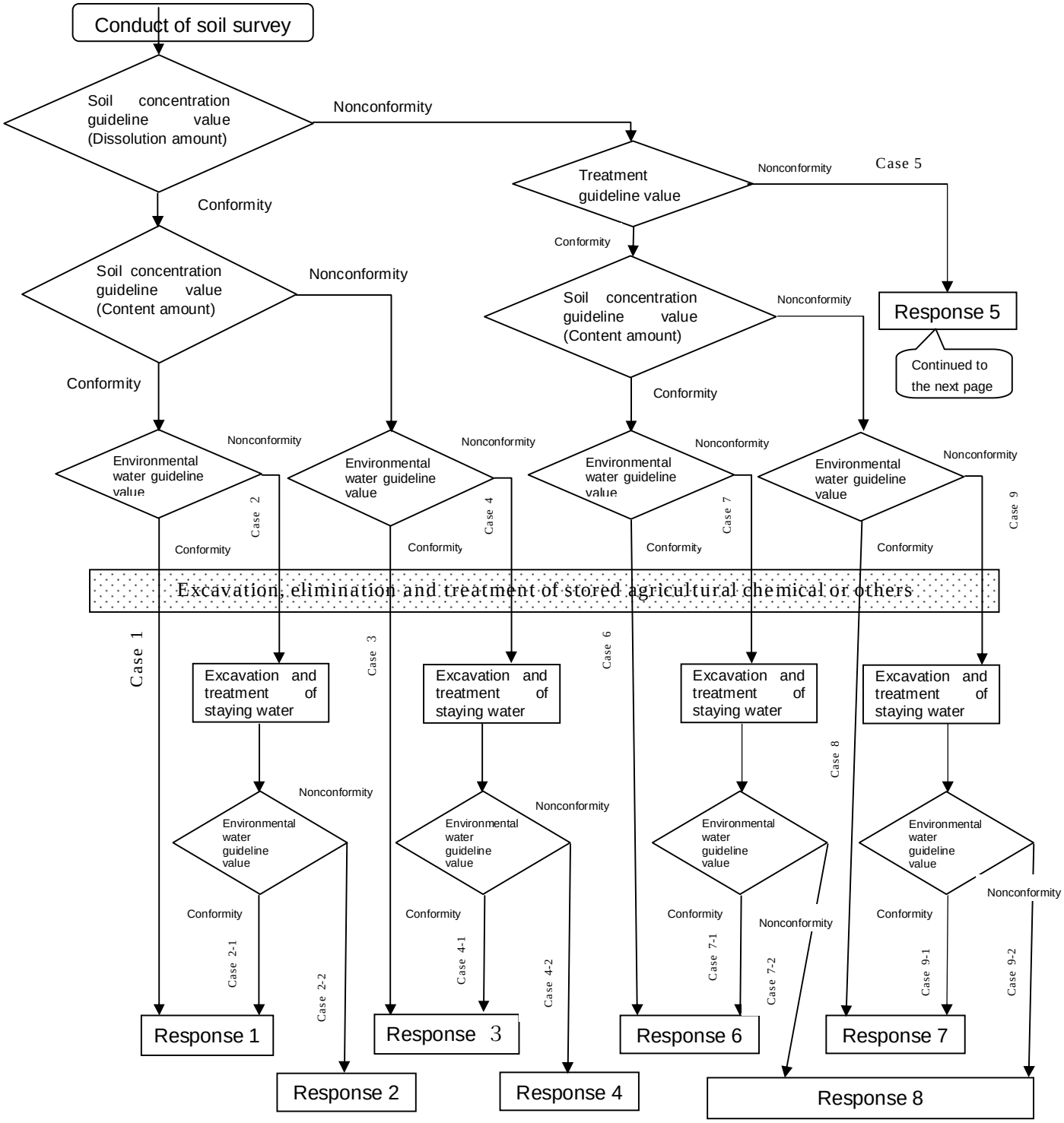


Figure 5.3: Flow of response to contaminated soil by use of the result of surveys of soil and water related to surrounding environment

Figure 5.3 (Continued): Flow of response to contaminated soil by use of the result of surveys of soil and water related to surrounding environment

Continued from Case 5, Response 5 (In the case of nonconformity of both soil concentration guideline value and treatment guideline value)

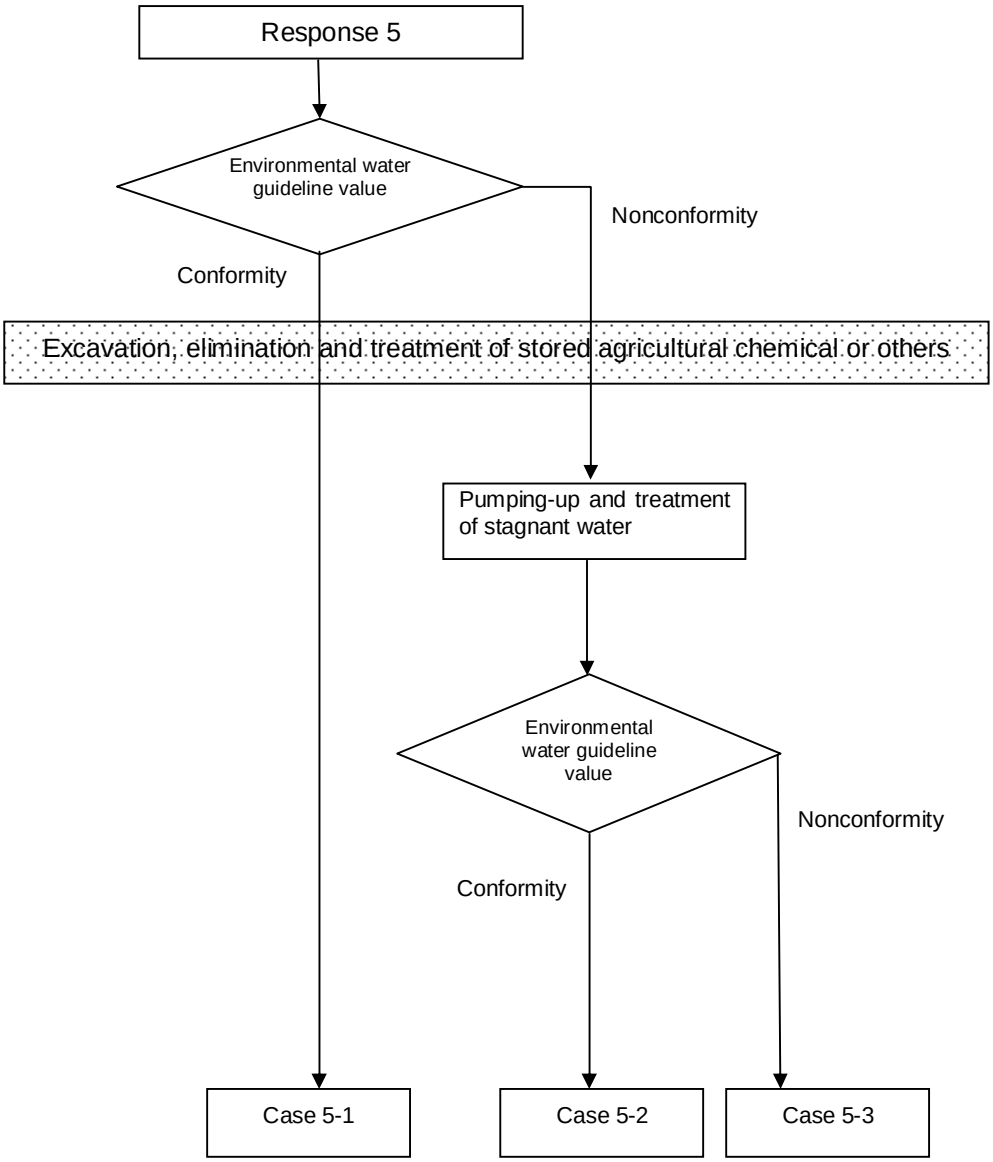


Table 5.1: Judgment for soil excavation and other treatment (In the case of detection of POPs and associated chemical from soil)

<table>
<tr><th rowspan="4"></th><th colspan="5">Soil concentration guideline value (dissolution amount)</th></tr>
<tr><th colspan="2">Conformity</th><th colspan="3">Nonconformity</th></tr>
<tr><th colspan="2">Environmental water concentration guideline value</th><th colspan="2">Conformity with treatment guideline value</th><th rowspan="3">Nonconformity with treatment guideline value</th></tr>
<tr><th rowspan="2">Conformity</th><th rowspan="2">Nonconformity</th><th colspan="2">Environmental water concentration guideline value</th></tr>
<tr><th>Conformity</th><th>Nonconformity</th></tr>
<tr><td>Conformity with soil concentration guideline value (Content amount)</td><td>Response 1</td><td>Response 2</td><td>Response 6</td><td rowspan="2">Response 8</td><td rowspan="2">Response 5</td></tr>
<tr><td>Nonconformity with soil concentration guideline value (Content amount)</td><td>Response 3</td><td>Response 4</td><td>Response 7</td></tr>
</table>

Interpretation of terms

- Soil concentration guideline value (dissolution amount)

The guideline value regarding eluted POPs or other content concentration when water is added to target soil under specific conditions (Refer to Attachment 7). When the sample has not complied with the value, relevant groundwater may be contaminated with POPs or other agricultural chemical eluting from the soil. Accordingly, noncompliant soil with the value should be excavated, eliminated and treated, except when it is not possible to cause groundwater contamination.

- Soil concentration guideline value (content amount)

The guideline value regarding POPs or other content concentration contained in target soil (Refer to Attachment 7). When the sample has not complied with the value, relevant soil may cause a health risk from direct intake of the soil or by contact with it. Accordingly, the noncompliant soil with the value should be excavated, eliminated and treated, in principle, or if excavation and elimination cannot be conducted for some reason, embankment, pavement and other retaining measures should be applied.

- Environmental water quality guideline value

The guideline value regarding POPs or other content concentration contained in target aquifer water (Refer to Attachment 7). When the sample has not complied with the value, the contaminated water may cause health risks when drunk. Accordingly, use of a well where the noncompliant water with the sampled value should be promptly stopped. Soil causing the water contamination should be excavated, removed and treated.

- Hazardous chemical eliminating treatment guideline value (hereafter, called “treatment guideline value”)

The guideline value regarding eluted POPs or other content concentration when water is added to target soil under specific conditions, and there is 10 times the soil concentration guideline value (dissolution amount) (Refer to Attachment 7). When the sample has not complied with the value, it cannot be moved to a controlled waste disposal site for treatment because of the higher contamination of the soil with POPs agricultural chemical or other chemicals.

- Aquifer water

Water penetrating into and staying in the stored point and its surrounding area (Refer to 10.2 (3)).

When the concentration of POPs or other chemicals in the soil sample does not comply with soil concentration guideline values (dissolution amount) or soil concentration guideline values (content amount) shown in Attachment 7 (hereafter called “contaminated soil”), the soil should be promptly excavated and removed. However, as prompt excavation and removal may be difficult for some reasons,

countermeasures should be recorded and taken for each case based on the dissolution amount (soil concentration guideline values (dissolution amount)) and content amount (soil concentration guideline values (content amount)), according to the measures in the Soil Contamination Countermeasures Law.

In response to each case, measures for reducing human health risks can be taken instead of excavation, removal and treatment of the contaminated soil. However, in the case when the contaminated soil is not excavated, removed and treated, information about the contaminated soil should be recorded and retained. In both cases, a survey after evacuation (P40, Action 5, 7.1.6) is conducted, and in the case that contaminated soil is found, it should be responded to depending on each case condition.

Case 1~4 (Refer to Figure 5.3, Table 5.1.)

Through primary and secondary surveys, when dissolution amount of POPs or other chemical concentration in the soil comply with soil concentration guideline values (dissolution amount), the target excavation area is determined based on POPs or other chemical content of the soil (content amount) and POPs or other chemical concentration in the groundwater sample near stored point.

Case 1

When POPs or other chemical concentrations in the soil complies with soil concentration guideline values (content amount)) and those in the groundwater sample also comply with environmental water quality concentration guideline values;

Response 1: Agricultural chemicals stored underground are evacuated and removed. As the soil has complied with the relevant value, evacuation, removal and treatment are not needed. Groundwater monitoring after excavation and removal of the agricultural chemicals stored underground is conducted for one year. (Refer to Table 8.1 “Surrounding environment monitoring items and their survey”).

Case 2

When POPs or other chemical concentrations in the soil is complies with soil concentration guideline values (content amount)), but those in the groundwater sample do not comply with environmental water quality concentration guideline values;

Use of the well where the sample exceeds relevant guideline values is promptly stopped and then agricultural chemicals stored underground is excavated and removed. At the same time, aquifer water is also pumped up. When the pumping-up work is completed, a groundwater sample from the same well, or the like, is taken and analyzed again. In response to the result, the countermeasure described in Case 2-1 or Case 2-2 is taken.

Case 2-1

When the result of reanalysis of the groundwater, POPs or other chemical concentrations complies with environmental water quality concentration guideline values;

The same measure as Response 1 is taken.

If it is confirmed that the sample value does not exceed relevant guideline values through periodical monitoring of POPs or other chemical concentration in the groundwater after excavation and removal of the agricultural chemicals stored underground, use of the well can be restarted. (Refer to Table 8.1 “Surrounding environment monitoring items and their survey.”)

Case 2-2

As the result of reanalysis of the groundwater, POPs or other chemical concentrations does not comply with environmental water quality concentration guideline values;

Response 2: When it is found that the soil sample value exceeds the relevant guideline value after excavation and removal of agricultural chemicals stored underground, contaminated soil is excavated, removed and treated (If the contaminated soil then complies with relevant treatment guideline values, it can be moved to the final controlled waste disposal site.) After the groundwater complies with the relevant guideline value, if it is confirmed that the sample is kept compliant with relevant guideline value for two years through periodical monitoring for POPs or other chemical concentration in the groundwater, use of the well can be restarted (Refer to Table 8.1 “Surrounding environment monitoring items and their survey ”, Note 3.)

Case 3

When POPs or other chemical concentrations in the soil do not comply with soil concentration guideline values (content amount)), but the groundwater sample does comply with the environmental water quality concentration guideline value;

Response 3: Agricultural chemicals stored underground and in contaminated soil are excavated, removed and treated (If the contaminated soil i complies with treatment guideline values, it can be moved to the final controlled waste disposal site.).

When contaminated soil cannot be excavated, removed and treated for some reason, the same countermeasure as those against direct exposure risk, according to the Soil Contamination Countermeasures Law (embankment, pavement, keeping-out, etc.), should be taken.

For all the above cases, monitoring in response to excavation and removal of agricultural chemicals stored underground containing POPs or other chemical should be conducted for one year (Refer to Table 8.1 “Surrounding environment monitoring items and their survey.”)

Note: With regard to countermeasures against direct exposure risk, refer to enforcement regulations in the Soil Contamination Countermeasures Law (Refer to ministerial ordinance of MOE, No.29, 26

December, 2002, Attachment No.5.).

Case 4

When POPs or other chemical concentrations in the soil do not comply with soil concentration guideline values (content amount)), and also those in the groundwater sample do not comply with environmental water quality concentration guideline values;

Use of well water with a sample that exceeds relevant guideline values is promptly stopped and agricultural chemicals stored underground are excavated and removed. At the same time, aquifer water is also pumped up. When the pump-up work is complete, groundwater samples from the same well or the like are taken and analyzed again. In response to the result, countermeasures described in Case 4-1 or Case 4-2 are taken.

Case 4-1

When the result of reanalysis of the groundwater, POPs or other chemical concentrations does not comply with environmental water quality concentration guideline values;

The same measure as Response 3 is taken.

If it is confirmed that the sample value does not exceed relevant guideline value through periodical monitoring of POPs or other chemical concentration in the groundwater after excavation of the agricultural chemicals, use of the well can be restarted after completion of a one-year monitoring survey (Refer to Table 8.1 “Surrounding environment monitoring items and their survey.”)

Case 4-2

When the result of reanalysis of the groundwater, POPs or other chemical concentration exceeds environmental water quality concentration guideline values;

Response 4: When it is found that soil sample value exceeds the relevant guideline value after excavation and removal of agricultural chemicals stored underground, contaminated soil is excavated, removed and treated. (If the contaminated soil then complies with relevant treatment guideline values, it can be moved to a controlled final waste disposal site.)

For contaminated soil which is judged not to cause groundwater contamination because soil is applied to cover agricultural chemicals stored underground under conditions of sufficiently low groundwater level, the same countermeasure as that used against direct exposure risk in the Soil Contamination Countermeasures Law (embankment, pavement, keeping-out, etc.) should be taken.

After the groundwater complies with the relevant guideline value, and if it is confirmed that the sample is compliant with relevant guideline values for two years through periodical monitoring of POPs or other chemical concentration in the groundwater, use of the well can be restarted (Refer to Table 8.1 “Surrounding environment monitoring items and their survey ”, Note 3.)

Case 5 (Refer to Figure 5.3, Table 5.1.)

Through primary and secondary surveys, dissolution amount of POPs or other chemical concentration in soil does not comply with treatment guideline values;

Response 5: Agricultural chemicals stored underground and contaminated soil are excavated, removed and treated.

The contaminated soil is not permitted to be moved to a controlled final waste disposal site. When it is found that the well sample exceeds relevant groundwater guideline values, use of the well is promptly stopped and aquifer water is also pumped up. When the pump-up work is completed, groundwater samples from the same well or the like are taken and analyzed again. In response to the result, the countermeasure described in Case 5-1, 5-2 or 5-2 is taken.

Case 5-1

When both results of primary analysis and reanalysis of the groundwater, POPs or other chemical concentration comply with environmental water quality concentration guideline values;

Periodical monitoring of POPs or other chemical concentration in the groundwater is conducted for one year (Refer to Table 8.1 “Surrounding environment monitoring items and their survey.”)

Case 5-2

When primary analysis of the groundwater, POPs or other chemical concentrations does not comply with environmental water quality concentration guideline values, however, as the result of reanalysis, the concentration does comply with the relevant values;

When it is confirmed that the well sample does not exceed relevant groundwater guideline values through periodical monitoring of POPs or other chemical of groundwater, use of the well can be restarted after completion of a one-year monitoring survey (Refer to Table 8.1 “Surrounding environment monitoring items and their survey.”)

Case 5-3

When reanalysis of the groundwater, POPs or other chemical concentrations does not comply with environmental water quality concentration guideline values;

A soil survey or others is re-conducted, and when it is found that the soil sample value exceeds relevant guideline values, the contaminated soil is excavated, removed and treated. If it is confirmed that the groundwater sample is kept compliant with relevant guideline values for two years through periodical monitoring of POPs or other chemical concentrations in the groundwater, use of the well can be restarted (Refer to Table 8.1 “Surrounding environment monitoring items and their survey ”, Note 3.)

Case 6~9 (Refer to Figure 5.3, Table 5.1.)

Through primary and secondary surveys, when dissolved amounts of POPs or other chemical concentrations in the soil do not comply with soil concentration guideline values (dissolution amount) but comply with treatment guideline values, the target excavation area is determined based on POPs or other chemical content of the soil (content amount) and POPs or other chemical concentration of groundwater sample near the stored point.

Case 6

When POPs or other chemical concentration in the soil comply with soil concentration guideline values (content amount)), and the groundwater sample is complies with environmental water quality concentration guideline value;

Response 6: Agricultural chemicals stored underground and contaminated soil are excavated, removed and treated. (If the contaminated soil complies with treatment guideline values, it can be moved to a controlled final waste disposal site.), and then periodical monitoring of POPs or other chemicals in the groundwater should be conducted for one year (Refer to Table 8.1 “Surrounding environment monitoring items and their survey.”)

When contaminated soil cannot be excavated, removed and treated for some reason, periodical monitoring of POPs or other chemicals in the groundwater should be conducted (Refer to Table 8.1 “Surrounding environment monitoring items and their survey ”, Note (2).)

Case 7

When POPs or other chemical concentrations in the soil complies with soil concentration guideline values (content amount)), and the groundwater sample does not comply with environmental water quality concentration guideline values;

Use of the well where the sample exceeds relevant guideline values is promptly stopped and then agricultural chemicals stored underground and contaminated soil are excavated, removed and treated.(If the contaminated soil complies with the treatment guideline value, it can be moved to a t controlled final waste disposal site.) At the same time, aquifer water is also pumped up. When the pump-up work is completed, a groundwater sample from the same well or the like is taken and analyzed again. In response to the result, the countermeasures described in Case 7-1 or Case 7-2 are taken.

Case 7-1

When reanalysis of the groundwater, POPs or other chemical concentrations complies with environmental water quality concentration guideline values;

The same measure as Response 6 is taken.

If it is confirmed that the groundwater sample is kept compliant with relevant guideline values through

periodical monitoring of POPs or other chemical concentration in the groundwater, use of the well can be restarted after completion of a one-year monitoring survey. (Refer to Table 8.1 “Surrounding environment monitoring items and their survey.”)

Case 7-2

When reanalysis of the groundwater, POPs or other chemical concentrations does not comply with environmental water quality concentration guideline values;

Response 8: Soil or other material is reanalyzed, and then the contaminated soil is excavated, removed and treated. (If the contaminated soil complies with relevant treatment guideline values, it can be moved to a controlled waste disposal site.) After the groundwater complies with the relevant guideline values, and if it is confirmed that the sample is kept in compliance with relevant guideline value for two years through periodic monitoring of POPs or other chemical concentrations in the groundwater, use of the well can be restarted. (Refer to Table 8.1 “Surrounding environment monitoring items and their survey,” Note 3.)

Case 8

When POPs or other chemical concentrations in the soil do not comply with soil concentration guideline values (content amount)), and a groundwater sample does comply with environmental water quality concentration guideline values;

Response 7: Agricultural chemicals stored underground and contaminated soil are excavated, removed and treated. (If the contaminated soil complies with treatment guideline value, it can be moved to a controlled final waste disposal site.)Then periodic monitoring of POPs or other chemicals in the groundwater should be conducted for one year (Refer to Table 8.1 “Surrounding environment monitoring items and their survey.”)

When contaminated soil cannot be excavated, removed and treated for some reason, the same countermeasure as those taken against direct exposure risk according to the Soil Contamination Countermeasures Law (embankment, pavement, keeping-out, etc.) should be taken and periodic monitoring of POPs or other chemical in the groundwater should be conducted (Refer to Table 8.1 “Surrounding environment monitoring items and their survey,” Note (2).)

Case 9

When POPs or other chemical concentration in the soil do not comply with soil concentration guideline values (content amount)) and groundwater samples do not comply with environmental water quality concentration guideline values;

Use of a well where a sample exceeds relevant guideline values is promptly stopped and agricultural chemicals stored underground and contaminated soil are excavated, removed and treated. (If the contaminated soil complies with treatment guideline values, it can be moved to a controlled final waste disposal site.) At the same time, aquifer water is also pumped up. When the pumping-up is completed, groundwater samples from the same well or the like are taken and analyzed again. In response to the result, countermeasures described in Case 9-1 or Case 9-2 are taken.

Case 9-1

When reanalysis of the groundwater, POPs or other chemical concentrations do comply with environmental water quality concentration guideline values;

The same measure as Response 7 is taken.

If it is confirmed that the groundwater sample is kept compliant with relevant guideline values through periodic monitoring of POPs or other chemical concentrations in the groundwater, use of the well can be restarted after completion of a one-year monitoring survey (Refer to Table 8.1 “Surrounding environment monitoring items and their survey.”)

Case 9-2

When reanalysis of the groundwater, POPs or other chemical concentrations is do not comply with environmental water quality concentration guideline values;

The same measure as Response 8 is taken.

5.9 Case study for selection of target area for excavation and other treatment

To check the contamination of surrounding soil and groundwater cased by leakage of agricultural chemicals stored underground or other materials, a primary survey was conducted.

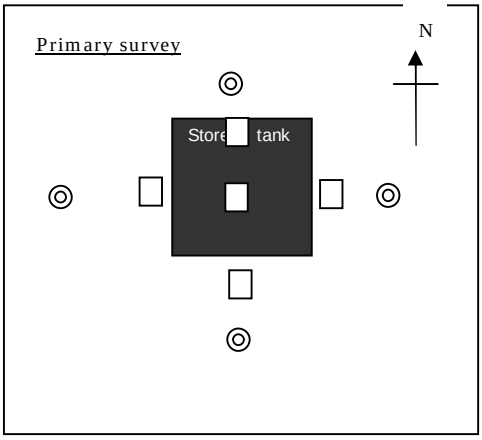
Results of the primary survey

1) Soil sample

As a result of the primary survey, BHC or other materials exceeding relevant guideline values was not found and only DDT exceeding relevant guideline values was found.

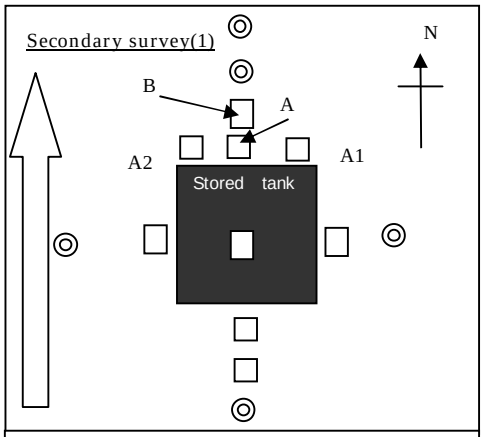
*North side of stored tank (Point A)

- Soil concentration guideline value (content amount):
- noncompliant
- Soil concentration guideline value (dissolution amount): noncompliant, compliance with treatment guideline value
- East, west and south of stored tank: No contamination



2) Groundwater sample

- East, west and south of stored tank:
- No contamination
- DDT concentration at well located in the north of stored tank does not comply with environmental water quality guideline values.



Legend

□Sampling point (Soil)

◎Sampling point (Groundwater)

■Stored tank

⇧Flow direction of groundwater

Results of secondary survey (1)

1) Soil sample

Based on the results of the primary survey, the following secondary survey (soil sampling and DDT analysis) was conducted.

- North side of the stored tank

(Survey point)

Points located at 1m away from and under point A (point B)

Both sides of point A (point A1 and A2)

(Results of survey)

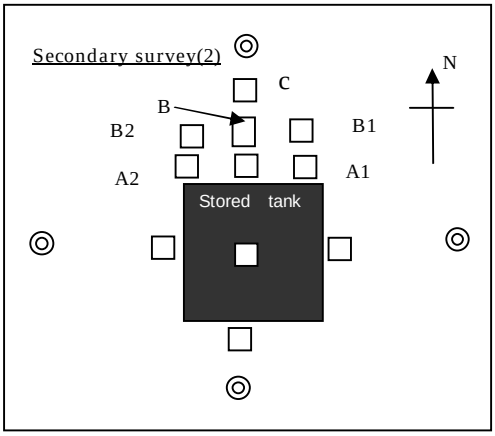
Point A1 and A2: DDT concentration complied with relevant guideline value.

Point B: Soil concentration guideline value (content amount): noncompliant
Soil concentration guideline value (dissolution amount): compliant

2) Groundwater sample

Based on the results of the primary survey, a secondary survey was conducted in the downstream direction of the groundwater.

(Legend) ◎: Compliant with environmental water quality guideline values



Results of secondary survey (2)

Survey point

Points located at 1m out of and under point B (point B1, C and B2)

Results of survey

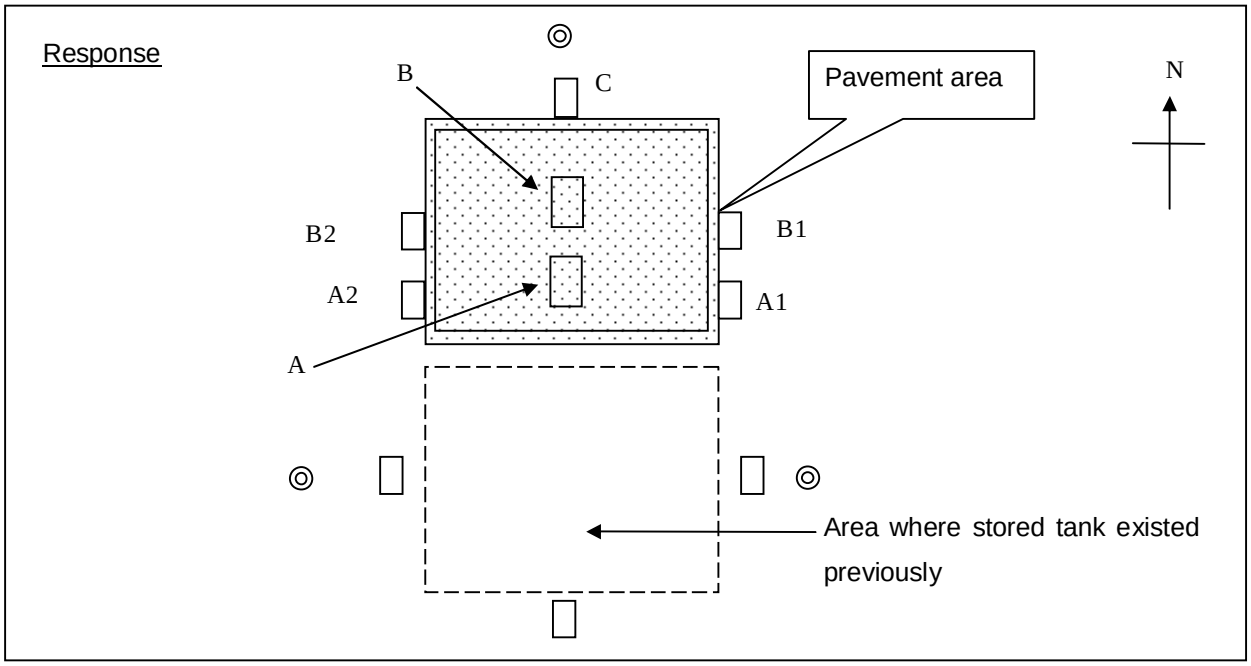
DDT concentration was complied with relevant guideline value.

To confirm the cause of groundwater contamination, agricultural chemicals stored underground were removed and water in the pit was also removed. Subsequently, groundwater at the north well was sampled by primary survey and then analyzed. As a result, DDT concentrations were then compliant with relevant environmental water quality guideline values. Judging from this, it was confirmed that the cause of the groundwater contamination was the water in the pit. As a result of a survey after excavation, soil exceeding relevant guideline values was not found.

Response

Point A: Though soil samples were not compliant with both relevant soil concentration guideline values (content amount) and relevant values (dissolution amount), they did comply with relevant treatment guideline values Also, the groundwater samples were compliant with relevant environmental water quality guideline values after removal of stagnant water, so that Case 9-1 was applied and Response 7 was planned. Because prompt excavation and removal was difficult, countermeasures against direct exposure risk were taken (pavement on contaminated soil area). In addition, periodical monitoring of DDT was determined necessary (Refer to Table 8.1 “Surrounding environment monitoring items and their survey,:Note (2).)

Point B: Soil sample complied with relevant oil concentration guideline values (dissolution amount) but not with the relevant value for content amount, and groundwater samples after removal of stagnant water complied with relevant environmental water quality guideline values, so Case 4-1 was applied. Countermeasure against direct exposure risk of Response 3 was planned and contaminated soil area was paved over.



6. Preparation of excavation work (Action 4)

For excavation of stored material, the following preparations should be made, after properly assessing the site condition.

1. Make excavation work plan.
2. Prepare storage containers and provide their temporary storage area.
3. Review risk evaluation of excavation site and measures for safety and prepare for it. If groundwater might flow into the working site, review reduction measures and take them.
4. Review measure for preventing agricultural chemicals from spreading to surrounding environment during work, and prepare for it.
5. Communicate symptoms of poisoning caused by relevant agricultural chemicals with workers.
6. Communicate impact of the work with neighboring residents.
7. Review and establish surrounding environment monitoring plan for agricultural chemical storage (Refer to “8. Monitoring of surrounding environment “(Action 7).)

6.1 Basic scheme

Excavation target site determined as the results of “5. Determination of contamination area (Survey for checking surrounding environment)(Action 3)” is excavated, and for the work, an excavation work plan considering the following points should be prepared, considering the hazard of POPs agricultural chemicals (Refer to “7.2 Safety control and prevention of environmental pollution during excavation and recovery works of agricultural chemicals stored underground” (Action 6).)

(1) Minimize contact by workers with agricultural chemicals, including checking and recovery of agricultural chemicals.
(2) Avoid raiding of agricultural chemicals stored underground.
(3) Take measures to prevent agricultural chemicals or materials being scattered into the surrounding environment.
(4) Sort agricultural chemicals as necessary, considering treatment condition after their recovery.
(In the case of mercury or arsenic material contained in agricultural chemicals, treatment after excavation may be different, so that it should be sorted by checking the labeling or the like. If an agricultural chemical for export is stored, caution should be paid because the effective contents may not be described on the label of the agricultural chemical.

6.2 Establishment of excavation plan

On excavation of stored material (in the case of leakage, soil should be included.), a work plan describing the following items is made.

(1) Location of stored point
Location of stored material (and surrounding contaminated area) targeted for excavation is described.
(2) Planned date and period of excavation work
Planned start and complete date of excavation work and working period are described.

(3) Excavation area and amount of agricultural chemicals stored underground or other Information regarding the excavation area and amount of agricultural chemicals stored underground including the calculation base size and man/days of work. Drawings should be attached to show stored condition.

(4) Surrounding condition of stored site (Geological, groundwater level and land use conditions)
Geological, groundwater level and land use conditions near storage site and the surrounding area are provided. Drawings are also attached.

(5) Contents of excavation work

Before excavation begins of agricultural chemicals stored underground, tools and procedures are reviewed and documented.

(6) Handling method of excavation material

Excavated material is classified and stored before moving off site.
Classification of excavated agricultural chemicals or others and handling methods are reviewed and documented. Handling of a storage container is planned, referring to “6.3 Preparation of storage containers.” Storage containers are temporarily placed before transfer to storage site, and the location and the filling method should be reviewed and determined in advance.

(7) Temporary storage area

A temporary storage area before transfer of excavated material to storage site should meet the following requirements, at least:

a) No irregular ground surface so that the storage container can be securely placed.
b) No disturbance to other excavation work.
c) Keep entrance route open for vehicles and machines.
d) Simple materials (sheets, etc.) to avoid weather exposure.
e) Apply sheets to prevent pollution caused by leakage from storage container.

Storage container for storing excavated material is labeled to identify contents
and a control number is recorded for each container for subsequent control and treatment. If excavated material is directly transferred to a treatment facility from the excavation site without being moved to a storage site, the same handling procedures should be taken.

(8) Measures for work safety and environmental conservation

Measures for work safety and environmental conservation for excavation sites are planned, referring to “6.5 Measure for prevention of pollution to surrounding environment,” “6.6 Information required sufficiently to communicate with workers,” and “7.2 Safety control and prevention of environmental pollution during excavation and recovery works of agricultural chemicals stored underground (Action 6)”.

(9) Environmental monitoring and method during work

Monitoring of the surrounding environment during work is planned, referring to “8 Monitoring of surrounding environment (Action 7)”.

(10) Temporary storage site for excavated and recovered agricultural chemical

Agricultural chemical storages site during excavation and recovery until treatment and final location, such as a treatment facility, should be documented. Storage site is planned, referring to “9. Storage (Action 8)”.

6.3 Preparation of storage container

Before excavation of agricultural chemicals stored underground, a storage container sufficient for transfer and storage of planned excavated amount (see “9.2 Requirements of storage container.”) should be prepared.

When stored material is contaminated with mercury, arsenic or the like, except for POPs agricultural chemicals, or other coarse particle contaminants are recovered, they should be sorted and stored in a different container at the site, if possible, because these materials require different handling after recovery. When a large amount of rainwater or groundwater has penetrated into the agricultural chemical pit, the wastewater, which may exceed the amount of agricultural chemicals stored underground, should be recovered. When the surrounding soil is contaminated by leakage of agricultural chemicals stored underground, a large amount of soil may be recovered. For these reasons, sufficient numbers of containers should be kept on hand after checking the information in the documents review and survey results, as well as after determining the size of the target excavation area during the stage of preparing the storage containers.

Moreover, large, thick plastic bags should be put in the containers for agricultural chemicals before putting in the agricultural chemicals and sealing the container.

6.4 Measures for keeping the excavation site safe

When agricultural chemicals are deeply stored, on an unsteady stratum, or at a potential spring, necessary prevention measures should be investigated based on the proceeding storage site survey because excavation using a sheet pile or the like may be needed to the keep work safe. When a sheet pile is used, it should be located approximately 1-2 m around the target site, so that is does not damage the stored material.

When stagnant wastewater remains at the storage site, pumps l and storage containers should be prepared because the wastewater may be pumped up. When the wastewater is transferred to a storage container, a waterproofing sheet, a pan (working plate) or the like should be prepared to prevent secondary pollution by leakage into the surrounding environment.

6.5 Measure for prevention of pollution to surrounding environment

As prevention measures against environmental pollution caused by blow-off or outflow of agricultural chemicals or others to areas surrounding the excavation site during excavation work, the following measures are effective. However, appropriate measures should be applied, considering the specific

conditions of the target site.

(1) Cover for excavation site (sheet for civil engineering, tent, temporary dome, etc.)
(2) Equipment for pumping stagnant water and for a storage container
(3) Area and equipment for cleaning storage container, work shoes, etc.

As shown in Figure 6.1, excavation work is mainly classified into 2 types: open-air work and closed space.

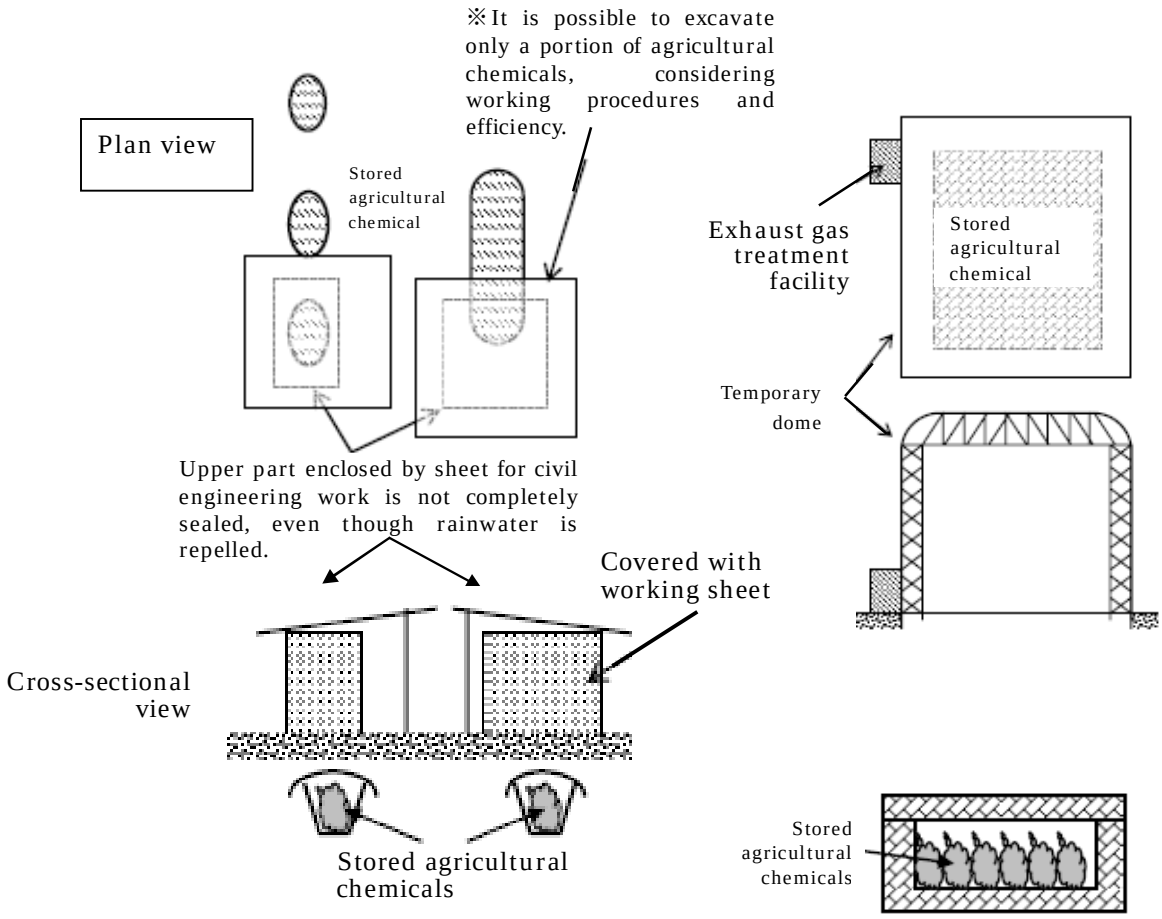


Figure 6.1: Types of excavation of agricultural chemicals

For open-air work, sufficient attention to the surrounding environment, as well as to workers, should be paid. For closed-space work, air is intensively exhausted to the outer environment for the safety of workers. Accordingly, the treatment method and location of the emission port should be reviewed based on land use conditions nearby and the traffic of passersby.

When the storage site is large, a procedure in which a part is excavated to recover agricultural chemicals and then another part is excavated may be applied to reduce the impact on the surrounding environment.

Excavation work should be conducted not to damage agricultural chemicals or others, if possible. Even if leakage or blow-off occurs, preventive measures against spreading and leakage should be taken and a monitoring point for monitoring leakage and blow-off (groundwater monitoring well, atmospheric air monitoring point, etc.) should be provided.

6.6 Information required to effectively communicate with workers

The following safety rules must be effectively communicated in advance to all workers conducting excavation and recovery work of agricultural chemicals stored underground and other related materials. This is especially true for potentially toxic mixtures of highly toxic substances, such as organic phosphorus. This should be communicated in advance to all affected workers.

(1) Objective and procedure of work
(2) Toxicity and symptoms of poisoning by target agricultural chemicals
(3) Countermeasure against blow-off of agricultural chemical during work
(4) Response to exposure to agricultural chemical (Emergency responses such as washing)
(5) Response to rapid change of weather

6.7 Communication with neighboring residents

Before starting work, the objective and procedure of the work should be communicated to neighboring residents. Emergency responses should be also communicated in advance.

7. Excavation

7.1 Excavation and recovery work of agricultural chemicals stored underground (Action 5)

The following points are to be followed for excavation and recovery work of stored agricultural chemicals. Wastewater after cleaning machines used for work with agricultural chemicals stored underground, contaminated soil or the like is handled the same as underground stagnant water.

Weather is also a problem, considering blow-off of agricultural chemicals during excavation and recovery work.

Excavation and recovery work of agricultural chemicals stored underground proceeds according to the following steps.

1) The soil covering agricultural chemicals stored underground (non-contaminated) is excavated and removed.
2) PVC sheets, soil and mortar contacting agricultural chemicals are excavated and removed.
3) If there is stagnant water at the agricultural chemical storage site, it must be pumped up and stored in a container.
4) Agricultural chemicals in unbroken containers are manually transferred to small containers. When the label is readable, it is recorded.
5) When mercury, arsenic or other liquid agents are found, they are transferred to a separate container from those of other agricultural chemicals, to prevent damage.
6) Agricultural chemicals in a broken container or soil, mortar or the like from the surrounding contaminated environment are packed in other containers, such as PVC bags.
7) Each container packed with agricultural chemicals or others by 5) and 6) is put into a larger storage container.
8) If stagnant water is found at the bottom of the pit after removing stored material, it is pumped up for storage in a container.
9) Contaminated bottom soil and mortar is removed (Determination of target area for excavation is referred to in 5.8.) When a storage facility is constructed in concrete, the surface is removed and then packed in a storage container. After that, It is cleaned and the wastewater is stored in container. A concrete receptacle is checked to see whether it is contaminated with POPs chemicals and then dismantled by the same method as other contaminated materials.
10) The surrounding soil and soil from below the excavated area is sampled to check whether it is contaminated with agricultural chemicals stored underground, and then the contaminated part is handled according to 9).
11) Monitoring of surrounding environment is conducted during excavation and after completion.
12) Excavation area is refilled with normal soil.

7.1.1 Excavation and recovery works of soil over agricultural chemicals stored underground

Soil lying 10 cm or more over stored material clarified by preliminary survey is removed. Machine operation is allowed for soil shallower than 30 cm over the stored material, and closer soil than that is manually excavated (shoveled).

Soil which is confirmed to have no contamination by preliminary survey of all excavated soil is handled as normal surplus soil. It is allowed to be used for refill at the site. When it is contaminated, suitable countermeasure should be taken according to 5.8.

7.1.2 Excavation and recovery of soil contacting agricultural chemicals stored underground (2)

PVC sheets, soil (approximately 10 cm in thickness), mortar or the like directly contacting agricultural chemicals may be potentially contaminated, and should be transferred to a storage container as contaminants. Mortar and other materials directly contacting agricultural chemical are broken up at the site to a suitable size to be put in storage containers. In these cases, caution is paid to prevent blow-off of agricultural chemical or others.

7.1.3 Pumping up of stagnant water (3), 8))

Water near stored material is pumped up to remove soil, concrete, etc. Water pumped up is stored in containers. In this case, a small sample should be taken from each container. When water springs from the bottom during work, it is pumped up to store in a container according to the same procedure for stagnant water. When the aquifer contacts agricultural chemicals stored underground because of higher water level near the site, the aquifer water should be pumped up after preventive measure against inflow- are taken. The existence of mercury or arsenic agents in the water pumped up is checked by simplified analysis or other methods, and then separated from agricultural chemicals.

To assess the contamination of the water pumped up, if the agricultural chemicals stored underground are completely identified, the contents of the agricultural chemicals are analyzed. On the other hand, if this is unclear, mercury, arsenic, thiram, organic phosphorus (parathion, methylparathion, methyldimethone, EPN) or the like is analyzed using the environmental quality standards provided for POPs agricultural chemical, soil and groundwater.

7.1.4 Recovery of agricultural chemicals(④⑤⑥⑦)

After removal of the cover soil over stored materials, recovery work is conducted in response to storage conditions and the properties of the agricultural chemicals.

(1) When an agricultural chemical container is not broken

The agricultural chemical container is manually and carefully transferred to a sealed, zippered PVC bag or the like without damage, and then it is transferred to a small container or drum. In this case, if the label is readable, the relevant records are retained for each type of agricultural chemical. Paper bag packaging of agricultural chemicals may be damaged by absorbing water and easily broken, even though its apparent storage condition seems good. Caution is paid to handling these items.

Agricultural chemicals confirmed as mercury or arsenic agents are transferred to small containers or drums separate from other agricultural chemicals.

(2) When an agricultural chemical container is broken

When a container is broken and agricultural chemicals or other material is scattered at the site,

excavation is conducted by machine operation, such as a backhoe, keeping workers away from the area. When water remains at the site, it is at first pumped up to transfer to a container. After that, muddy agricultural chemicals and mortar are excavated and removed. The mortar or other material is broken into suitable sizes to be put into a storage container.

7.1.5 Removal of soil, concrete or other contaminated material from the bottom or sidewall of the site (⑨)

After removing agricultural chemicals or other materials, soil lying in contact with the excavation area is transferred to a container as a contaminant.

In the case where agricultural chemicals stored underground are stored in a concrete receptacle, if POPs chemical or others in the concrete exceeds the guideline value, they are handled as contaminants, as well as other large-particle contaminants.

A concrete sample should be analyzed in addition to that on the surface to check contamination because POPs chemical or others may have penetrated into the concrete. When all concrete is removed and treated by the same method as contaminants, the above analysis is not needed.

7.1.6 Handling of contaminated material (⑩) (After excavation survey)

Soil near and under the excavated material is sampled to check for contamination with agricultural chemicals. As there is no preliminary checking method of contamination caused by leakage of soil under agricultural chemicals, soil under the chemicals is sampled to analyze after excavation (according to “5.5 Conduct of primary survey, 3): Analysis of sample.”)

7.1.7 Handling of contaminated material (⑦⑧⑨⑩)

Soil judged as “leakage” by a survey for checking the surrounding environment should be excavated, removed and treated according to “5.8 Determination of target area for excavation and other treatment: Determination of contamination area and specific countermeasure”, and it should be suitably stored .

When the excavated material is directly moved to a treatment facility without storing it in a storage facility, it can be stored at a temporary area on the site (Refer to “6.2 Establishment of excavation plan (7).”, however, the storage period should not be increased.

7.1.8 Environmental monitoring after completion of excavation work (⑪)

As a long time may pass before the impact caused by excavation work emerges, monitoring of the surrounding environment is done after completion of excavation work according to “5.8 Determination of target area for excavation and other treatment: Determination of contamination area and specific countermeasure.” When agricultural chemicals stored underground are removed but potentially contaminated soil is not excavated, removed and treated, the countermeasure shown in the relevant

note Figure 8.1 is taken according to 5.8.

7.1.9 Refill of excavation site (⑫)

After agricultural chemicals stored underground and contaminated soil or other material is excavated and stored in a container, the hole is refilled with non-contaminated soil.

7.2 Safety and prevention of environmental pollution during excavation and recovery work of agricultural chemicals stored underground (Action 6)

The basic policy for work safety and environmental pollution prevention during excavation and recovery work of agricultural chemicals stored underground is as follows.

1) To keep workers safe, work is conducted with suitable safety tools and equipment. Information regarding agricultural chemical or other materials is effectively communicated to workers and managers.
2) Excavation site is isolated from the surrounding environment by sheets, temporary tent, etc. to prevent blow-off of dust.
3) Disposable working wear, gloves, etc., are used, and working shoes or other items are thoroughly cleaned each day to prevent deposits from being taken to outside areas.
4) Periodic monitoring of the surrounding environment is conducted during excavation work (Refer to “8. Monitoring of surrounding environment” (Action 7).)

7.2.1 Worker safety

(1) Safety equipment

Agricultural chemicals having acute toxicity may be contained within other stored agricultural chemicals. For that reason, work safety equipment necessary to avoid skin contact and inhalation (working wear through which an agricultural chemical does not penetrate, safety masks, gloves, protection goggles, etc.) are necessary. As work with safety equipment creates higher temperatures and humidity and causes exhaustion and fatigue, it is necessary to reduced relevant work to within approximately 2 hour cycles with sufficient rest in between.

(2) Information regarding agricultural chemicals

Safety control during excavation work is referred to in notices for application of agricultural chemicals. Examples of general notices are listed in Attachment 8.

(3) If an abnormal symptom on the body is found

If an abnormal symptom is found on a worker's body during excavation work, the work should be promptly suspended and he/she should be seen by a doctor (Refer to Attachment 9: List of symptoms of poisoning by POPs and associated agricultural chemical their emergency responses.) Cleaning water and other emergency response items should also be on hand.

7.2.2 Isolation from surrounding environment

The working site is isolated from the surrounding environment be means of a sheet, tent, etc. When air is exhausted from a closed working space to the outer atmosphere, it should be exhausted after treatment through suitable exhaust gas treatment because odors and/or agricultural chemical contents may be blown off. Location of the exhaust port for the treated gas should taken account of passersby and others.

7.2.3 Handling of workers

As contaminants may adhere to working wear or other items, disposable gear should be used, and used items should be handled the same as other contaminated material.

8. Monitoring of surrounding environment (Monitoring survey) (Action 7)

Surrounding environmental conditions should be checked by survey and visual observation, considering the leakage potential of agricultural chemicals stored underground through excavation. For that reason, a monitoring plan for surrounding environment should be made during the preparation stage for excavation based on "3. Survey for confirmation of the storage site" (Action 2) and "5. Determination of contamination area (Survey for checking surrounding environment)" (Action 3). Then, environmental monitoring is conducted during and after excavation work according to the monitoring plan.

8.1 Objective

To suitably evaluate the impact on the surrounding environment caused by excavation work and the existence of remaining agricultural chemicals stored underground, a planned continuous monitoring of the surrounding environment during and after completion of the work should be conducted. For that purpose, air samples are taken for analysis and groundwater samples are taken from near the storage site. (When a river or lake is nearby, it should be included (hereafter, called "Groundwater or others.")). Whether or not there is an abnormal condition regarding surrounding water, vegetation, etc., should be checked visually.

(1) During excavation work

a) Because an agricultural chemical bag may be broken by excavation work and then leak, any impact caused by leakage to the surrounding soil and /or groundwater is checked. For that reason, periodic monitoring of groundwater or others is conducted.
b) Existence of impact of leakage, blow-off, etc. caused by exposure of agricultural chemicals stored underground during excavation work to surrounding environment is checked. For that reason, the air around the work site is continuously monitored.

(2) After completion of excavation

As the delayed impact caused by excavation of agricultural chemicals stored underground or others may emerge after completion of the work, a groundwater well for monitoring the surrounding environmental is retained for one year (An existing well may be used for monitoring)Then periodical sampling and analysis of groundwater or others is conducted. Monitoring for each case is conducted based on “5.8 Determination of target area for excavation and other treatment: Determination of contamination area and specific countermeasure”, referring to Table 5.1 and Table 8.1.

8.2 Establishment of surrounding environment monitoring plan

(1) Concept of survey point

a) Groundwater or other elements

For groundwater quality monitoring, a well located near the target excavation area is used for surrounding environmental monitoring. It should be chosen among all of the wells where groundwater is not contaminated according to “5. Determination of contamination area (Survey for checking surrounding environment)” (Action 3). When the flow direction of groundwater at the target site is clear, monitoring is conducted at two points upstream and downstream. When it is unclear, monitoring is conducted at four surrounding monitoring wells.

b) Atmospheric air (only during excavation work)

As agricultural chemicals may spread from the working site into the air during excavation work, air samples are taken to analyze at a laboratory, considering wind direction, location of internal air exhaust port at the work site, etc. For the atmospheric air sampling method, the presence of mercury is referred to in the “Manual for measuring method of hazardous atmospheric air pollutant (mercury, benzo［a］pyrene)” (Environmental Agency Air Quality Bureau atmosphere regulation section) and POPs or other chemicals is referred to Attachment 1.

(2) Monitoring item

Monitoring items are basically shown in Table 8.1.

Contamination caused by leakage of agricultural chemicals or others is assessed by simplified analysis or odor check. However, since the symptoms are not always present, POPs chemicals or others potentially contained in agricultural chemicals stored underground should be analyzed at a laboratory, irrespective of the existence of the symptom.

a) Groundwater or others

Simplified analysis is conducted for pH, electric conductivity and chloride ion (additionally TOC, if necessary). When information regarding the content of agricultural chemicals stored underground is completely understood at the monitoring stage, the contents are targeted. When the contents are unclear the following are analyzed at a laboratory: POPs or other chemicals potentially contained in agricultural chemicals stored underground, heavy metals related POPs agricultural chemical contents such as mercury, thiram, organic phosphorus (parathione, methylparathione, methyldimethone, EPN) and copper whose environmental quality standards are provided, and contents detected according to “5. Determination of contamination area (Survey for checking surrounding environment)” (Action 3) .

b) Atmospheric air (only during excavation work)

The existence of an odor is checked at the area surrounding the work site .(An odor intensity meter can be used, if necessary.) To grasp diffusion situation of POPs or other chemicals and mercury to the surrounding environment, atmospheric air is sampled downstream of the work site to be analyzed at a laboratory.

(3) Frequency of surveys and notices of survey results

The frequency of surveys is basically shown in Table 8.1. When a trend of increasing concentration different from expected concentrations is found by simplified analysis and stronger or different quality of odor is sensed by odor check, contamination caused by leakage is suspected and then the sample is promptly analyzed at a laboratory.

Survey results are sent to respective local governments, local residents and land owners.

Table 8.1: Surrounding environment monitoring items and surveys

Timing	Method	Monitoring item	Monitoring frequency and period
During excavation work	Visual	Check of abnormal condition of surrounding water area and vegetation	Daily
	Water analysis	Simplified analysis: pH, EC, Chloride ion (TOC may be added.)	Daily
		Laboratory analysis: In the case where agricultural chemicals stored underground is completely proven, the agricultural chemical content is analyzed. If unclear, POPs or others chemicals, mercury, thiram, arsenic, organic phosphorus and heavy metals are analyzed.	Monthly Note (1)
	Air analysis	Downwind check of existence of odor	Any time
		Laboratory analysis: POPs or other chemicals, mercury	Monthly Note (1)
After completion of excavation Note (2)	Visual	Check of abnormal conditions of surrounding water area and vegetation	Every 2 months for 1 year
	Water analysis	Simplified analysis: pH, EC, Chloride ion (TOC may be added.)	Semiannually(Heavy rain and drought seasons) for 1 year Note (3)

		Laboratory analysis: In the case where agricultural chemicals stored underground is completely proven, the agricultural chemical content is analyzed. If unclear, POPs or others chemicals, mercury, thiram, arsenic, organic phosphorus and heavy metals are analyzed.	

Note (1): When abnormal condition is observed by simplified analysis or smell check, laboratory analysis should be also conducted.

Note (2): In the case that soil containing POPs and associated chemicals, which exceeds the Soil concentration guideline value (dissolution amount) but is complied with the treatment guideline value, is neither excavated nor eliminated and then monitoring by groundwater quality measurement is adopted as an alternative, periodical groundwater quality monitoring should be conducted at an interval of quarter or more for the 1st year, annual for the 2nd to 10th year and every 2 years after the 11th year.

When groundwater contamination happens during the monitoring period, the contaminated soil should be promptly excavated, eliminated and treated.

Note (3): When groundwater contamination is found by primary and secondary survey conducted for determining target area for excavation and/or treatment (Figure 5.3, Case study 2-2, Case study 4-2, Case study 5-3, Case study 7-2 and Case study 9-2), quarterly or more groundwater quality measurement should be conducted to check non-contaminated groundwater condition is kept for 2 years.

8.3 Response to abnormal situations

(1) During excavation works

When there are abnormal conditions regarding agricultural chemicals stored underground and the leakage area, such as agricultural chemicals stored underground at a different point from anticipated, or a larger volume of flowing groundwater than planned anticipated, or softer ground on the excavation site is found, work should be suspended promptly and then the leakage point should be checked according to “5. Determination of contamination area (Survey for checking surrounding environment)” (Action 3). The actual leakage area should be determined. The work can be restarted after the necessary countermeasure is taken.

(2) After completion of excavation

When abnormal groundwater condition, such as deviation form guideline value of groundwater quality is found as the result of monitoring after completion of excavation, leakage point causing the abnormal condition should be checked according to “5. Determination of contamination area (Survey for checking surrounding environment)” (Action 3). The actual leakage area surrounding there should again be determined. After that, the need for additional excavation is assessed, if necessary.

9. Storage (Action 8)

9.1 Basic policy

Basic policy for storage of agricultural chemical excavated and recovered is shown as follows.

1) Agricultural chemical or others excavated and recovered are suitably stored until final treatment by means of hazardous chemical treatment technology with confirmed safety and performance. Storage is conducted according to the Waste Management and Public Cleansing Law.
2) For storage, a suitable storage container is selected not to cause leakage to surrounding environment.
3) For the storage site, periodic environmental monitoring is conducted to check that there is no leaking into the surrounding environment.

9.1.1 Storage period and responsibility during storage

Excavated agricultural chemicals stored underground or other chemicals are suitably stored until final treatment by means of hazardous chemical treatment technology with confirmed safety and performance to prevent loss and stealing during storage and monitoring the amount of storage. Storage

is conducted according to the Waste Management and Public Cleansing Law.

Storage should be resistant to weather high temperatures and humidity and be a leak-proof structure for contaminants in the surrounding environment (soil, groundwater and atmospheric air) when a container breaks.

9.1.2 Use of storage container at excavation site

A container in which stored material was put at the excavation site is, in some cases, used as a storage container by itself to avoid complicated transfer of contents, considering hazardous property of POPs agricultural chemical or others. Such a container is transferred to a larger container, if necessary.

9.1.3 Periodic monitoring during storage

At the storage site for agricultural chemicals or others, conditions should be periodically monitored visually and POPs chemical or others in the surrounding environment should be analyzed, if necessary. If leakage of stored contents is found, POPs chemicals or others in the surrounding environment are promptly analyzed to check for environmental pollution and then effective countermeasures, such as the transfer of each storage container to another one, are taken.

9.2 Requirements of storage container

As for the storage container, a container which is suitable for countermeasures against blow-off, spill, leakage or the like on carrying agricultural chemicals, contaminated soil, and stagnant water should be used. In addition, it should have sufficient durability for the weight and shape of the contents.

9.2.1 Raw material of storage container

Air-tightness, sturdiness, corrosion resistance, etc. of the storage container should be maintained because agricultural chemical may be stored for several years. On the other hand, hazardous chemicals require an overall strong container, not only for the contents. The following containers are considered suitable to satisfy the above requirements:

(1) Steel drum (except for stainless)
(2) Pail (except for stainless)
(3) Air-tight structural plastic container

Steel drums are the priority from the viewpoint of strength and ease of use when handling after storage is considered. However, even small plastic containers or plastic drums can be used if the shape is suitable for subsequent treatment. A stainless container which is not melted, incinerated and deformed should not be used because of difficult handling in the case of hazardous

chemical thermal treatment.

9.2.2 Capacity of storage container and others

Capacity of storage container should be determined, considering handling for its transfer and subsequent treatment.

9.3 Requirements of storage site

Storage facility for agricultural chemical or others should satisfy the following requirements in addition to compliance with the storage standard according to the Waste Management and Public Cleansing Law.

1) Condition where storage container is not impacted by weather.
2) If leakage occurs from the storage container, a facility for reducing spreading is provided.
3) Storage container is isolated from neighboring residents and other materials.

9.3.1 Location of storage facility and others

When a storage container for agricultural chemical or others is placed in wind, rain and higher temperatures and humidity, it may deteriorate or aged, so a facility where the storage container is not placed under these conditions should be provided. As a location exposed to the risk of heavy rain or land slide is not suitable as a storage site, selection of the location must also taken into consideration.

As a solvent may be left with agricultural chemicals stored underground, shade must also taken into consideration to prevent volatilization, ignition, etc.

9.3.2 Structure of floor and base of storage facility

The storage facility should be constructed of concrete and have leakage diffusion prevention walls or similar to prevent penetration of the contents into the table water or underground, even when the contents leak from the storage container. To improve waterproofing, a sealing agent, such as resins (epoxy resin or the like), should be applied to the floor and lower inside wall.

9.3.3 Prevention of contact with agricultural chemical or others during storage

Storage site for storage containers should be structured to keep people out. If other materials are also stored together, the storage container for agricultural chemicals may be bumped accidentally, so that a control system for distinguishing storage containers from other materials (partition, display, etc.) should be provided.

9.3.4 Others

When recovered agricultural chemicals stored underground or others are transferred to the storage

site, compliance with the requirements of the Waste Management and Public Cleansing Law is required. Regarding treatment of agricultural chemicals stored underground, requirements for collection and transportation are shown in technical notices published by the Waste Management and Recycling Department of MOE.

9.4 Monitoring during storage period

At the storage facility of containers filled with agricultural chemical or others, leaks caused by breakage, deterioration or other problems with the containers should be monitored. Monitoring is mainly conducted by the following methods.

1) Visual monitoring of storage condition
2) Monitoring for leaks by chemical analysis

Monitoring items and frequency of monitoring are summarized as follows.

(1) Visual monitoring (monthly)

The following items are monitored at the storage site to confirm that there is no abnormal condition. If a leak of stored contents is found, POPs chemical or others in the surrounding environment is promptly analyzed to check for environmental pollution and then suitable countermeasures, such as transfer of another storage container, are taken.

a) Discolored or deformed container
b) Leakage from container
c) Crack or discoloration of storage site floor

(2) Monitoring by chemical analysis (annually)

POPs agricultural or other chemicals, pH, chloride ion, etc. in surrounding environment are analyzed.

10. Response in the case of no early excavation and treatment of stored agricultural chemical (Action 9)

10.1 Basic policy

Excavation and treatment of agricultural chemicals stored underground should proceed promptly after confirmation of the storage site. However, there may be some stored points where early groundbreaking of excavation is difficult. For example, when there are many sites in a target block and land use is restricted. In these cases, the following basic policy is given:

1) “Action 3” is conducted according to “5. Determination of contamination area (Survey for checking surrounding environment)”.
2) When leakage is found after a survey, excavation and treatment is promptly conducted.
3) When excavation and treatment is difficult because of a leak, the pollution expansion preventive measures are taken.

When the difficulty removed, excavation and treatment is done promptly.

Even though excavation and treatment of agricultural chemicals stored underground is not conducted promptly (within one year is the general guideline), “Action 3” should be conducted according to “5. Determination of contamination area (Survey for checking surrounding environment)” to assess impact on the surrounding environment caused by leakage of agricultural chemicals. When a leak is found by survey of the surrounding environment, excavation and treatment of the agricultural chemicals stored underground is handled as a top priority because it should be promptly excavated and treated. (When a leak is found in soil near the storage site, other countermeasures, except for excavation, removal and treatment, are also applicable. Refer to “5. Determination of contamination area ”.)

When excavation and treatment is not easily applicable because of a special situation such as a structure over the target site (Refer to “4. Determination of evacuation period”), a countermeasure against increased environmental pollution caused by the leak should be taken. Moreover, the effectiveness of the prevention measure is verified and then the surrounding environmental monitoring is conducted, after completion of the countermeasure work, to evaluate the impact on the surrounding environment.

When a factor causing difficulty of the excavation and treatment is (was) removed, excavation and treatment should be promptly conducted. If a structure over the site is planned to be renovated or dismantled, it may be effective to conduct this works together with excavation and treatment. Accordingly, excavation and treatment for agricultural chemicals stored underground should be conducted in collaboration with other treatment by looking at other project plans and so on in advance though periodical collection of associated information.

10.2 Evaluation and judgment of priority

Even if it was determined that agricultural chemicals stored underground are not excavated at an earlier stage, early excavation and treatment should be conducted under the following condition.

1) When it is judged there is leakage into the surrounding environment
2) When there is a change in the storage form or some alteration near the storage site
3) When there is water stays at the storage site

When the storage site is not excavated when it was determined that agricultural chemicals were stored underground at an earlier stage, and even though excavation and treatment is planned, prompt excavation should be conducted in the case of the following condition.

(1) When it is judged there is leakage into the surrounding environment

When the impact to the surrounding environment is assessed by leakage of agricultural chemical and clarified by results of a survey for checking surrounding environment, and there is a high potential for pollution increase based on the flow regime of groundwater, the use of well water should be restricted based and relevant agricultural chemicals stored underground should be excavated and removed, and then soil and groundwater located in the contamination area should be remediated according to “5.8 Determination of target area for excavation and other treatment”. When contamination with mercury or arsenic is found, the Soil Contamination Countermeasures Law and the Water Quality Prevention Law should be followed.

(2) When there is a change to the stored form or alterations near the stored point

Even though it was determined that storage site was not excavated at an earlier stage, exposure of part of the stored material cause by erosion of surface soil due to rain or other action and new construction of residential houses, warehouses, roads or the like over or near stored material is supposed to have happened.

In such cases, countermeasures, such as prompt excavation or new containment should be taken, because it is risky to leave the storage site without taking sufficient countermeasures against surrounding environmental pollution caused by exposure of the stored material.

On the other hand, even though leakage to the surrounding environment is not found at present, surrounding environmental pollution may occur from excavation work conducted in response to modifications of building, road or others. Accordingly, when alteration work is conducted or planned at and near the storage site, pollution preventive measures should be taken or excavation and treatment of the agricultural chemicals stored underground, contaminants, or others should be conducted.

(3) When water remains at the storage site

When water remains in stored tanks or other containers and stored material is soaked in water, it is supposed that the agricultural chemicals or others will be easy to move. Accordingly, the water should be sampled to analyze POPs contents. When the value exceeds the relevant guideline value for POPs chemical or others, countermeasure against overflow of the remaining water should be taken. Even if it does not exceed the relevant value, preventive measures like the above one should be taken against potential leakage of the remaining water. When excavation of the site becomes possible, it should be promptly excavated and the contents should be recovered and treated after removal of the stagnant water. During excavation work, caution to prevent leaks of the stagnant water should be used.

10.3 Management scheme before excavation

To promote the effective and prompt, excavation and treatment of agricultural chemicals stored underground the following actions should be conducted suitably before excavation begins.

1) Explanation to neighboring residents regarding current condition of agricultural chemicals stored underground
2) Countermeasure against pollution increase and surrounding environmental monitoring
3) Review of excavation opportunity in response to change of land use

(1) Explanation for neighboring residents regarding situation of agricultural chemicals stored underground

As neighboring residents may feel stress about environmental pollution caused by agricultural chemicals stored underground when prompt excavation is not conducted, the current condition of agricultural chemicals stored underground and its control condition should be explained to neighboring residents in advance. As for excavation work, the contents of the planned excavation and treatment project, its implementation schedule, etc., should be communicated to neighboring residents because their opinion should be also taken into consideration.

(2) Countermeasures against pollution expansion and surrounding environmental monitoring

Measures for minimizing the environmental impact caused by agricultural chemicals stored underground and related monitoring are conducted not to cause surrounding environmental pollution until the excavation stage.

When work is performed near the storage site point, the existence of agricultural chemicals in the block is explained to neighboring residents and sufficient care is taken during the work.

Surrounding environmental monitoring and periodical site reconnaissance is conducted to check abnormal conditions, and their results are recorded.

When a natural disaster takes place at the storage site, a survey for checking surrounding environment is promptly conducted and countermeasures against pollution increase are taken, if necessary.

(2) Review of excavation opportunity in response to change of land use

Even if it was determined that the storage site is not being excavated because of a structure over the site or for other reasons, the structure may be dismantled by change of land use. In such a case as this, whether excavation can be conducted or not should be reviewed. Not to overlook such an opportunity, associated information should be collected through communication with relevant organizations, such as by site reconnaissance, public hearing, etc.

10.4 Prevention of expansion of environmental pollution

When agricultural chemical cannot be promptly excavated for a special reason despite judgment of leakage, preventive measure for stemming an expansion of environmental pollution into the surrounding environment should be communicated, and investigated for the following items, with relevant bodies of the local prefecture.

Despite a judgment of leakage, it is considered to take some time for groundbreaking work for special reasons, preventive measures to stem the expansion of environmental pollution, such as the following items, through communication and investigation with relevant bodies of the local prefecture should be reviewed and conducted. (Refer to Attachment 10: Examples of preventive measure of pollution expansion for details.).

(1) Application of sealing works (sheet pile works or others) for surrounding of storage site
(2) Control of groundwater flow by pumping-up surrounding groundwater or others
(3) Prohibition of intake, drinking and spraying of surrounding groundwater
(4) Restriction of excavation and transfer of surrounding soil

(Reference) Control points for selection of treatment facility of POPs and associated agricultural chemical including mercury (Hg) and arsenic (As)

Mercury or arsenic may be contained in agricultural chemicals stored underground at a storage site. Before treatment of agricultural chemicals stored underground or others containing mercury or arsenic, sufficient communication with a treatment facility should be performed in advance because acceptable concentrations of mercury or arsenic are different for each treatment facility. For this reason, it is very

important to sort mercury and arsenic contained in agricultural chemicals stored underground and to assess their concentration.

(Sorting of mercury and arsenic and assessing their concentration)

a) If the existence of a mercury or arsenic agent contained in agricultural chemicals stored underground is checked at the document review stage and the name of agricultural chemicals stored underground is verified, concentration of its content can be understood.

b) When agricultural chemicals stored underground is excavated, a mercury agent, arsenic agent, or other agricultural chemical should be sorted, if possible. In the case of good condition of agricultural chemicals stored underground, whether mercury is contained or not can be checked by looking at the label of the agricultural chemical. (It is verified and noted that agricultural chemicals for export may have no display of mercury according to results of investigation of accrual conditions.) However, it may be difficult to identify the type of agricultural chemical because of a dirty label caused by rainwater or others into the agricultural chemicals storage site. In these cases, the stored material should be analyzed to completely assess the concentration of mercury and arsenic.

(Attachment 1) Active ingredient of POPs or other agricultural chemical product

○ Aldrin contained product

Name of product	Active ingredient	Concentration (%)
Aldrin powder	aldrin	1.9~3.8
Aldrin hydrate	Aldrin	38
Aldrin emulsion	Aldrin	22.8
Aldrin and thiram powder	Aldrin Thiram	15~25 25~35
BHC, aldrin and organic tin emulsion	Aldrin γ-BHC Tributhyllead fumarate	5 10 2
Aldrin complex fertilizer	aldrin	0.2~0.23

○ Chlordane contained product

Name of product	Active ingredient	Concentration (%)
Chlordane emulsion	Chlordane	40
Chlordane powder	Chlordane	5~10
BHC, EDB and chlordane emulsion	Chlordane γ-BHC EDB	1.2 5~10 10~25

○ Dieldrin contained product

Name of product	Active ingredient	Concentration (%)
BHC and dieldrin emulsion	Dieldrin γ-BHC	4.25 5
Dieldrin powder	Dieldrin	1.7~3.4
Dieldrin hydrate	Dieldrin	42.4
Dieldrin emulsion	Dieldrin	8.5~15.7
Dieldrin paint	Dieldrin	5
Dieldrin and organic mercury emulsion	Dieldrin Phenylmercury dioctylsulfosaccinate	15.7 10
Dieldrin, EDB and organic tin emulsion	Dieldrin EDB	2.5 25

	Tributyltin oxide	2
PCP and dieldrin oil solution	Dieldrin PCP	0.6 2
Repellent　(ramtarin D、)	Dieldrin Cycloheximide	2.5 0.07

"ラムタリン D "英語表記がないため、日本語をローマ字表記にした。

○ Endrin contained product

Name of product	Active ingredient	Concentration (%)
Endrin and DDT powder	Endrin DDT	0.8 3.2
Endrin and DDT hydrate	Endrin DDT	10 10
Endrin and DDT emulsion	Endrin DDT	10 20
Endrin emulsion	Endrin	1.5~2
Endrin powder	Endrin	19.5
Endrin granular	Endrin	2~5
Endrin paint	Endrin	5
Organic tin, DDT and endrin hydrate	Endrin DDT Triphenyltin acetate or triphenyltin hydroxide	13 13 20 or 17
DDVP and endrin emulsion	Endrin DDVP	14 6
Endrin rodenticide	Endrin	4

○ Heptachlor contained product

Name of product	Active ingredient	Concentration (%)
Ethylthiomethone and heptachlor granular	Heptachlor Ethylthiomethone	2 5
Heptachlor powder	Heptachlor	2.5~4
Heptachlor emulsion	Heptachlor	20
Heptachlor hydrate	Heptachlor	25
Heptachlor granular	Heptachlor	5~10

DDT and heptachlor powder	Heptachlor DDT	1~2.5 4~5
Nicotine and heptachlor powder	Heptachlor Nicotine	0.7 0.5
Heptachlor and EDB oil solution	Heptachlor EDB	2 25
Heptachlor and thiram powder	Heptachlor Thiram	20 20
Heptachlor complex fertilizer	Heptachlor	0.2

○ DDT contained product

Name of product	Active ingredient	Concentration (%)
Derris and DDT powder	DDT Rotenone	5 0.5
DDT powder	DDT	5~10
DDT hydrate	DDT	20~75
DDT emulsion	DDT	20~30
DDT emulsion	DDT Partly, Diazinon or NAC	5~20 1 or 1
DDT and pyrethrum powder	DDT Pyrethrin partly, Piperonylbutoxide or Safroxan	5 0.04~0.08 0.5 or 1
DDT and pyrethrum emulsion	DDT Pyrethrin	15 1.3
DDT and nicotine powder	DDT Nicotine	3 0.8
DDT and BHC powder	DDT γ-BHC	8 0.2
DDT and BHC emulsion	DDT Lindane	13~20 5
DDT and endrin powder	DDT Endrin	3.2 0.8
DDT and endrin hydrate	DDT Endrin	10 10
DDT and endrin emulsion	DDT Endrin	20 10

DDT and heptachlor powder	DDT Heptachlor	4 1
DDT and Marason powder	DDT Marason	5 0.5
DDT and Marason emulsion	DDT Marason	10~20 10~25
DDT and DDVP emulsion	DDT DDVP	15~20 5~10
DDT and PAP powder	DDT PAP	2.5~4 1~2
DDT and PAP hydrate	DDT PAP	40 40
DDT and MEP powder	DDT MEP	2.5~4 2
DDT and CYAP emulsion	DDT CYAP	15 10
DDT and NAC powder	DDT NAC	4 1
DDT and NAC emulsion	DDT NAC	15 10
DDT and PHC powder	DDT PHC	4 0.7
DDT and CPMC powder	DDT CPMC	5 1.5
DDT and MPMC powder	DDT MPMC	4~5 1.5

Name of product	Active ingredient	Concentration (%)
DDT and MTMC powder	DDT MTMC	3.5~4 1.5
DDT and Formothion emulsion	DDT Formothion	20 10
EPN and DDT powder	DDT EPN	2.5~4 0.75~1
EPN and DDT emulsion	DDT EPN	20 20
CPCBS and DDT emulsion	DDT	27

	CPCBS	13
DDT smoking agent	DDT	27
BHC and DDT smoking agent	DDT γ-BHC or lindane	10~27.5 15~27.5
Allethrin and DDT aerosol	DDT Allethrin	0.1 0.045
DDT, Marason and organic arsenic powder	DDT Marason Polymethyldithiocyanathoarsine	5 0.5 0.23
EPN, DDT and Blasticidin powder	DDT EPN Blasticidin S	3 1 0.16
DDT, Marason and PCBA powder	DDT Marason PCBA	5 0.5 4
DDT, Marason and Kasugamycin powder	DDT Marason Kasugamycin	5 0.5 0.23
DDT, EPN, organic arsenic and PCBA powder	DDT EPN Polymethyldithiocyanathoarsine or Iron methanearsonate PCBA	5 1.5 0.23 or 0.4 4
DDT, NAC Kasugamycin powder	DDT NAC Kasugamycin	4 1 0.23
EPN, DDT and organic mercury powder	DDT EPN (as mercury)	5 1.5 (0.2)
EPN, DDT and PCBA powder	DDT EPN PCBA	5 1.5 4
Phthalthrin, DDT, dichlone, thiram and sulfer powder	DDT Phthalthrin Thiram Sulfer	5 0.06 2 10

	Piperonylbutoxide	0.3
Copper and DDT powder	DDT (Copper)	5 (6)
Copper and DDT hydrate	DDT (Copper)	15 (35)
Organic tin and DDT powder	DDT Chlorotriphenyltin	5 1.5

Name of product	Active ingredient	Concentration (%)
Organic tin and DDT hydrate	DDT Chlorotriphenyltin	30 20
Organic tin, DDT and endrin hydrate	DDT Endrin Acetotriphenyltin or Hydroxyltriphenyltin	13 13 20 or 17
Organic mercury, DDT and machine oil emulsion	DDT Organic tin (as mercury) Machine oil	1.5 (0.25) 93
5 substances mixed insecticide and fungicide (Floral spray)	DDT Zineb Captan Lindane, CPCBS	7.3 19.5 1 3

○ BHC contained product

Name of product	Active ingredient	Concentration (%)
Derris and BHC powder	γ-BHC or lindane Rotenone	0.3~0.6 0.5~0.6
Derris and BHC emulsion	γ-BHC Rotenone	5 1
Derris and BHC hydrate	Lindane Rotenone	10 1
DDT and BHC powder	DDT γ-BHC or lindane	8 0.2~1
DDT and BHC powder	DDT Lindane	13~20 5
BHC powder	γ-BHC or lindane	0.5~1

BHC hydrate	γ-BHC or lindane	5.0~50
BHC emulsion	γ-BHC or lindane	5.0~20
BHC powder (applied to water surface) (BHC powder for applying to water surface)	γ-BHC	6
BHC granular (applied to water surface) (BHC granular for applying to water surface)	γ-BHC	2~6
BHC oil solution	γ-BHC	0.2~10
BHC paint	γ-BHC or lindane	0.5~20
BHC and pyrethrum powder	γ-BHC Pyrethrin	0.8~1.5 0.05~0.075
BHC and pyrethrum emulsion	γ-BHC or lindane Pyrethrin	3~10 0.5~1.5
BHC and nicotine powder	γ-BHC Nicotine	0.5~3 0.5~1
BHC and nicotine emulsion	γ-BHC Nicotine	10 5
BHC, nicotine and NAC powder	γ-BHC Nicotine NAC	1 1 1
BHC and dieldrin emulsion	γ-BHC Dieldrin	5 4.25
BHC and Marason powder	γ-BHC Marason	2~3 0.5
BHC and Marason emulsion	Lindane Marason	10 10

Name of product	Active ingredient	Concentration (%)
BHC and dimethoate granular	γ-BHC Dimethoate	4 2
BHC and MEP hydrate	γ-BHC	1.3

	MEP	8
BHC, MEP and EDB emulsion	γ-BHC	10
	MEP	6
	EDB	5
BHC and NAC powder	γ-BHC	2~3
	NAC	1~1.5
BHC and NAC emulsion	γ-BHC	15
	NAC	15
BHC and NAC granular	γ-BHC	6
	NAC	6~8
γ-BHC, NAC and DEP powder	γ-BHC	2
	NAC	1
	DEP	2
BHC and PHC powder	γ-BHC	3
	PHC	0.7
BHC and PHC granular	γ-BHC	6
	PHC	5
BHC and CPMC powder	γ-BHC	3.0
	CPMC	5
BHC and MIPC granular	γ-BHC	6
	MIPC	3~4
BHC and MPMC powder	γ-BHC	3.0
	MPMC	1.5
BHC and MPMC granular	γ-BHC	4~6
	MPMC	4
BHC and MTMC powder	γ-BHC	1~3
	MTMC	1~2
BHC and BPMC powder	γ-BHC	3
	BPMC	1.5
BHC and BPMC granular	γ-BHC	6
	BPMC	3~4
BHC and DCIP emulsion	γ-BHC	2.5
	DCIP	80
BHC and DCIP oil solution	γ-BHC	2.5
	DCIP	95
BHC and EDB emulsion	γ-BHC or lindane	2.5~10
	EDB	5~25

BHC and EDB oil solution	γ-BHC or lindane EDB	0.25~8.4 2.5~84
BHC, EDB and chlordane emulsion	γ-BHC Chlordane EDB	5~10 1.2 10~25
BHC, EDB and Diazinon oil solution	γ-BHC EDB Diazinon	0.25~2.5 25 0.3~3.0
Methylparathion and BHC powder	γ-BHC Parathion	2 0.5
Parathion and BHC powder	γ-BHC Parathion	2 10
Parathion and BHC emulsion	γ-BHC Parathion	10 20

Name of product	Active ingredient	Concentration (%)
EPN and BHC powder	γ-BHC EPN	2 0.5
EPN and BHC emulsion	Lindane EPN	10 25
Ethylthiomethone and BHC powder	γ-BHC Ethylthiomethone	3~5 3~5
BHC and machine oil emulsion	Lindane Machine oil	1 90
BHC smoking agent	γ-BHC or lindane	10~55
BHC and DDT smoking agent	DDT γ-BHC or lindane	10~27.5 15~27.5
Pyrethrum and BHC smoking agent	γ-BHC Pyrethrin	33.3 0.2
BHC and DDVP smoking agent	Lindane DDVP	5 8
BHC, DDVP, chlorbenzylate smoking agent	Lindane DDVP Chlorbenzylate	17.4 8 5

Chlorbenzylate and BHC smoking agent	γ-BHC DDVP	10 10
BHC for grain stock	γ-BHC or lindane	1.0~10
3 substances mixture pesticide	γ-BHC or lindane Pyrethrin Rotenone or Piperonylbutoxide	0.06~0.08 0.05~0.065 0.042~0.05 0.16
Organic mercury and BHC powder	γ-BHC Organic mercury (as mercury)	1.5~4.5 (0.06~0.3)
BHC, organic mercury and arsenic powder	γ-BHC Organic mercury (as mercury) Iron methane arsonate	3 (0.17~0.3) 0.4
BHC and organic arsenic powder	γ-BHC Iron methane arsonate	3 0.4
BHC, organic arsenic and Kasugamycin powder	γ-BHC Kasugamycin Iron methane arsonate or Calcium methane arsonate monohydrate	3 0.2 0.4 or 0.26
BHC and sulphur powder	γ-BHC Sulphur	0.5 50
BHC, NAC and organic mercury powder	γ-BHC NAC Organic mercury (as mercury)	3 1~1.5 (0.2)
BHC, NAC and organic arsenic powder	γ-BHC NAC Iron methane arsonate or Calcium methane arsonate monohydrate	3 1 0.4 or 0.26
BHC, MPMC and organic arsenic powder	γ-BHC MPMC Iron methane arsonate or Calcium methane arsonate monohydrate or Polymethyldithiocyanatearsine	3 1.5~2 0.4 or 0.26 or 0.23
BHC and EBP powder	γ-BHC	3

	EBP	1.5

"ポリメチルジチオシアナトアルシン "英語表記がないため、日本語をローマ字表記にした。

Name of product	Active ingredient	Concentration (%)
BHC, NAC and EBP powder	γ-BHC NAC EBP	3 1 1.5
BHC and IBP powder	γ-BHC IBP	3 2
BHC, IBP and organic arsenic powder	γ-BHC IBP Iron methane arsonate	3 2 0.4
BHC, NAC and IBP powder	γ-BHC NAC IBP	3 1.5 2
BHC, NAC, IBP and PCBA powder	γ-BHC NAC IBP PCBA	3 1.5 1.5 2.5
BHC, MPMC, IBP and PCBA powder	γ-BHC MPMC IBP PCBA	3 2 1.5 2.5
BHC, MTMC and IBP powder	γ-BHC MTMC IBP	3 1.5 2
BHC, MTMC, IBP and organic arsenic powder	γ-BHC MTMC IBP Iron methane arsonate	3 1.5 2 0.4
BHC, NAC and EDDP powder	γ-BHC NAC EDDP	3 1 1.5
BHC and PCBA powder	γ-BHC PCBA	3 4

BHC, MPMC and PCBA powder	γ-BHC MPMC PCBA	3 1.5 4
BHC, MPMC, PCBA and Kasugamycin powder	γ-BHC MPMC PCBA Iron methane arsonate	3 1.5 2.5 0.14
BHC, MTMC and organic arsenic powder	γ-BHC MTMC Iron methane arsonate	3 1.5 0.4
BHC and CPA powder	γ-BHC CPA	3 3
BHC, NAC and PCMN powder	γ-BHC NAC PCMN	3 1 3
BHC and Blasticidin S powder	γ-BHC Blasticidin S Benzylaminobenzene sulphonate	3 0.16
BHC, NAC and Blasticidin S powder	γ-BHC NAC Blasticidin S Benzylaminobenzene sulphonate	3.0 1.5 0.16

Name of product	Active ingredient	Concentration (%)
BHC, NAC, Blastcidin S and organic arsenic powder	γ-BHC NAC Blastcidin S Benzylaminobenzene sulphonate Iron methane arsonate	3.0 1.5 0.16 0.4
BHC, NAC, Blastcidin S and PCMN powder	γ-BHC NAC Blastcidin S Benzylaminobenzene sulphonate PCMN	3.0 1 0.1 2
BHC, NAC, Blastcidin S and ETM powder	γ-BHC NAC Blastcidin S Benzylaminobenzene sulphonate ETM	3.0 1.5 0.1 1.5
BHC and Kasugamycin powder	γ-BHC Kasugamycin	3 0.23~0.34
BHC, Kasugamycin and organic arsenic powder	γ-BHC Kasugamycin Iron methane arsonate or calcium methane arsonate monohydrate	3.0 0.23 0.4 or 0.26
BHC, Kasugamycin and CPA powder	γ-BHC Kasugamycin monohydrochloride CPA	3.0 0.14 2
BHC, CPMC and organic mercury powder	γ-BHC CPMC PMI (as mercury)	3.0 1 0.4 (0.2)
BHC, NAC and Kasugamycin powder	γ-BHC NAC Kasugamycin	3.0 1~1.5 0.23~0.34
BHC, NAC, Kasugamycin and organic mercury powder	γ-BHC NAC Kasugamycin	3.0 1 0.1

	PMI (as mercury)	0.2 (0.2)
BHC, NAC, Kasugamycin and PCBA powder	γ-BHC NAC Kasugamycin PCBA	3 1 0.14 (0.12) 2.5
BHC, MTMC and Kasugamycin powder	γ-BHC Metatril-N-methylcarbamate Kasugamycin	3 1.5 0.23 (0.2)
BHC and organic mercury emulsion	γ-BHC Organic mercury (as mercury)	10 (1)
BHC and organic tin emulsion	γ-BHC or lindane Tributyltin oxide	1.5~15 2~10

"メタトリル-N "英語表記がないため、日本語をローマ字表記にした。

Name of product	Active ingredient	Concentration (%)
BHC and PCP emulsion	γ-BHC or lindane Pentachlorophenol	3~10 5~10
BHC and PCP oil solution	γ-BHC Pentachlorophenol	0.5 5
BHC, aldrin and organic tin emulsion	γ-BHC Aldrin Tributyltin fumarate	10 5 2
BHC, EDB and PCP oil solution	γ-BHC EDB PCP	0.5~12.5 2.5~12.5 0.5~10
BHC and PCP smoking agent	Lindane Pentachlorophenol	20 10
5 substances mixture pesticide (a part of them)	Lindane Zineb DDT	5.5 19.5 1.0

	Opotran	7.3 3
BHC and MCP granular	γ-BHC MCP	6 1.2
BHC and Prometryn granular	γ-BHC Prometryn	6 1.5
BHC and MCPCA granular	γ-BHC MCPCA	6 2.5
BHC and NIP granular	γ-BHC NIP	6 7
BHC and CNP granular	γ-BHC CNP	6 7
Turpentine oil and BHC trap agent	γ-BHC Turpentine oil	1~4 68~74
Repellent (a part of them)	γ-BHC Naphthalene or cresol or pentachlorophenol	4~5 49 2 5

Note: (Abstract from “Directory of agricultural chemicals”)

"オボトラン "英語表記がないため、日本語をローマ字表記にした。

(Attachment 2) Index of name of POPs or other agricultural chemicals

「"～"英語表記がないため、日本語をローマ字表記にした」

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
666	BHC powder, BHC hydrate							○	
BCT	Nicotine, BHC and NAC powder							○	
BHC	BHC and PHC powder							○	
BHC hydrate	BHC hydrate							○	
BHC emulsion	BHC emulsion							○	
BHC powder	BHC powder							○	
BHC oil solution	BHC oil solution							○	
BHC granular	BHC granular							○	
BHC pyrethrum powder	BHC pyrethrum powder							○	
BS	BHC and NAC powder							○	
BS mercury	BHC, NAC and organic mercury powder							○	○
B arsenic	BHC and organic arsenic powder							○	
C-D	Copper and DDT hydrate	○							
DC	DDVP and endrin emulsion		○						
DDT and VP emulsion	DDT and VP emulsion	○							
DDT duct	DDT powder	○							
DDT powder	DDT powder	○							

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
DDT pyrethrum emulsion	DDT pyrethrum emulsion	○							
DDT hydrate	DDT hydrate	○							
DDT emulsion	DDT emulsion	○							
DM	DDT and Marason emulsion	○							
DM seven	DDT and Marason powder	○							
DM powder	DDT and Marason powder	○							
DP emulsion	DDT and DDVP emulsion	○							
DS	DDT and MEP powder	○							
DS	DDT and NAC powder	○							
DS	DDT and NAC emulsion	○							
D emulsion	DDT and DDVP emulsion	○							
EB	EPN and BHC powder							○	
ED emulsion	EPN and DDT emulsion	○							
ED Buraesu	EPN, DDT and Blastcidin S powder	○							
ED powder	EPN and DDT powder	○							
EPN Lindane	EPN and BHC emulsion							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
K-55	BHC and PCP oil solution							○	
KD	Copper and DDT powder	○							
MD	DDT and Marason emulsion	○							
PB	Methylparathion and BHC powder							○	
PB	Parathion and BHC powder							○	
PCD powder	BHC powder							○	
PNB powder	Nicotine, BHC and parathion powder							○	
SB	BHC and NAC powder							○	
SB	BHC and NAC emulsion							○	
SB	BHC and NAC granular							○	
SB Orizon	BHC, NAC and PCMN powder							○	
SB Oribura	BHC, NAC, Blasticidin S and PCMN powder							○	
SB mercury	BHC, NAC and organic mercury powder							○	○
SB Hinozan	BHC, NAC and EDDP powder							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
SB Buraesu	BHC, NAC and Blasticidin S powder							○	
SB Buraesu U	BHC, NAC, Blasticidin S and ETM powder							○	
SB Burazetto	BHC, NAC, Blasticidin S and organic arsenic powder							○	
T-7.5	Turpentine oil and BHC trap agent							○	
T-7.5	BHC, EDB and chlordane emulsion						○	○	
T-75 emulsion	(Lindane emulsion)							○	
TD・BHC	Ethylthiomethone and BHC granular							○	
Akaaru B	Chlorbenzylate and BHC smoking agent							○	
Asahi pesticide	BHC agent							○	
Asotsumapii	BHC, MTMC and organic arsenic powder							○	
Asobii	BHC and organic arsenic powder							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Asobii mercury	BHC, organic mercury and arsenic powder							○	○
Asobiinakku	BHC, NAC and organic arsenic powder							○	
Asobiibaaru	BHC, MPMC and organic arsenic powder							○	
Achiramu	Aldrin and thiram powder				○				
Adekkusu	BHC powder							○	
Anizo-ru	BHC emulsion							○	
Aldrin formation	Aldrin complex fertilizer				○				
Aldrin hydrate	Aldrin hydrate				○				
Aldrin emulsion	Aldrin emulsion				○				
Aldrin powder	Aldrin powder				○				
Anchio D	DDT and formothion emulsion	○							
Imadu pesticide	BHC agent							○	
Uddokiru	BHC, EDB and diazinon oil solution							○	
Uddosaido	BHC and EDB oil solution							○	
Uddosaido C	BHC and EDB oil solution							○	
Uddozooru C	BHC, EDB and PCP oil solution							○	

Eitoganma	BHC and dimetholate granular							○	
Ekaki	DDT and Marason emulsion	○							
Ekachin TD・Heputagranular	Ethylthiomethone and heptachlor granular					○			
Esuganmaa	BHC and sulphur powder							○	
Echiru PB	Parathion and BHC emulsion							○	
Erudee powder	DDT and PAP powder	○							
Erutoman	DDT emulsion	○							
Engei Waipaazoru	Allethrin and DDT aerosol	○							
Endrin emulsion	Endrin emulsion		○						
Endrin granular	Endrin granular		○						

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Endrin powder	Endrin powder		○						
Entoron	DDT and endrin emulsion	○	○						
Ka- B	BHC and NAC powder							○	
Kaimo	DDT and DEP powder	○							
Kaimo	DDT and DEP hydrate	○							
Kasusan SB	BHC, NAC and Kasugamycin powder							○	
Kasunakku BM	BHC, NAC, Kasugamycin and organic mercury powder							○	○
Kasunakku D	DDT, NAC and Kasugamycin powder	○							
Kasupura SB	BHC, NAC, Kasugamycin and PCBA powder							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Kasupurameopii	BHC, MPMC, PCBA and Kasugamycin powder							○	
Kasumin BHC	BHC and Kasugamycin powder							○	
Kasumin D	DDT, Marason and Kasugamycin powder	○							
Kasumin SB	BHC, NAC and Kasugamycin powder							○	
Gatto	BHC paint, BHC hydrate							○	
Gattosaido	BHC paint							○	
Kamekuron	BHC and pyrethrum emulsion							○	
Karasaido	BHC agent for grain stock							○	
Ganma-MO	BHC and CNP granular							○	
Ganma	BHC and PHC granular							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Ganma	BHC powder							○	
Ganma-666 hydrate	BHC hydrate							○	
Ganma-666 powder	BHC powder							○	
Ganma-AM	BHC and MCP granular							○	
Ganma-MIPC	BHC and MIPC granular							○	
Ganma-coat	BHC paint							○	
Ganma-hydrat	BHC hydrate							○	
Ganma-thione	（Lindane emulsion）							○	
Ganmaanippu	BHC and NIP granular							○	
Ganma-emulsion	BHC emulsion							○	
Ganmaabasa	BHC and BPMC granular							○	
Ganmaa-powder	BHC powder for water surface application							○	
Ganmaa-hexane	BHC fumigation agent, BHC agent							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Ganmaamipushin	BHC and MIPC granular							○	
Ganma granular	BHC granular							○	
Ganmazooru	BHC agent for grain stock							○	
Ganmadoru	BHC powder for water surface application							○	
Ganmaraito	BHC paint							○	
Ganmarin	BHC emulsion							○	
Kisujin	DDT and BHC powder	○						○	
Kita ＳＢ	BHC, NAC and EBP powder							○	
Kitajin P and BHC	BHC and IBP powder							○	
Kitajin Ｐ and BHC	BHC, NAC and IBP powder							○	
Kitajin Ｐ tsumapii powder	BHC, MTMC and IBP powder							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Kitasuchin SB	BHC, NAC, IBP and PCBA powder							○	
Kitasuchinmeopii powder	BHC, MPMC, IBP and PCBA powder							○	
Kitapii	BHC and EBP powder							○	
Kimuzooru M	(Lindane emulsion)							○	
Kiruson	DDT and Marason emulsion	○							
Kirutesu C	BHC smoking agent (for forestry)								
Kirudorin	BHC and dieldrin emulsion			○				○	
Kirumosu tsutsu	BHC smoking agent (for forestry)								
Kunoshin	BHC and EDB oil solution							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Chlor	DDT agent for bag, DDT oil solution (for bag)	○							
Chlordane	Chlordane emulsion and powder						○		
Chlordane	Chlordane emulsion and powder						○		
Smoking agent Jet F	BHC smoking agent (for forestry)						○		
Smoking agent Jet I	BHC and DDT smoking agent	○						○	
Smoking agent Jet Fuji	BHC smoking agent (for forestry)								
Smoking agent Super Jet	BHC and DDT smoking agent	○						○	
Geza Guard BHC	BHC and prometryn granular							○	
Gezakkusu	DDT emulsion	○							

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Gerabii	Derris and BHC emulsion							○	
Kokuzou elimination agent	BHC agent							○	
Kokuzou liquid	BHC liquid							○	
Kokuzou pesticide	BHC liquid							○	
Kokuzou powder	BHC powder							○	
Kokutah powder	BHC powder for grain stock							○	
Kokuren	BHC agent for insect proof of grain stock							○	
Sacchukooto	DDT and BHC emulsion (for paint)	○						○	
Sapuron	BHC and EDB oil solution							○	
Sankingu powder	Pyrethrum and BHC powder							○	
Sankurin	BHC smoking agent (for forestry)							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Sansaido BHC	BHC and PHC powder							○	
Sansaido DDT	DDT and PHC powder	○							
Sansaido Ganma	BHC and PHC granular							○	
Sanchion	EPN and BHC emulsion							○	
Sanchukooto	DDT and BHC emulsion	○						○	
Sandesu	DDT and Marason powder	○							
Santoku	BHC, organic mercury and arsenic powder							○	○
Sanpun Kankou	Derris and BHC powder							○	
Sanpun Geran	Derris and BHC powder							○	
Sanpun Dekorin	Derris and BHC powder							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Sanpun Derris	Derris and BHC powder							○	
Sanmei emulsion 30	DDT emulsion	○							
San Lindane	BHC smoking agent (for forestry)								
Jet	BHC and DDT fumigation agent	○						○	
Jet BP	BHC and PCP smoking agent							○	
Jet U	DDT smoking agent	○							
Shisutoron	BHC emulsion							○	
Shimazooru	BHC emulsion, BHC powder							○	
Pyrethrum BHC	Pyrethrum and BHC emulsion							○	
Pyrethrum emulsion	BHC and pyrethrum emulsion							○	
Suzumikku	Organic tin, DDT and endrin hydrate	○	○						
Suzumikku H	Organic tin, DDT and endrin hydrate	○	○						
Sutemukooto D	Dieldrin paint			○					
Sutemukooto E	Endrin paint		○						
Supekutan	DDT emulsion	○							

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Sumikurooru	DDT and MEP powder	○							
Sumipaaku	BHC, MEP and EDB emulsion							○	
Sumoreito	BHC, DDVP and chlorbenzylate smoking agent							○	
Settopii	BHC and CPMC powder							○	
Settopii mercury	BHC, CPMC and organic mercury powder							○	○
Zokuzaa	BHC powder							○	
Daishisuton Ganma	Ethylthiomethone and BHC granular							○	
Tanesan	Heptachlor and thiram powder					○			
Taneton	Aldrin and thiram powder				○				
Tanebaridorin	Aldrin powder				○				
Tabanon	Derris and DDT powder	○							
Tafujin P BHC	BHC, IBP and organic arsenic powder							○	
Tafujin P Tsumapii powder	BHC, MTMC, IBP and organic arsenic powder							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Tafumikku	BHC, organic mercury and arsenic powder							○	○
Tawaranokusuri	BHC agent for grain stock							○	
Chiojet	BHC and DDVP smoking agent							○	
Ascaricide for grain stock	BHC agent							○	
Tsumaguro powder	DDT and Marason powder	○							
Tsumaguro emulsion	DDT and Marason emulsion	○							
Tsumasaido B	BHC and MTMC powder							○	
Tsumasaido C	DDT and MTMC powder	○							
Tsumapii	BHC and MTMC powder							○	
Dynakku	Copper and DDT powder	○							
Dieldrin hydrate	Dieldrin hydrate			○					
Dieldrin emulsion	Dieldrin emulsion			○					
Dieldrin powder	Dieldrin powder			○					
Deegan	DDT and BHC powder	○						○	
Deesu	BHC powder							○	
Deeto powder	DDT and Marason powder	○							

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Deepoppu	DDT and CPMC powder	○							
Deeman	DDT and Marason powder	○							
Detoron	DDT and BHC emulsion	○						○	
Detoron	DDT and BHC emulsion (paint)	○						○	
Denoon	Derris and DDT powder	○							
Deriton	Derris and DDT powder	○							
Deruson	DDT and Marason emulsion	○							
Deruson powder	DDT and Marason powder	○							
Dieldrin hydrate	Dieldrin hydrate			○					
Dieldrin emulsion	Dieldrin emulsion			○					
Dieldrin powder	Dieldrin powder			○					
Derotan	BHC powder							○	
Denmeetopurasu	Organic tin and DDT powder (hydrate)	○							
Toazooru	BHC powder, BHC hydrate							○	
Toppuzooru	(Lindane emulsion)							○	
Tominooru	Pyrethrum and BHC emulsion							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Dorunakku	BHC and NAC granular							○	
Dorunippu	BHC and NIP granular							○	
Dorumapika	BHC and MCPCA granular							○	
Doru granular	BHC powder for water surface application							○	
Niko B	Nicotine and BHC powder							○	
Niko BHC	BHC and nicotine powder (emulsion)							○	
Nikoganmaa	Nicotine and BHC powder							○	
Nikokurooru	BHC and cigarette powder							○	
Nicotine BHC	BHC and nicotine powder (emulsion)							○	
Nicotine DDT	Nicotine and DDT powder	○							
Nicotine Dasuto	DDT and nicotine powder	○							
Nikopii	Nicotine and BHC powder							○	
Nikoheputa	Heptachlor and nicotine powder					○			
Nikopooru D	PCP and DDT emulsion	○							

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Neokaa B	BHC, NAC and DEP powder							○	
Neokirumosu	Pyrethrum and BHC smoking agent							○	
NeoParkside	BHC, EDB and Diazinon oil solution							○	
Neopirimen	BHC emulsion							○	
Neopiretto	Pyrethrum and BHC emulsion							○	
Neohenochion	DDT and Marason emulsion	○							
Neonoukou	Derris and BHC hydrate							○	
Nekkusu	CPCBS and DDT emulsion	○							
Nennrin	BHC paint							○	
Parkside	BHC and EDB oil solution							○	
Parkside emulsion	BHC and EDB emulsion							○	
Haazen	Repellent							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Baidooru B	BHC emulsion							○	
Bainakkusu	BHC and NAC powder							○	
Pineside	BHC, EDB and PCP oil solution							○	
Pineside emulsion	BHC and EDB emulsion							○	
Bassabii	BHC and BPMC powder							○	
Babudee	DDT and PAP powder	○							
Hamogurin	DDT and Marason emulsion	○							
Parabii	Parathion and BHC powder							○	
Parabiiemu	Methylparathion and BHC powder							○	
Hariden	BHC emulsion							○	
Paridon	BHC oil solution							○	
Barusanponpu	BHC smoking agent							○	
Barusanponpu 「Satsudaniyou」 B	Chlorbenzylate and BHC smoking agent							○	
Barusanponpu Rinyayou	BHC smoking agent (for forestry)								

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
B Jet	BHC and organic arsenic powder							○	
B Jet mercury	BHC, organic mercury and arsenic powder							○	○
Biitoron hydrate	DDT and endrin hydrate	○	○						
Hishikuron	BHC agent							○	
Hiton	DDT and pyrethrum powder	○							
Pimerin	Pyrethrum and BHC emulsion							○	
Pireooru	Pyrethrum and BHC emulsion							○	
Pirekisan	Pyrethrum and BHC emulsion							○	
Pirekkusu	Pyrethrum and BHC emulsion							○	
Piretora	Pyrethrum and BHC emulsion							○	
Fainkemu	BHC and organic tin emulsion							○	
Fainkemumono A emulsion	(Lindane emulsion)							○	
Fainkemumono－B emulsion	Dieldrin, EDB and organic tin emulsion			○					

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Fogu B	BHC and DDT smoking agent	○						○	
Foggu A	BHC smoking agent (for forestry)							○	
Foggu B	BHC and DDT smoking agent	○						○	
Fujisaide	BHC pesticide for grain stock							○	
Fujitokishin	BHC emulsion							○	
Fujitoron	DDT emulsion	○							
Fumakiraa Nougeiyou powder	BHC agent							○	
Fumatoron	BHC emulsion							○	
Fumi B	Organic mercury and BHC powder							○	○
Furaidan	BHC smoking agent (for forestry)								
Burasuchin	DDT, Marason and PCBA powder	○							
Burasuchin BHC	BHC and PCBA powder							○	
Burasuchin D	DDT, EPN, organic arsenic and PCBA powder	○							

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Burasuchinmeopii	BHC, MPMC and PCBA powder							○	
Burabii	BHC and Blasticidin S powder							○	
Flowermate	BHC and MEP hydrate							○	
Burotekkusu	BHC agent							○	
Hekisaaru	BHC powder							○	
Hekisachin	BHC powder							○	
Hekusaaru	BHC powder							○	
Pesutoron	DDT emulsion	○							
Pesurin	BHC emulsion							○	
Penatan	(Lindane emulsion)							○	
Pepaaru	DDT agent for bag, DDT oil solution (for bag)	○							
Hepukuron	DDT and heptachlor powder	○							
Hepta	Heptachlor granular					○			
Hepta DDT	DDT and heptachlor powder	○				○			
Heptachlor	Heptachlor powder					○			
Hepta hydrate	Heptachlor hydrate					○			

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Hepta emulsion	Heptachlor emulsion					○			
Hepta complex	Heptachlor and complex fertilizer					○			
Hepta powder	Heptachlor powder					○			
Peruma emulsion	Pyrethrum and BHC emulsion							○	
Pentakuron	BHC and PCP emulsion							○	
Bentamin N	BHC, aldrin and organic tin emulsion				○			○	
Bendorin	Dieldrin and PCP oil solution			○					
Hooden	BHC powder							○	
Hokukouemashin	Organic mercury, DDT and machine oil emulsion	○							○
Hokuchion emulsion	(Lindane emulsion)							○	
Hokurooru	Organic tin, DDT and endrin hydrate	○	○						
Hokurooru H	Organic tin, DDT and endrin hydrate	○	○						
Hokurooru hydrate	DDT and endrin hydrate	○	○						

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Hokurooru powder	DDT and endrin powder	○	○						
Hosueru Jet	BHC and DDVP smoking agent							○	
Hosupurasuchin D	EPN, DDT and PCBA powder	○							
Hosumeran D	EPN, DDT and organic mercury powder	○							○
Boratakku	BHC and DCIP emulsion (oil solution)							○	
Hori Ace emulsion	BHC and EDB emulsion							○	
Horisaido emulsion	BHC and EDB emulsion							○	
Horidooru PB	Methylparathion and BHC powder							○	
Magochin emulsion	(Lindane emulsion)							○	
Makku SB	BHC, NAC and organic arsenic powder)							○	
Mapikajii	BHC and MCPCA granular							○	
Marukizooru	Heptachlor and EDB oil solution					○			
Marukiraa	Pyrethrum and BHC emulsion							○	

Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Mitsui Chemicals Bouchuueki	BHC liquid							○	
Mikku	DDT and endrin hydrate	○	○						
Mikku powder	DDT and endrin powder	○	○						
Meopaaru BHC	BHC and MPMC powder							○	

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Word included in name of agricultural chemical	Agricultural chemical product	Contained POPs or other chemical							Mercury
		DDT	Endrin	Dieldrin	Aldrin	Heptachlor	Chlordane	BHC	
Meopaaru D	DDT and MPMC powder	○							
Meopaaru Ganmaa	BHC and MPMC granular							○	
Methyl PB	Methylparathion and BHC powder							○	
Merudorin	Endrin emulsion		○						
Merudorin	Dieldrin emulsion			○					
Merumaato B	BHC and MTMC powder							○	
Moguran	Repellent							○	
Mosukiiru	BHC smoking agent (for forestry)								
Monisaido	Dieldrin and organic mercury emulsion			○					○
Morisandesu	DDT, Marason and organic arsenic powder	○							
Monbii	BHC and organic arsenic powder							○	
Monmeobii	BHC, MPMC and organic arsenic powder							○	
Yaso	Endrin Rodenticide		○						

Yasoendo	Endrin Rodenticide		○						
Yasokoron	Endrin Rodenticide		○						
Yasotooru	Endrin Rodenticide		○						
Yasonokku	Endrin Rodenticide		○						
Yamachion emulsion	(Lindane emulsion)							○	
Yukizooru	BHC agent							○	
Yondee	DDT and DDVP emulsion	○							
Rat end	Endrin rodenticide		○						
Rabukon・BHC	BHC and CPA powder							○	
Ramutarin D	Repellent			○					
Riudorin	Endrin granular		○						
Rinouru	BHC and organic mercury emulsion							○	○
Ripin	DDT and pyrethrum powder	○							
Rindesu	(Lindane emulsion)							○	
Rinderisu	Derris and BHC hydrate							○	
Lindane	(Lindane emulsion)							○	
Lindane gas	BHC smoking agent							○	
Lindane Sukerusin	BHC and machine oil emulsion							○	
Lindane	(Lindane							○	

emulsion	emulsion)								
Lindane powder	(Lindane emulsion)							○	
Lindane Mashinzouru	BHC and machine oil emulsion							○	
Lindane Roddo	BHC smoking agent (for forestry)								
Lindane Kiku emulsion	BHC and pyrethrum emulsion							○	
Rinton	BHC and pyrethrum powder							○	
Rinraito emulsion	(Lindane emulsion)							○	
Routen	Derris and DDT powder	○							
Rozarin	BHC powder							○	
Rokkusu hydrate	BHC hydrate							○	
Rokkusu powder	BHC agent							○	
Rotezouru	Derris and BHC emulsion							○	
Wiper Dasuto	Futarusurin, DDT, dichlone, thiram and sulphur powder	○							

Note: Contained POPs or other agricultural chemicals are shown corresponding to the part in which abbreviation name of manufacturer and numeral value indicating major component concentration are excluded from name of agricultural chemical.

(Attachment 3) Physiochemical property and toxicity of POPs or other chemical substances

Name of chemical substance	ADI (TDI) (mg/kg/day)	WS (mg/l)	VP (Pa)	Log Kow	Koc	DT50w	DT50s	BCF	LC50 (Fish) (mg/l)
Aldrin	0.0001 (including dieldrin)	0.027 (27℃) 1)	3×10^{-3} (20℃) 1)	5.17~7.4 2)	17,500 1)	19days~52yrs 4)5)6)	20days~10yrs 4)5)6)	735~20,000 4)	0.12~0.55 (Carp, 48h) 7) 0.081 (Killfish, 48h) 4)7)
Dieldrin	0.0001 (including aldrin)	0.14 (20℃) 1)	2.4×10^{-5} (20℃) 1)	3.692~6.2 2)	12,000 1)	4hrs~42hrs 4)5)6)	20days~7yrs 4)5)6)	3,300~14,500 4)	0.018~0.32 (Carp, 48h) 7) 0.035 (Killfish, 48h) 7)
Endrin	0.0002	0.24 (25℃) 1)	9.3×10^{-5} (25℃) 1)	3.209~5.340 2)	10,000 1)	5.33days~13yrs 4)6)	63days~12yrs 4)6)	4,860~14,500 4)	0.00084~0.0047 (Carp, 48h) 7) 0.008 (Killfish, 48h) 7)
DDT	0.01	0.0077 (20℃) (p, p') 1)	2.5×10^{-5} (20℃) 1)	4.89~6.914 2)	426,580 1)	3.1days~12yrs 4)5)6)	50days~15.6yrs 4)5)6)	600~154,100 2)4)	0.11~0.25 (Carp, 48h) 7) 0.012 (Killfish, 48h) 7)
Chlordane	0.0005	0.056 (25℃) 1)	1.3×10^{-3} (25℃)	6.00 2)	60,000 1)	3.6days~3.8yrs 4)5)6)	9days~9.6yrs 4)5)6)	400~38,000 4)	0.26 (Carp, 48h) 7) 0.01~0.1 (Killfish, 48h) 7)

			1)						
Heptachlor	0.0001	0.056 (25~29℃) 1)	5.3 × 10^{-2} (25℃) 1)	4.4~5.5 2)	24,000 1)	7hrs ~1.5yrs 4)5)6)	23.1days~ 5.5yrs 4)5)6)	200~ 37,000 4)	0.30 (Carp, 48h) 7) 0.2~0.56 (Killfish, 48h) 7)
Lindane (γ-HCH)	0.005	7 (20℃) 1)	4.4 × 10^{-3} (20℃) 1)	3.61~3. 72 3)	1,355 1)	4days ~191days 4)	4.23days 2)	5.5~ 4,240 4)	0.17 (BHC, Carp, 48h) 7) 0.12 (BHC, Killfish, 96h) 7)

Note) ADI (TDI): 1-day acceptable (tolerable) intake amount (evaluated by JMPR (FAO/WHO United ad hoc committee for persistent agricultural chemicals), WS: Water solubility, VP: Vapor pressure, log Kow: Distribution coefficient of octanol/water, Koc: Distibution coefficient of water/organic carbon, DT50w: Half-time in water (p: Photolysis, Hydrolysis), DT50s: Half-time in soil, BCF: Biological enrichment coefficient (Fish), LC50: Median lethal dose concentration

Source) 1: USDA, ARS Pesticide Properties Database (http://www.ars.usda.gov/Services/docs.html?docid=6433) 2: UNEP/POPS/INC.1/INF/10(15June1988) (http://www.pops.int/documents/meetings/inc1/RITTER-En.html) 3: Database of biological impact by chemical substances suspected as endocrine disrupting act (edited by Tokyo Metropolitan Institute of Public Health: http://www.Tokyo-eiken.go.jp/edcs_index.html) 4: TOXNET HSDB (Hazardous Substances Data Bank (http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB) 5: Handbook of environmental degradation rates (Lewis Publishers, 1991) 6: Illustrated handbook of physical-chemical prosperities and environmental fate for organic chemicals (Lewis Publishers, 1992-1997) 7: Aquatic organism and agricultural chemicals (Part of acute toxicity)

(Attachment 4) Procedure for the survey of storage sites

1. Survey storage sites

   For surveying storage sites, a physical prospecting survey company is subcontracted. The summarized process is composed of stages: establishment of survey plan, conduct of survey, and analysis and reporting of the survey results. The project implementing body for excavation and treatment of agricultural chemicals stored underground should closely communicate with the subcontractor on establishment of the survey plan, and implement and control of the survey work to provide useful information for subsequent excavation survey or others.

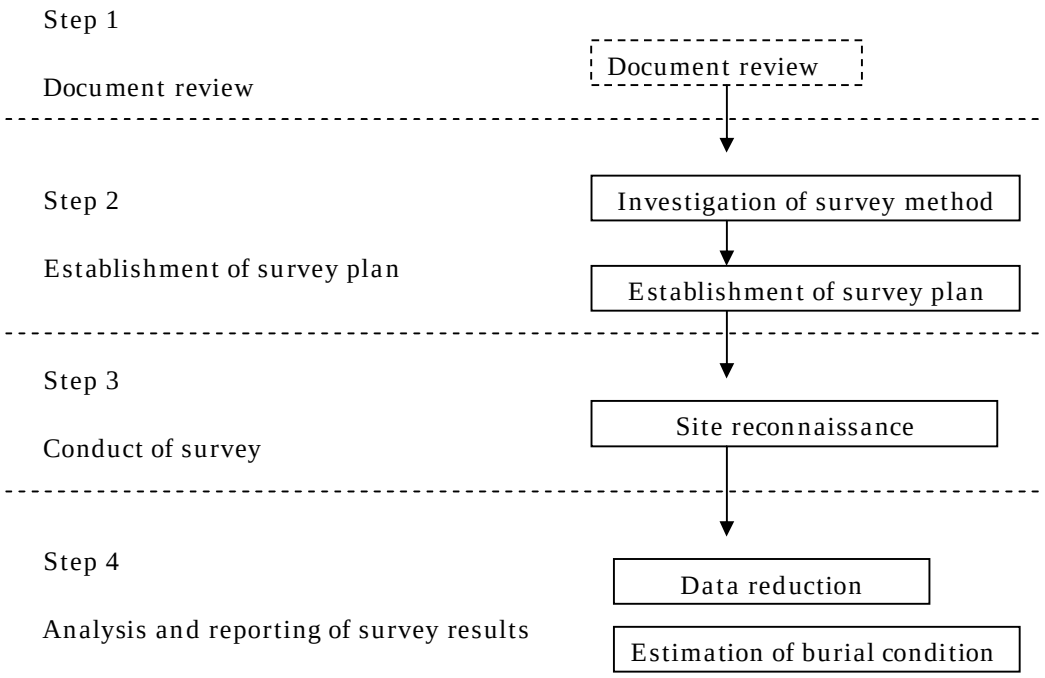


Figure 1 Flow of survey of burial condition

2. Establishment of survey plan (Step 2)

A suitable sensing survey plan is established by estimating the storage site location and the burial type based on a document review (Step 1). Then, a sensing method applicable to condition of the storage site is selected. There are two main burial types: small-scale scattered sites (approximately 300 kg/point) and large-scale collective sites (over 3 tons, if a concrete storage structure or others is provided.), and the survey method should be investigated in response to the type of burial.

2.1 Estimation of stored point and burial type

The storage area and burial type are estimated in advance based on the results of "3.2 documents review." Since this estimation is very important for establishing the survey plan and has a large effect on the survey results, precise information, as much as possible, should be collected. Necessary information for establishment of survey plan is shown as follows.

(1) Understanding of current condition of land surface and geology

As the condition of the ground and surrounding structures in the survey area have an effect on prospecting survey results, their existence or others should be understood.

(2) Understanding of burial depth and groundwater level

A sensible depth, determined by means of a prospecting bar and physical prospecting, varies by method and site condition, and it may be approximately 2~3 m. Whether such a method is applicable or not requires investigation, referring to records of the burial depth or others described in the relevant documents. As some prospecting methods may not be applicable due to impact by groundwater, groundwater level should be roughly assessed.

(3) Estimation of burial amount and storage site

To select a prospecting method and establish a prospecting plan, the rough horizontal layout of the storage site needs to be assessed.. A rough layout of the land area is also estimated based on information covering the stored agricultural chemical amount and the burial type. As over 3 tons of agricultural chemicals are stored at one point in a large-scale burial, the volume exceeds 2.5 m^3 (weight per unit volume is assumed 1.2 t/m^3), and further, in the case of use of a container such as a drum (thickness in the direction of depth is approximately 1 m.), the land area is supposed over 2.5 m^2. For small-scale scattered burials, as it is supposed that 300 kg per area (in the case of stored agricultural chemicals) has been directly put into the hole lined with a PVC sheet. This corresponds to 100~200 general-sized paper bags used for agricultural chemicals,

which corresponds to approximately 0.4~0.5 m3 (0.5 m in thickness×0.8~1 m^2 in bottom area). Even though over 3 tons of agricultural chemicals are stored, they may be removed, under the condition that it is a small-scale scattered burial, not a collective burial to one point. So, caution should be taken to judge the size by reviewing the records.

(4) Assessing the burial type and burial method

To select a suitable prospecting method, it is important to check whether the storage siteis a large-scale collective type or a small-scale scattered type, whether mortar or the like or a metal container is used as a stored tank, or others. If photos are found, they should be collected.

(5) Electromagnetic property of soil at target block

As some types of prospecting methods may be impacted by electromagnetics (relative permeability, etc.) of the soil, related information regarding the target block (to judge availability of the prospecting method) should be collected for investigation, if possible.

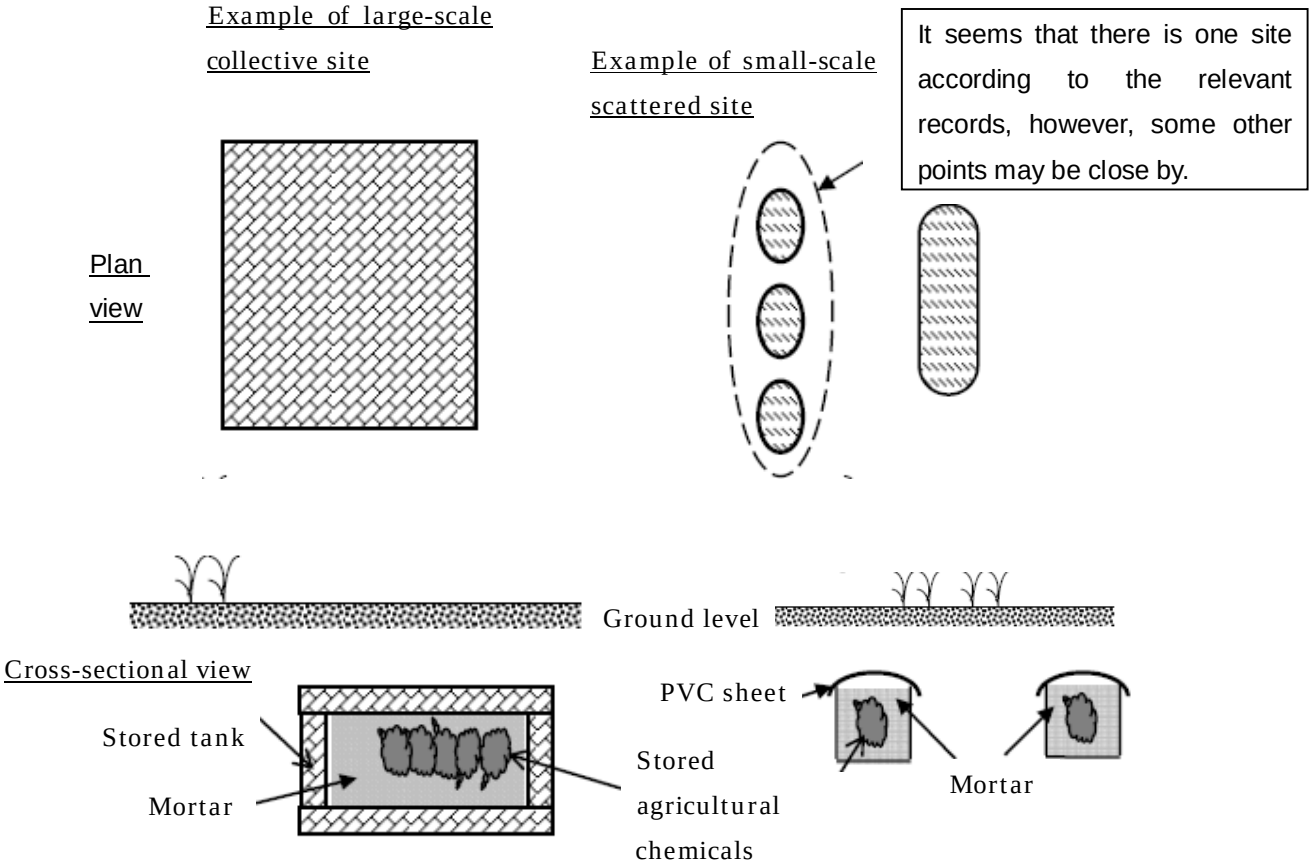


Figure 2 Typical example of stored agricultural chemicals

2.2 Investigation of prospecting method

A suitable prospecting method is selected based on the estimated results of the storage site and the burial type. The methods generally used for prospecting of stored material are underground radar prospecting, electromagnetic prospecting and magnetic prospecting. For especially big large-scale collective burials, electric prospecting, seismic reflection method, surface wave prospecting and gravity prospecting may be applied. The method is selected considering the availability of each method, based on burial depth and burial type estimated by results of document review (Step 1). (Refer to Attachment 5 with regard to physical prospecting method.)

The most suitable method for survey of stored agricultural chemicals is underground radar prospecting. When material is stored in a metal container, such as steel plate or reinforced concrete, electromagnetic prospecting and magnetic prospecting as also effective, and further surer prospecting results is expected by utilizing underground radar prospecting together. For land containing much sandy soil, the stored material prospecting method by detection stick, such as a bamboo stick, narrow stick or the like into soil, is also effective. However, in the case of small-scale scattered burial, caution should be paid because a very complicated survey may be needed due to the higher difficulty of finding all the storage sites, except for regular layouts, such as linear ones.

2.3 Establishment of survey plan

When stored material is surveyed, an axis or grid pattern for the survey should be provided. These lines are generally called “traverse lines.” The procedure for survey planning and notices for setting the direction and interval of traverse lines are shown as follows.

(1) Rough survey and detailed survey

In the case that the layout of the stored material is understood in advance, a detailed survey can be conducted focusing on the area. However, when the position of the storage site is unclear, a rough survey should be conducted through setting a relatively broad survey area at first and then detailed survey to narrow down target area based on the results should be conducted.

(2) Distribution direction of stored material and direction of traverse lines

For underground radar prospecting, two perpendicular traverse lines are set. On the other

hand, when the broad location of stored material is known, efficient survey traverse lines are first set perpendicular to the long axis of the material to estimate the site area. Then a survey is conducted perpendicular to those traverse lines in the surrounding area near the block. When the distribution direction of the stored material is unclear, the site is surveyed without giving priority to the survey area from the initial stages.

For magnetic prospecting, traverse lines should generally be set in the direction of true north.

(3) Interval of traverse lines

(a) Detailed survey is conducted as shown in Figure 3, considering size and the interval of materials estimated, whether a large-scale collective burial or a small-scale scattered one, etc. Specifically, traverse lines are set to contact the stored material by close intervals of the lines (Figure 3 (1)) or a change of the direction of the traverse lines (Figure 3 (2)) for fear that the stored material may be overlooked by setting traverse lines without contacting the burial material as shown in Figure 3 (3) of p.74.

(b) For a detailed survey, the traverse lines are set to comprehensively uncover the overall stored material area, considering the characteristics of the survey method and the possible width of the survey.

For a large-scale collective burial, the layout of the stored material seems at least 1 m2.On the other hand, in the case of small-scale scattered burial, one stored point area may be under 1 m2. For the latter type, since small sites are laid out linearly, in some cases, a survey should be conducted, taking into account the possibility of such a regular layout. Further, for the type, since large construction machine may not be used for burial, the depth of burial is likely to be approximately 1 ~ 2 m.

For example, when underground prospecting is conducted by means of an antenna having a 1-meter width, it seems effective that the interval of traverse lines is 50 cm ~ 1 m. It seems effective for 1 m interval for magnetic prospecting and electromagnetic prospecting. If the depth of the burial is supposed to be approximately 2 m, 1 m intervals seem appropriate, judging from the prospecting.

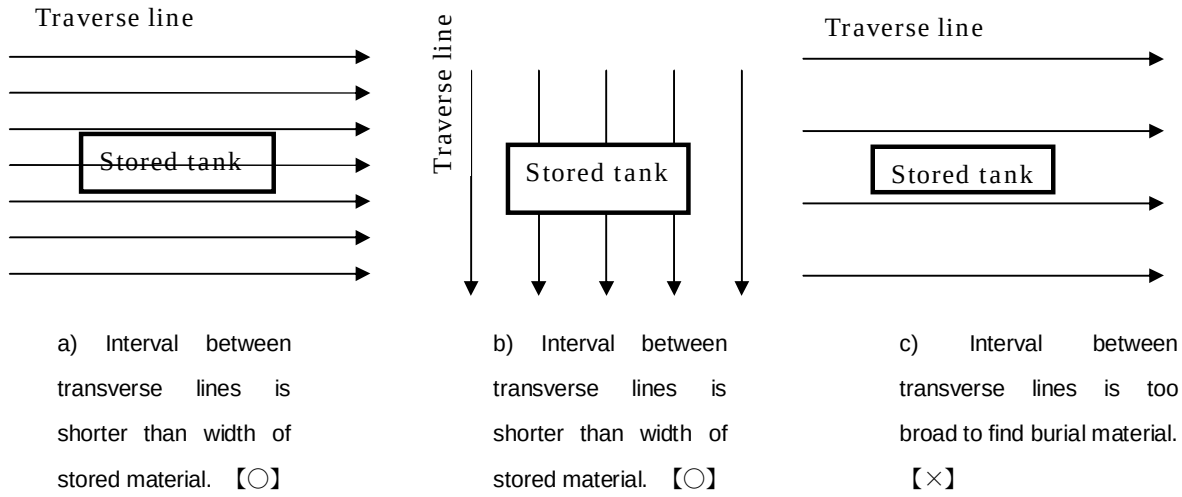


Figure 3: Size and interval of traverse lines of stored agricultural chemical (Preliminary survey)

3. Conduct of site sensing (Step 3)

A sensing survey of the site and its surrounding area is conducted according to a sensing survey plan (Step 2). Site sensing survey should be done flexibly based on measurement results of site.

3.1 Notices for site sensing

The following points should be noticed for site measuring survey.

(1) Observation of the site condition

Before a site measuring survey, the site condition is observed again from the viewpoint of physical prospecting. For example, the excavation and refill area may be estimated based on the irregularity of the ground, the color and properties of the soil, vegetation, etc., which may be referred to interpret physical prospecting results. In the case of a survey by means of a detecting stick, caution should be paid for sensing the position of stored agricultural chemical because gravel, roots or other material may disturb the work.

(2) Measuring survey for setting traverse line

To identify the layout of stored material easily and certainly on the excavation stage, position coordinates of traverse lines are by determining by a fixed reference point (line).

3.2 Flexible response at burial site

Site sensing should be flexibly conducted in response to survey results to catch find the

storage site.

(1) On-site analysis and additional measurements

If on-site analysis is possible, the estimated area of the stored material is marked (marking) and A measuring survey of the position is conducted according to the results. Additional measurement and trial boring are conducted based on on-site analysis results if necessary, to acquire more precise sensing results.

(2) Improvement of survey precision through conation

It is effective for improving survey precision when survey conation is conducted at a position where the soil properties are the same as those in the already surveyed block, and which have already been clarified, and then the electromagnetic properties are determined based on the results for reference to the interpretation of survey results, so that conation should be conducted if necessary.

4. Analysis of results (data) and reporting (Step 4)

Sensing survey results are reported as maps for identifying the relationship between reference points and the site to be utilized for excavation. These results are displayed at the job site to visually confirm the area of suspected stored material by means of a wooden stake and painted marks to be utilized for subsequent survey and excavation works, if possible.

4.1 Analysis of sensing by means of detecting stick

The point where are obstacle is encountered by means of detecting stick is plotted on a survey map. The depth of the obstacle (Insertion length of detecting stick) is also recorded.

4.2 Underground radar prospecting and data reduction

Data is reduced by the sensing subcontractor to make the underground conditions clear, considering the following points:

- To describe associated information such as a reference point, road, etc. that make an existing map clear.
- To make an overlay map with the existing map
- A plan and cross-section view for identifying the position of estimated stored material
- Scale or dimension (Caution is paid if there is a different scale between the

horizontal and vertical directions.)

4.3 Data reduction of electromagnetic prospecting and magnetic prospecting

Distribution of stored metal materials is estimated by grasping then distribution of different values from surrounding ones through the horizontal display of measured data. For this estimate, related maps are made by a sensing subcontractor, considering items specified by 4.2, as well as data reduction of the distribution of metals supposed to used as stored material, such as drums.

4.4 Estimation and confirmation of storage site

The storage site is estimated based on results of sensing and documents review. An overlay map of analysis results with an existing map is made and then rechecked by persons responsible to reconfirm information related to the burial type and estimated condition. The above results are displayed at the job site to visually confirm the area of suspected stored material by means of a wooden stake and painted marks. When unclear parts are left on the estimated location of the of stored materials, the actual existence of stored material should be checked, if necessary, through trial boring of part of the estimated area with extreme care not to destroy and scatter stored agricultural chemical or others.

(Attachment 5) Availability of physical survey and presentation example of the analysis results

1. Availability of physical survey

A physical survey of the ground is advisable for sensing agricultural chemicals stored underground. Underground radar prospecting, electromagnetic prospecting (time domain and frequency domain) and magnetic prospecting are frequently used to find stored material. In addition, electrical prospecting (resistivity method), reflection method earthquake prospecting, surface wave prospecting and gravity prospecting may be used for larger targets.

On the other hand, for various agricultural chemicals and land surface conditions, the sensing methods applicable are shown in Table XXX.

(1) Burial conditions of agricultural chemicals

The following burial conditions of agricultural chemicals are supposed.

a) Agricultural chemicals stored underground in emulsion which is absorbed in powder, clay and hydrated lime.
b) Upper and lower parts and all sides of the agricultural chemicals stored underground are covered with hydrated lime.
c) Agricultural chemicals stored underground are packed in thick PVC bags.
d) Agricultural chemicals stored underground are put into a metal can, such as an oil can.
e) Agricultural chemicals stored underground are put into a large concrete container (facility) (whether there is a reinforced concrete lid or metal one or neither)

The method applicable to all of these conditions is radar prospecting. Electromagnetic prospecting and magnetic prospecting are effectively for metals.

(2) Land surface condition

As for the land surface condition, the land may be changed because approximately 30 years have passed since the burial. The following conditions are supposed after consideration of such a site.

a) Land lot without construction (Condition has been maintained since burial.)
b) In a crop field and/or fruit field
c) In a forest
d) Paved road in control area (asphalt, concrete, reinforced concrete)
e) Under a structure
f) Near a structure

As sensing is conducted from the ground, it is impossible to sense under a structure. Near a structure, it is necessary to keep some distance from the structure so not to be affected by it when the structure itself is made of metal or the foundation of the structure is around there. Weeds and

trees should be cut down to enable measurement for each sensing method.

(3) Availability

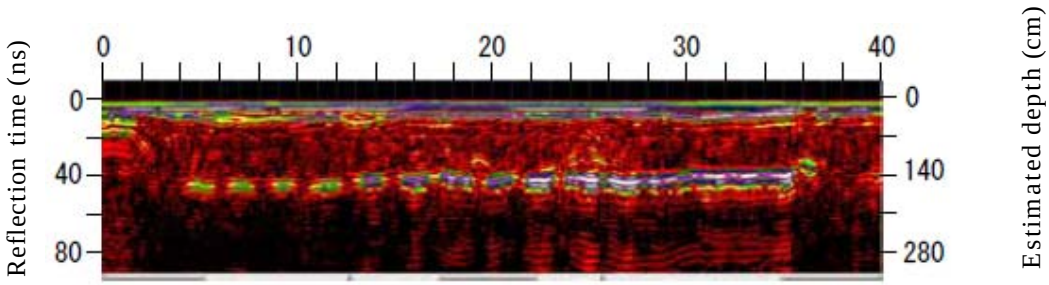
Availability of physical sensing methods in response to the above burial conditions and land surface condition are shown in Table 1 and 2. In these cases, the depth to the upper surface of stored material is supposed to be approximately 2 m.

In these tables, the following marks are provided; "×" in the case where application is theoretically difficult, "△" in the case where it is applicable under certain conditions, and "○" in the case where it is applicable. However, it is noted that "○" does not apply to all conditions.

2. Description examples of analysis results of physical sensing survey

Analysis results of underground radar prospecting are described as a two-dimensional cross section view (vertical line indicates depth, horizontal line indicates distance along traverse line) as shown in Figure 1. Where there are tight intervals between traverse lines, such as when a detailed survey is conducted, the slicing view of depth (rough horizontal cross-sectional view) is made to estimate the existence of stored material by utilizing the two views.

Two-dimensional cross-section view (Y = 5 m)



Slicing view of depth (central depth 1.5 m)

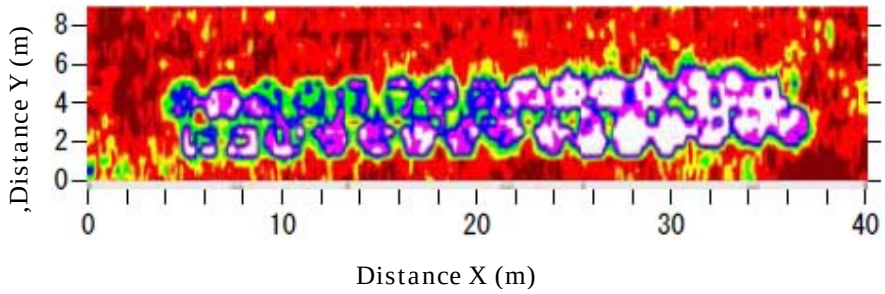

figure_text,Distance Y (m)
8
6
4
2
0
0
10
20
30
40
Distance X (m)

Figure 1 Description examples of underground radar prospecting and analysis results

Table 1 Availability of various types of physical sensing survey for burial conditions

	(Emulsion agent is) absorbed in powder agent, clay agent or hydrated lime agent	(Powder agent is) enclosed with hydrated lime	In PVC bag	Metal container such as oil can	Large-scale burial	
					Only concrete (no iron bars)	Reinforced concrete or metallic lid
Underground radar prospecting	○	○	○	○	○	○
Electromagnetic prospecting (time range, frequency range)	△	△	△	○	△	○
Magnetic prospecting	×	×	×	○ (magnetic metal)	×	○ (magnetic metal)
Electric prospecting (Resistivity method)	△	△	△	△	△	△
Reflection method earthquake prospecting	△	△	△	△	△	△
Surface wave prospecting	△	△	△	△	△	△
Gravity prospecting	△	△	△	△	△	△

○ ：applicable
△ ：applicable under a certain condition

Table 2 Availability of various types of physical sensing survey for land surface conditions

	Land lot without construction	In crop field and/or fruit field	In forest	Paved road in control area			Under structure	Near structure	Operability
				Asphalt	Concrete	Reinforced concrete			
Underground radar prospecting	○	○	□	○	○	□	×	□	Excellent
Electromagnetic prospecting (time range, frequency range)	○	○	□	○	○	×	×	□	Excellent
Magnetic prospecting	○	○	○	○	○	×	×	□	Excellent
Electric prospecting (Resistivity method)	○	○	○	□	□	□	×	□	Good
Reflection method earthquake prospecting	○	○	□	○	○	○	×	□	Bad
Surface wave prospecting	○	○	○	○	○	○	×	□	Good
Gravity prospecting	○	○	○	○	○	○	×	□	Good or bad

○ ：applicable

△ ：applicable under a certain condition

×：theoretically difficult to apply

Operability is judged to be relative.

【Attachment 6】 List of Summary of Analysis methods

♦ POPs or other chemical substances
(Target substance: DDT, BHC, aldrin, dieldrin, endrin, chlordane, heptachlor)

○ Analysis method for atmospheric air sample
Analysis of atmospheric air is conducted according to "The 2nd Review meeting of endocrine disruptors in 2001", File 6 and "Atmospheric air environmental survey results of endocrine disruptors in 2000" (Air environment division, Environmental management bureau of the MOE). For sampling method of atmospheric air, refer to the "Manual for monitoring survey" (Version 2005, "Chemical substance and environment", Documents file (issued on March, 2006 by Environmental Health and Safety Division, Environmental Health Department of the MOE).

○ Analysis method for water samples
Analysis method: According to "Survey and analysis method of actual condition of environmentally residual agricultural chemical or others", Ⅰ. Water quality; Analysis method for organochlorine compounds.
Summary: It is extracted by n-hexane from sample, and refined through Florisil Minicolumn, and then measured by means of GC/ECD (or GC/MS).

○ Analysis method for dissolution amount of agricultural chemicals, soil, etc.
Liquid sample preparation: According to the method specified by the Environmental standards relating to soil contamination (issued in 1991, Notification of the MOE, No.46).
Analysis method: According to "Survey and analysis method of actual condition of environmentally residual agricultural chemical or others", Ⅰ. Water quality; Analysis method for organochlorine compounds.
Summary: It is extracted by n-hexane from sample, refined through Florisil Minicolumn, and then measured by means of GC/ECD (or GC/MS).

- Analysis method for content amount of agricultural chemicals, soil, etc.
Analysis method: According to "Survey and analysis method of actual condition of environmentally residual agricultural chemical or others", Ⅳ. Soil quality; Analysis

method for organochlorine compounds.

Summary: It is extracted by hexane after extraction by acetone from sample, and refined through graphite-carbon + Florisil + NH2 connection Minicolumn, and then measured by means of GC/MS (SIM).

♦ Environmental standard setting substances

○ Mercury

According to the analysis method specified by Table of the Environmental standards relating to water pollution (issued in 1971, the Notification of the MOE, No.59).

○ Thiram

According to the analysis method specified by Table of the Environmental standards relating to water pollution (issued in 1971, the Notification of the MOE, No.59).

○ Arsenic

According to the analysis method specified by JIS K 0102, “Testing method for industrial wastewater”.

○ Organic phosphorus

1. According to the analysis method specified by Table of the Testing method relating to effluent standard (issued in 1974, the Notification of the MOE, No.64).
2. According to the analysis method specified by JIS K 0102, “Testing method for industrial wastewater”.

(Attachment 7) List of environmental control guideline values concerning agricultural or other chemicals

Name of agricultural or other chemicals (aliases)	ADI (Acceptable Daily Intake) mg/kg body weight		Analysis method	Atmospheric air concentration guideline value Note 2 mg/m3	Environ-mental water concentration guideline value Note 3 mg/L	Soil concentration guideline value (Dissolution amount) Note 4 mg/L	Treatment guideline value (Dissolution amount) Note 5 mg/L	Soil concentration guideline value (Content amount) Note 6 mg/kg	Remarks
	Japan Note 1	Others							
POPs agricultural or other chemical									
BHC	0.0125 (1975)	PTDI(JMPR) Note 7 0.005 (2002)	A	0.0017	0.0013	0.0013	0.013	Note8 50	Each guideline value indicates total amount including isomer(s).
DDT	0.005 (1975)	PTDI(JMPR) 0.01 (2000)	A	0.0035	0.026	0.026	0.26	Note 8 50	Each guideline value indicates total amount including isomer(s).
Aldrin	0.0001 (1973)	PTDI(JMPR) 0.0001 (1994)	A	0.000035	0.00026	0.00026	0.0026	4.1	Including dieldrin
Endrin	0.0002 (1973)	PTDI(JMPR) 0.0002 (1994)	A	0.000071	0.00053	0.00053	0.0053	8.3	
Dieldrin	0.0001 (1973)	0.0001 (1994)	A	0.000035q	0.00026	0.00026	0.0026	4.1	Including aldrin
Chlordane		PTDI(JMPR)	A	0.00017	0.0013	0.0013	0.013	20	Each guideline value

		0.0005 (1994)							indicates total amount of trans-chlordane, cis-chlordane, trans-nonachlor, cis-nonachlor and oxychlordane.
Heptachlor		PTDI(JMPR) 0.0001 (1994)	A	0.000035	0.00026	0.00026	0.0026	4.1	Each guideline value indicates total amount including metabolite(s).
Environmental quality standard setting substance									
Mercury and its compound			B	0.00004 Note 9	0.0005 Note 10	0.0005 Note 11	0.005	15 Note 12	
Thiram	0.0084 (1999)	ADI(JMPR) 0.01 (1994)	B	0.0029	0.006 Note 10	0.006 Note 11	0.06		
Arsenic and its compound		PTWI(JECFA) 0.015 (1988)	C	0.00076	0.01 Note 10	0.01 Note 11	0.1	150 Note 12	
Organic phosphorus (parathion, methylparathion, methyl demeton and EPN)			C, D		Not detected (Previous water	Not detected (Soil environmen	1 (Effluent standard)		

	Parathion	0.005	ADI(JMPR) 0.004 (1995)		0.0014	environmental quality standard) Note 13	tal quality standard) Note 14	Note 15		
	Methylparathion	0.015	ADI(JMPR) 0.003 (1995)		0.0010					
	Methyl demeton		ADI(JMPR) 0.0003 (1989)		0.00010					
	EPN	0.0014 (2003)			0.00049					

JMPR = FAO/WHO Joint Meeting on Pesticide Residues

JECFA = FAO/WHO Joint Expert Committee on Food Additives

PTDI = Tentative Tolerable Daily Intake

PTWI = Tentative Tolerable Weekly Intake

Concept of guideline value calculation (Current value is adopted for ADI or others. Significant digit is set to double figures and the broken number is rounded down.)

“A” is a substance whose analysis method is specified according to the“analysis method for investigation of actual condition of environmental residue of agricultural or other chemicals”.

“B” is a substance whose analysis method is specified according to the “environmental quality standard concerning water pollution (the MOE notification, No.59, enforced on 1971)”, appendix table 1 or 4.

“C” is a substance whose analysis method is specified according to JIS K 0102, “Testing method for industrial wastewater.”

“D” is substance whose analysis method is specified according to the appendix table of the “inspection method concerning diffluent quality standard (the MOE notification, No.64, enforced on 1974).”

Note 1: Value set by the Central Environment Council, the Investigation Committee for Food Hygiene、the Food Safety Commission and the Residue-prone Agricultural Chemical Safety Evaluation Committee.

Note 2: Atmospheric air concentration guideline value

Atmospheric air concentration guideline value = ADI × Body weight (53.3kg) × Allocation of path to atmospheric air (0.1) ÷ Daily respiratory volume ($15m^3$)

Note 3: Environmental water concentration guideline value = ADI × Body weight (53.3kg) × Allocation of path to water (0.1) ÷ Daily water intake (2L)

Note 4: In this manual, the environmental water concentration guideline value has been adopted for the soil concentration guideline value (dissolution amount) if there is no existing specification.

Note 5: Judgment criteria (Class 2 dissolution standard) concerning burial disposal of specific hazardous substance according to the Soil Contamination Countermeasures Law (Article 24 and Appendix table 4 of Enforcement regulation of the Soil Contamination Countermeasures Law) is set at 10~30 times thesoil dissolution standard (Article 18 and Appendix table 2 of Enforcement regulation of the Soil Contamination Countermeasures Law). In reference to this, the treatment guideline value in this manual is set as 10 times the soil concentration guideline value (dissolution amount).

Note 6: Setting method of soil concentration guideline value (content amount)

Soil concentration guideline value (content amount) = ADI × Body weight (53.3kg) × Allocation of path to soil (0.1) ÷ {Life average daily soil intake (108.6mg) ＋ Life average daily soil skin contact amount (463.8mg) × absorption rate (0.04)}

Setting method in this case is shown as follows.

- Life average daily soil intake = (Daily soil intake (child) (200 cm2/day) × 6 (years) + Daily soil intake (adult) (100mg/day) × 64 (years)) ÷ Life period (70 years)
- Life average daily soil skin contact amount

= {Daily soil contact amount per skin area (0.5mg/m2/day) × Skin area (child) (2800 cm2) × clear sky rate (0.6) × Outdoor soil contact rate (child, everyday) (7/7) × 6 (years) + Daily soil contact amount per skin area (0.5mg/m2/day) × Skin area (adult) (5000 cm2) × clear sky rate (0.6) × Outdoor soil contact rate (adult, weekend) (2/7) × 64 (years)} ÷ Life period (70 years)

- Absorption rate: Maximum value of absorption rate which is clarified in POPs agricultural chemicals is adopted. Source: U.S. EPA, RAGS, Part E, Supplemental Guidance for Dermal Risk Assessment, Interim Guidance, 2001.
- Calculation method of intake amount of hazardous substance refers to “Calculation method of hazardous substance through soil intake or others” (Soil

content risk evaluation investigation report, issued in 2001).

Note 7: PTDI made by JMPR is γ-BHC (Lindane). This value is adopted in this manual.

Note 8: For the general technical guideline concerning the proper environmental control of POPs wastes according to Basel Convention, "Low POPs Content" of lower priority of treatment is used and the criteria is set at 50 ppm or less. Referring to this value, BHC and DDT are set 50 ppm lower than the value calculated according to the formula in Note 6.

Note 9: Value of mercury in Attachment 2 of the "Future countermeasure against atmospheric hazardous substance"
(7th report) (the Central Environmental Council, 31 July, 2003)

Note 10: The value of "Environmental water quality standard for protecting human health" according to the Appendix, Table 1 of the Environmental standard concerning water pollution (The MOE notification No.59, enforced in 1971) (In this table, mercury and its compounds are indicated as total mercury, and arsenic and its compounds are indicated as arsenic).

Note 11: The value of the appendix table of the Environmental standard concerning soil contamination (The MOE notification No.46, enforced in 1991) (In this table, mercury and its compounds are indicated as total mercury, and arsenic and its compounds are indicated as arsenic).

Note 12: The value of the Enforcement regulation of the Soil Contamination Countermeasures Law, article 18, section 2, appendix table 3.

Note 13: Previous environmental standard concerning water pollution: No detection of organic phosphorus (parathion, methyl demeton and EPN) (Deleted in 1993).
"No detection" is defined as the total concentration of four organic phosphorus compounds in agricultural chemicals does not exceed the detection limit according to the detection method shown in table C and D of "Detection method specified by Environmental minister, based on the Ministerial ordinance of wastewater quality standard (the MOE notification No.64, enforced in 1974)", and the detection limit value of organic phosphorus is specified 0.1mg/l according to Analysis D of "Inspection method concerning wastewater quality standard specified by the MOE minister, based on the regulation of the Ministerial ordinance specifying wastewater quality standard" (The MOE notification No.64, enforced in 1974).

Note 14: The value of the appendix table of Environmental standard concerning soil contamination (The MOE notification No.46, enforced in 1974).
"No detection" is defined as the total concentration of four organic phosphorus compounds containing agricultural chemicals does not exceed the detection limit according to the detection method shown in table C and D of "Detection method specified by Environmental minister, based on the Ministerial ordinance of wastewater quality standard (the MOE notification No.64, enforced in 1974)", and the detection limit value of organic phosphorus is specified 0.1mg/l according to Analysis D of "Inspection method concerning wastewater quality standard specified by the MOE minister, based on the regulation of the Ministerial ordinance specifying wastewater quality standard" (The MOE notification No.64, enforced in 1974).

Note 15: The value of the ministerial ordinance specifying wastewater quality standard, Article 1, Appendix table 1 (Ministerial ordinance of the Ministry of Public Management 29, enforced in 1971).

Note 16: Environmental water guideline value of EPN is 0.006mg/l, according to the guideline concerning water pollution specified on 31 March, 2004 (Notification by general manager of Water environment department of the MOE, "Enforcement of environmental standard or others concerning protection of human health caused by water pollution", therefore its treatment concentration guideline value is 0.06mg/l of 10 times of the above value. However, the standard for organic phosphorus compounds containing agricultural chemicals is determined as the value shown in this table because it is the defined total concentration of the four substances (Refer to Note 13). According to the Advisory Committee for Life Environment and Supply Water of the Public Welfare Science Council held on 26 October, 2007,thewater quality standard value of EPN should be changed to 0.004mg/l from 0.006mg/l.

(Attachment 8) Description examples of notices

(Acutely toxic agricultural chemicals)

- Wear protection mask, gloves and impermeable clothes during work.
- Wash your whole body and change your clothes after use.
- If you are directly exposed to it by accident, remove it and consult a doctor immediately.
- If you feel sick during the removal operation, consult a doctor immediately.

(Weakly toxic agricultural chemicals)

- Wear protection mask, gloves, long trousers and long sleeves during work.
- Wash your hands, feet, etc. and change your clothes after use.
- If you are directly exposed to it by accident, remove it and consult a doctor immediately.
- If you feel sick during the removal operation, consult a doctor immediately.

(Strong eye stimulus agricultural chemicals)

- Strong stimulation on eye. Wear protective glasses. Do not put in your eye. If it gets into your eye, wash up your eye thoroughly and consult an eye doctor. Wash your eyes after use.

(Strong skin stimulus agricultural chemicals)

- Strong stimulation on skin. If it gets on your skin, wash up your skin. Wear impermeable gloves, rubber boots and impermeable clothes.

(Skin sensitizing agricultural chemicals)

- Wear protection masks, gloves and impermeable clothes, and use protection cream.
- Do not let an allergic person work at the site and keep him/her away from these materials.
- Wash your whole body and change your clothes after use.
- Wash the clothes worn during work, separating them from other clothes.

Definition

Protection mask: Disposable dustproof mask made of non-woven fabric or similar material

Chemical-cartridge respiratory mask: For a gas agent, this is called a gas mask. For a

powder or liquid agent, this is called a “direct connection replaceable mask. The filter is replaceable.

Impermeable wear: Working wear, with trousers, hood and long sleeve jacket, made of raw material through which a liquid on the surface cannot penetrate.

Impermeable gloves: Gloves made of a raw material through which a liquid on the surface cannot penetrate.

(Attachment 9) List of symptoms of poisoning by POPs agricultural chemical or others and emergency responses

1. Symptom of poisoning

Name of substance	Symptom of poisoning
Aldrin	headache at early stage, dizziness, sicchasia, emesis, malaise of whole body In the case of large intake, autonomic cholinergic agnists, paroxysm like epilepsy, mydriasis, excitation, dyspnea, liver injury, anemia, and abnormal brain waves may be found.
Dieldrin	headache, dizziness, sicchasia, emesis, sweating, tremors, insomnia, muscle spasms, unconsciousness, respiratory paralysis, liver injury, abnormal brain wave, etc.
Endrin	sicchasia, emesis, emesis, irritation, spasm like epilepsy, unconsciousness, sweating, autonomic symptom such as salivation, myocardiopathy, liver injury, abnormal brain wave, anorexia, neuropath, etc.
Chlordane	sicchasia, emesis, diarrhea, anorexia, tremors, spasms, etc. For chronic poisoning, central nervous system stimulus, liver injury, pulmonary emphysema, alimentary stimulus symptom, etc.
Heptachlor	Especially as for a person suffering from a liver injury, significant symptoms may occur after 1~3 g intake. For acute symptoms, tremors, spasms, kidney injury, breakdown of respiratory organs
DDT	headache, dizziness, anorexia, sicchasia, emesis, malaise of whole body diarrhea, sweating, salivation, dyspnea, imbalance, paroxysm like epilepsy, aplastic anemia, liver injury, etc.
BHC	headache, dizziness, sicchasia, emesis, tremors, diataxia, spasms, dyspnea, neuropath, liver injury, hematopoietic injury, hypogonadism, dermatitis, etc.
Mercury	acute symptoms
Mercury phenylacetate	Contact on eye: flare, pain, ablepsy, significant burn Contact on skin: flare, skin burn, pain, bleb Respiration: cough, headache, hardness of breathe, out of breath、sore throat, ardor Intake: stomachache, ardor, diarrhea, sicchasia, shock or collapse, emesis

Organic phosphorus	Acute poisoning symptom: constriction of respiratory tract, dyspnea, anorexia, sicchasia, emesis, tachycardia, blood pressure rising on the earlier stage and blood pressure drop on the ending stage, coreclisis, spasm, coma Chronic poisoning symptom: immune depression, hormone injury, eye injury, autonomic imbalance

Source: "Dictionary of the Toxicity of Agricultural Chemicals" and others

Name of substance	Emergency response
Aldrin	Contact on eye: Wash out eyes promptly with large amount of water for 15 minutes or more (Open the eyelid by thumb and second finger and move the eye to various directions). Contact on skin: Take off contaminated clothes, shoes, etc. promptly. Clean up contaminated part with soap and wash it out with large amount of water to prevent absorption into the body. Respiration: Wrap patient promptly with a blanket and allow him/her to rest lying down, and then move him/her to fresh air. If he/she suffers from dyspnea or his/her respiration has stopped, artificial respiration should be immediately conducted. Intake: Rinse the mouth.
Dieldrin	Contact on eye: Wash out an eye immediately with a large amount of water for 15 minutes or more (Open the eye lid by thumb and second finger and move the eye in various directions). Contact on skin: Take off contaminated clothes, shoes, etc. promptly. Clean up contaminated area with soap and wash it out with large amount of water. Respiration: Wrap patient promptly with a blanket and allow him/her to rest lying down, and then move him/her to fresh air. If he/she suffers from dyspnea or his/her respiration has stopped, artificial respiration should be immediately conducted. Intake: Rinse the mouth.
Endrin	Contact on eye: Wash out an eye immediately with a large amount of water for 15 minutes or more (Open the eye lid by thumb and second finger and move the eye in various directions). Contact on skin: Take off contaminated clothes, shoes, etc. promptly. Clean up contamination part with soap and wash it out with large

	amount of water to prevent absorption into the body. Respiration: Wrap patient promptly with a blanket and allow him/her to rest lying down, and then move him/her to fresh air. If he/she suffers from dyspnea or his/her respiration has stopped, artificial respiration should be immediately conducted. Intake: Induce vomiting. Let him/her drink large amount of water, especially tea to promote excretion from kidney and gut. Also magnesium sulfate dissolved in warm water is an effective cathartic.
Chlordane	Contact on eye: Wash out an eye immediately with a large amount of water for 15 minutes or more (Open the eye lid by thumb and second finger and move the eye in various directions). Contact on skin: Take off contaminated clothes, shoes, etc. promptly. Clean up contamination part with soap and wash it out with large amount of water. Respiration: Wrap patient promptly with a blanket and allow him/her to rest lying down, and then move him/her to fresh air. If he/she suffers from dyspnea or his/her respiration has stopped, artificial respiration should be immediately conducted. Intake: Rinse the mouth.
Heptachlor	Contact on eye: Wash out an eye immediately with a large amount of water for 15 minutes or more (Open the eye lid by thumb and second finger and move the eye in various directions).Contact on skin: Take off contaminated clothes, shoes, etc. promptly. Clean up contamination part with soap and wash it out with large amount of water. Intake: Rinse the mouth.
DDT	Contact on eye: Wash out the eye with a large amount of water for several minutes (remove contact lens, if possible) and consult a doctor. Contact on skin: Take off contaminated clothes immediately. Clean skin with water and soap after washing out. Respiration: Fresh air, rest position. Artificial respiration, if necessary. Consult a medical organization. Intake: Rinse the mouth. Let him/her drink charcoal suspended in water. Let him/her vomit (if conscious). Keep at rest. Consult a medical organization.

BHC	Contact on eye: Wash out the eye with a large amount of water for several minutes (remove contact lens, if possible) and consult a doctor. Contact on skin: Take off contaminated clothes immediately. Clean skin with water and soap after washing out. Respiration: Fresh air, rest position. Artificial respiration, if necessary. Consult a medical organization. Intake: Rinse the mouth. Let him/her drink charcoal suspended in water. Let him/her vomit (if conscious). Keep at rest. Consult a medical organization.
Mercury	Contact on eye: Wash out an eye immediately with a large amount of water for 15 minutes or more (Open the eye lid by thumb and second finger and move the eye in various directions).Contact on skin: Take off contaminated clothes, shoes, etc. immediately. Clean up contaminated part with soap and wash it out with large amount of water. Respiration: Let him/her sneeze and gargle. Move him/her to fresh air and keep him/her at rest and then loosen tight clothes, If his/her respiration stops, mouth-to-mouth respiration, or artificial respiration or oxygen aspiration by should be done. Intake: Let him/her drink a large amount of water, milk or albumen to vomit.
Organic phosphorus	Gaster cleaning, intestine cleaning (after gaster cleaning, 1g/kg-body weight charcoal and cathartic are given), respiration control, countermeasure against spasms Intake of PAM, astropin sulfate, etc. of antidote

Source: “Chemical Substances Safety Data Book” and others

As for poisoning symptoms, please ask your doctor to ask the Japan Poison Information Center.

“Osaka Poisoning Response Office, dial 100” (all day, any time)

- Special call for general citizen 072-727-2499 (No information charge)
- Special call for medical organizations 072-726-9923 (Information charge: @2,000 each)
  <Supported by Trauma and Acute Critical Care Center of Osaka University Hospital>

“Tsukuba Poisoning Response Office, dial 100” (9:00 ~ 21:00)

- Special call for general citizens 029-852-9999 (No information charge)
- Special call for medical organizations 029-851-9999 (Information charge: @2,000 each)
  <Supported by Tsukuba Medical Center>

【Attachment 10】

Examples of countermeasures against spreading of pollution

1. Water sealing (sheet piling or others) to surround the storage site

   Spreading of the pollution can be prevented by providing a vertical wall surrounding the site to restrict groundwater leaks. This method has used before and its performance has been confirmed. Various methods, such as steel sheet piling and underground continuous cut-off wall (formation of water blockage structure by cement filling or others), can be used in response to deep underground water, the geology of the target ground, etc. An appropriate method should be selected because some methods are costly.

2. Control of underground water flow

   By pumping up contaminated underground water into which agricultural chemicals are dissolved, the spreading of agricultural chemicals from the storage site to the surrounding area can be reduced. For this purpose, periodic water-quality analysis and monitoring should be conducted by arranging monitoring wells suitable to monitor the impact on the underground water flow caused by changes of season, pumping condition, etc. The existence of contamination in the pumped-up underground water is checked and then it is drained after suitable treatment in response to contamination.

3. Restriction of direct exposure, drinking and spraying of underground water in the surrounding area

   Agricultural chemical leaks are considered not to spread rapidly. As continual drinking of contaminated underground water cause potential long-term exposure, drinking and spraying the underground water from a well in which contamination is found (or potential future contamination is supposed judging from underground water flow or other conditions) should be suspended. In this case, a considerable amount of water may have been used and the underground water flow may have changed, so that caution should be used.

4. Restriction of excavation and transfer of surrounding soil

   Soil contaminated with agricultural chemical content that has leaked should be kept in its original condition without excavation and transferred before excavation and treatment begins.

<Reference 1> Summary of the Stockholm Convention on Persistent Organic Pollutants (POPs Convention)

1. Background

Global environmental pollution by POPs (Persistent Organic Pollutants) having toxic, low degradable, highly accumulated and long-range transport potential properties cannot be satisfactorily prevented through countermeasures by only limited countries, and POPs should not be eliminated and reduced without international collaboration. Under these circumstances, the Stockholm Convention on Persistent Organic Pollutants was adopted in May 2001.

2. Summary of the Convention

(1) Objective

To protect human health and conserve the environment against persistent organic pollutants, considering precautionary approach stated in the 15th Principle of the Rio Declaration.

(2) Countermeasures to be taken by each country

1) The prohibition of the manufacture and use, in principle, of nine chemical substances (aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphen and PCBs) and the restriction, in principle, of DDT.
2) The reduction of the release of four unintentionally produced chemical substances (dioxins, dibenzofuran, hexachlorobenzene and PCBs)
3) The proper control and treatment of the stockpile of, and waste, including POPs
4) The establishment of internal implementation plans regarding these countermeasures
5) Other measures
   - Preventive measures against the manufacture and use of other organic pollutants having the same properties as the twelve chemical substances registered in the Convention.
   - Research and study, monitoring, information provision and training regarding POPs.
   - Technical and financial support for developing countries.

3. Effective Date of the Convention

17 May, 2004. Ratified by 144 countries (at present) on 22 February, 2007.

4. Recent movement (regarding POPs agricultural chemical substances)

The POPs investigation committee (auxiliary organization of contracted countries) for investigating the addition of chemical substances subject to the convention was held, and 10 chemical substances are being investigated at present in February 2007. (Investigated chemical substances at each of the

present investigation stages are described on the next page, (1) and (2).). BHC (another name for HCH) outlined in this manual is also being investigated to be added in the chemical substances subject to the convention.

Attachment F: Chemicals investigated for “Information regarding socio-economic investigation”

Name of chemical	Main use
Chlordecone	Agricultural chemical
Lindane（γ-HCH）	Agricultural chemical
Pentabromodiphenylether	Plastic flame retardant
Hexabromobiphenyl	Plastic flame retardant
Perfluorooctanesulfonate (PFOS)	Water and oil repellent, surfactant

Attachment E : Chemicals investigated for “Information regarding overview of risks”

Name of chemical substance	Main use
Short chain chlorinated paraffin	Flame retardant
Pentachlorobenzene	Agricultural chemical, unintentional byproduct
Octabromodiphenylether	Plastic flame retardant
α-HCH and β-HCH	Byproduct of lindane

（Reference 2） Summary of the Soil Contamination Countermeasures Law

○ Objective

To find effective countermeasures against soil contamination and to protect human health by providing measures regarding the understanding of soil contamination and prevention of human health risks caused by the contamination.

○ Framework

Survey

- When use of hazardous substances at a specified site ends (Article 3 of the law).
- When the potential health risk caused by soil contamination is determined by local prefectures (Article 4 of the law)

↓

Survey and reporting

↓ <When soil contamination does not comply with designated criteria>

Determination of designated area

Designated area is determined and announced by relevant local prefecture (Article 5 of the law) and recorded in the designated area list to be disclosed to the public (Article 6 of the law).

↓

Control of designated area

<Restriction of land reform> (Article 9 of the law)

- When land reform is planned in a designated area, notification to the relevant local prefecture is required.
- If this is not feasible, a change of plan is ordered by the local prefecture.

↓

<When potential health risk caused by soil contamination is determined>

↓

<Elimination of contamination or other countermeasures> (Article 7 of the law)
Elimination of contamination or other countermeasures is ordered to landowner or polluter by the local prefecture.

※ When a polluter is not found, a fund provides for the landowner or others removing the contamination or others (Article 22 of the law).

When contamination is removed, the designation of contaminated site is cleared (Article 5 of the law).

○ The surrounding soil contaminated with buried agricultural chemicals falls under the Soil Contamination Countermeasures Law when;

Under the Soil Contamination Countermeasures Law (hereafter called, “the law”), when soil contamination exceeding the relevant specified quality standard is found as a result of soil contamination condition survey conducted based on survey according to article 3 and 4 of the law, the area is designated as a contaminated area (Article of the law) and then countermeasures such as removal of the soil contamination (Article 7 of the law) and regulation regarding land reform (Article 9 of the law) are imposed.

Article 3 of the law requires a survey after the removal of hazardous chemicals to a specified facility (Article 3 of the law, Section 1), and may not be directly related to the excavation of buried agricultural chemicals. On the other hand, article 4 of the law requires the landowner or others through the local prefectural governor to survey when potential soil contamination with specified hazardous chemical may cause a human health risk, so that soil contamination with buried agricultural chemicals may be also applied. Twenty-five substances are designated as specific hazardous chemicals according to the law, and soil contamination with mercury or arsenic should be especially dealt with when found with agricultural chemicals.

○ Countermeasures, such as elimination of contamination

(1) Countermeasure against direct exposure risk

This countermeasure is taken against contaminated soil that does not comply with the criteria for the amount of soil contamination.

Regarding countermeasures against direct exposure risk of contaminated soil, there are three methods

of exposure

control (reduction of human contact with contaminated soil), blocking exposure route (reduction of the transfer of contaminated soil or specified hazardous chemicals contained in contaminated soil) and the removal of soil contamination (Extraction or decomposition of specified hazardous chemical contained in contaminated soil, or moving from the contaminated area).

From the viewpoint of direct exposure risk, these are the following countermeasures:

1) Keeping out (exposure control)
2) Paving over (blockage of exposure route)
3) Embankment or damming (blockage of exposure route)
4) Soil exchanging (Soil exchanging measure in a designated area, soil exchanging measure for non-designated area soil) (Blockage of exposure route)
5) Soil contamination removal (On-site purification, excavating and removing) (Elimination of soil contamination)

(2) Countermeasure against groundwater drinking risk

This countermeasure is taken against contaminated soil that does not comply with the criteria for dissolved

soil contamination.

For countermeasures against groundwater drinking risk of contaminated soil, there are two methods: blockage of the exposure route (reduction of surrounding groundwater contaminated with specified hazardous chemical contained in contaminated soil) and the removal of soil contamination (extraction or decomposition of specified hazardous chemical contained in contaminated soil, or removal from relevant area). “Groundwater quality measurement (monitoring)” is a preventive measure to be taken at the stage of decontamination of groundwater. This is a method for indirectly reducing the drinking of contaminated groundwater caused by soil contamination, and may be applied for exposure control.

From the viewpoint of groundwater drinking risk, there are the countermeasures:

1) Groundwater quality measurement (exposure control)
2) On-site measures for making contaminants insoluble (blockage of exposure route)
3) Measures for making contaminant insoluble and refilling soil (blockage of exposure route)
4) On-site containment measures (blockage of exposure route)
5) Water sealing and containment (blockage of exposure route)
6) Blockage and containment (blockage of exposure route)
7) Soil contamination elimination (on-site purification, excavation and removal) (soil contamination elimination measure)

Countermeasures against direct exposure risk

Enforcement regulation of the Soil Contamination Countermeasures law (The Ministerial ordinance of MOE, No.29, enforced on 26 December, 2002)

(Implementation method of the countermeasure)
Article 28
The following measures are defined in Table 5: measuring groundwater quality, elimination of soil contamination, on-site containment, containment by damming water, making hazardous substance insoluble at the site, making hazardous substance insoluble and reusing the soil, containment by sheet piling, replacement of soil, banking, paving over and keeping out.

Type of countermeasure against elimination of contamination or others	Implementation method of the countermeasure against elimination of contamination or others
1. Measuring groundwater quality	For detailed implementation methods, refer to the Ministerial ordinance of the Soil Contamination Countermeasures Law, Article 28, item 1, Table 5.
2. Elimination of soil contamination	
3. On-site containment	
4. Containment by damming water	
5. Making hazardous substance insoluble at the site	
6. Making hazardous substance insoluble and reusing the soil	
7. Containment by sheet piling	

8. Replacement of soil	
9. Banking	
10. Paving over	
11. Keeping out	

Attachment 7

Note 5: Ministerial ordinance of the Soil Contamination Countermeasures Law, Article 24, Table 4

(Countermeasure for prevention of human health risk through groundwater contamination caused by Class 1 specified hazardous substances)

When contamination that applies to the Ministerial ordinance, article 5, item イ of the article 5 of the Law and groundwater contamination is caused by soil contamination by Class 1 specified hazardous substances, countermeasure against elimination of the contamination or others shall be conducted according to the requirements for the corresponding item.

1. When the measurement results of the specified hazardous substance concentration in the soil sampled at the target site (according to the method stipulated by Environmental Minister, of the article 5, item 3, No.4 of the Law) is not complied with, the reference standard listed in the lower column of Table 4 is used. This corresponds with the classification of the type of specified hazardous substance listed in the upper column (hereafter, called “secondary dissolution amount standard”), and the contaminated soil shall be removed from the land or the specified hazardous substance in contaminated soil shall be removed (hereafter, called “removal of soil contamination”).

2. A structure to the prevent groundwater penetration shall be installed at the shallowest impermeable stratum, on the side walls of the block including the contaminated soil in land, except for the land defined by the above item (hereafter, called “on-site containment).

2-2 In the above case, a person or organization of the landowner causing soil contamination of the land requests any other countermeasure than the following ones listed, it shall be taken for removal of contamination or others irrespective of the requirement of this item.

1. Elimination of soil contamination
2. For contaminated land complying with Class 2 dissolution amount standards, the contaminated soil shall be excavated from the land, a structure for prevention of groundwater penetration into the land shall be provided and the contaminated soil shall be put into the interior of the structure (hereafter, called "containment by water blockage").

Table 4 (Related to the article 24, item 1, No.1)

Type of specified hazardous substance	Class 2 dissolution amount standard
Cadmium and its compounds	0.3 mg or less of cadmium per 1 liter sample
Hexavalent chromium and its compounds	1.5 mg or less of hexavalent chromium per 1 liter sample
Simazine	0.03 mg or less per 1 liter sample
Cyanide compounds	1 mg or less of cyanide per 1 liter sample
Thiobencarb	0.2 mg or less per 1 liter sample
Carbon tetrachloride	0.02 mg or less per 1 liter sample
1,2-dichloromethane	0.04 mg or less per 1 liter sample

Note 9:
Future policy regarding countermeasures against hazardous atmospheric air pollutants (7th report)
Issued on 31 July, 2003, by the Central Environment Council
Annual average mercury concentration: 0.04 μg Hg／m3 or less

Note 10:
Environmental standard relating to water pollution
Issued on 28 December, 1971
Notification of the MOE, No.59

Environmental standard relating to human health protection

Arsenic	0.01mg／l or less	Method specified in the standard 61.2 or 61.3
Total mercury	0.0005mg／l or less	Method listed in Attachment 1

Note 11
Environmental standard relating to the soil contamination
Issued on 23 August, 1991
Notification of the MOE, No.46

Attachment

Item	Environmental condition	Measuring method
Arsenic	0.01 mg or less per 1 liter sample, and as for agricultural land (limited to rice field), 15 mg or less per 1 kg soil sample	With regard to environmental condition, method specified by the Standard, No. 61 for liquid sample concentration, and method specified by the Ordinance of the Prime Minister's Office Standard, No.31, issued on April, 1975 for agricultural land
Total mercury	0.0005 mg or less per 1 liter sample	Method listed Attachment 1 of the Notification of the MOE, No.59, issued December, 1971

Note 12
The Enforcement regulation of the Soil Contamination Countermeasures Law
(The Ministerial ordinance of the MOE, No.29, issued on 26 December, 2002)

Article 18-2

The standard relating to amount of specified hazardous substance contained in soil, of the standards specified by the Ministerial ordinance of the MOE of the article 5, item 1 of the Law shall be measured according to the method specified by the Minister of the MOE of the article 5, item 4, No.2, and its results shall be complied with the requirements listed in the lower column of Table 3, in response to classification of the type of specified hazardous substance listed in the upper column of it.

Table 3 (Related to the article 18, item 2)

Type of specified hazardous substance	Requirement
Mercury and its compounds	15 mg or less mercury per 1 kg soil sample
Arsenic and its compounds	150 mg or less arsenic per 1 kg soil sample