Pilot Project for the Environmental Technology Verification

Treatment Technologies for Human Waste in Mountain Districts

Protocol for Verification Tests on Human Waste Treatment Technologies in Mountain Districts for FY2004

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Nature Conservation Bureau,
the Ministry of the Environment

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I. Introduction

1. Purpose

The present verification test is intended to provide an objective evaluation of the effectiveness of an advanced technology that has gained the status of a real-world application for environmental conservation and to make public the results thereof. Here, we will attempt to establish the methods and organization of verification testing of human waste treatment technology in mountain districts. We will also seek to promote the dissemination of the mountain district human waste treatment technologies found to be most effective in preserving the natural environment in such regions.

2. Target Technologies

The target mountain district human waste treatment technologies for the present verification test are those that will effectively treat human waste in regions with inadequate social infrastructures, such as water supply and sewage systems, electricity (commercial power source), and roads, as in mountain districts.

Treatment technologies include biological, chemical, physical treatment methods applied independently or in combination. The technologies considered in this project will generally be of the non-discharge type; that is, technologies that do not result in the release of wastewater or effluents into public water resources.

3. Basic Policies of Verification Tests

To fulfill the above goal, the verification tests will be undertaken as a joint effort involving various associated bodies in the government (Ministry of the Environment), the verification organization (local government), and privately owned mountain resorts. In principle, the results are to be made available to the public.

Information obtained through the verification testing is expected to improve the performance of the tested apparatus and to help end users (including local public agencies and privately owned mountain resorts) select the most suitable model for their own particular needs.

To ensure that the verification tests fulfill their intended purpose, the following points are to be observed in realizing the basic policies:

(a) Treatment technologies for human waste in mountain districts are to be categorized by treatment method. The performance required and various technological problems are to be identified.

(b) The verification tests will focus primarily on the performance specifications of an apparatus.

(c) The tests will be carried out for the overall purpose of establishing a comprehensive mountain district human waste treatment technology system, from installation to transportation of discharged materials.

(d) The performance characteristics of the apparatus under various natural conditions, seasonal variations, and load conditions are to be assessed.

(e) The verifications tests shall be designed to permit impartial assessment of all treatment methods.

(f) Verification test items and procedures are to be comprehensively defined in the Protocol. The specifics of each method are to be specified in the Test Plan drawn up by the verification organization.

4. Types and Overview of Verification Tests

(1) Verification Test Items

The present verification test will evaluate the performance of human waste disposal technologies upon the request of a developer or distributor (hereafter referred to as "verification applicant") under the conditions anticipated for actual use. The verification test items are as follows.

- Appropriate range of operating conditions, required power, and types and consumption of fuel and resources
- Status of operation and maintenance conditions
- Conditions within the toilet
- Effects on the surrounding environment
- Human waste treatment capacity

(2) Overview of Verification Tests

The verification organization will conduct the tests according to the steps given below. Figure 1 shows the flow of test procedures.

1) Establishment of the Technology Panel

The verification organization will establish a Technology Panel consisting of experts within the field (academic authorities, user representatives, etc.) who will offer advice on solicitation of bids and selection of target verification technology, design of the Test Plan, and production of the Verification Report.

2) Solicitation of Bids and Selection of Target Verification Technology

The verification organization will solicit bids and select the technology or proposal submitted by verification applicants for the target technology. The verification organization will then obtain the approval of the Ministry of the Environment (MoE). All applicants are to be notified of selection results.

3) Design of the Test Plan

The verification organization will design a Test Plan before conducting the verification test. Applicants are to be consulted regarding Test Plan design, which will subsequently be reviewed by the Technology Panel and submitted to the MoE.

The Ministry of the Environment will provide comments on the Test Plan to the verification organization. Additionally, the verification organization may adopt a test method differing from the Protocol, as circumstances require, upon consultation with the MoE.

The following items will be heeded in designing the Test Plan.

(a) The names of the person and organization that will be involved in the test will be made public.

(b) The following items will also be made public: test conditions; test period; contents, method, and structure of operations and maintenance (O&M); test items; sampling method; analysis method; and final disposal method of discharge material that must be transported from the area.

(c) The methods of data processing and verification are to be specified.

(d) When the verification tests are to be performed at multiple sites, a separate Test Plan will be designed for each site.

4) Implementation of Verification Tests

The verification organization will conduct tests according to the Protocol and Test Plan. The verification organization may commission or subcontract external parties to conduct the tests when appropriate.

5) Preparation of Verification Report

The verification organization will analyze and verify all data, and prepare a Verification Report, taking care to maintain the confidentiality requested by the verification applicant. The report shall be reviewed by the Technology Panel and submitted to the MoE for approval. The verification organization may commission external parties to manage the work required for verification and to prepare the Verification Report.

6) Registration onto the Database and Publication

The verification organization will send a copy of the Verification Report to the verification applicant and the database operating organization specified by the MoE. The results of the tests will be made available to users as environment technology information via the Internet.

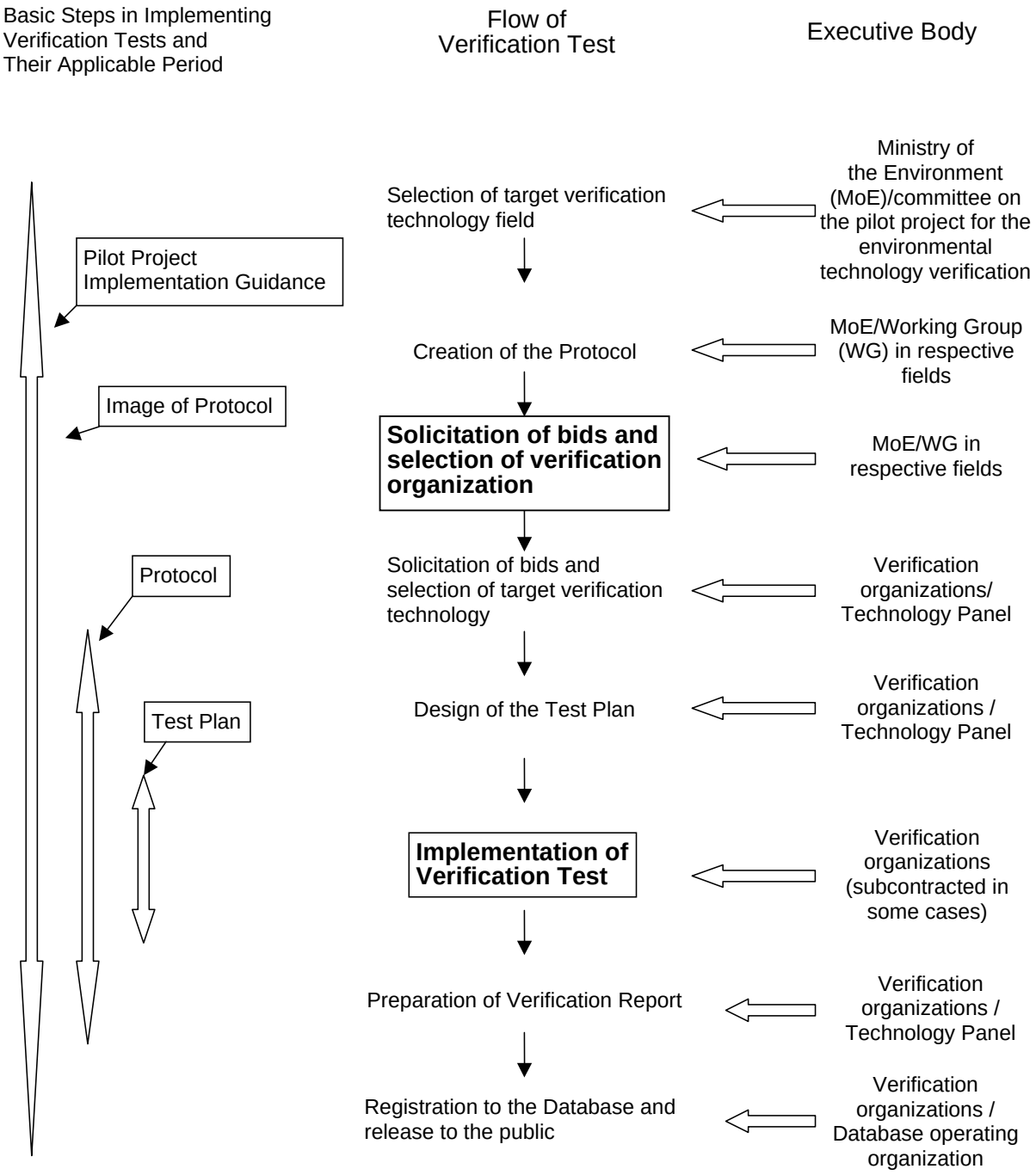


Figure 1. Flow of the pilot project for environmental technology verification

II. Organization for Verification Test Implementation

The roles of the organizations involved in the implementation of the verification tests will be given below. Figure 2 shows the organization for implementation of verification testing for the area of mountain district human waste treatment technologies.

1. Ministry of the Environment

The Ministry of Environment will:

(a) retain responsibility for the operation and management of the overall pilot project for environmental technology verification and comprehensive examination of projects for establishing the verification method and organization;

(b) select the target verification technology field;

(c) develop technology related to the verification tests for different methods;

(d) establish and administer the committee on the pilot project for the environmental technology verification and Working Group (WG) in respective fields;

(e) create the Protocol, which is to be revised as necessary;

(f) select the verification organization;

(g) grant approval for target verification technology;

(h) offer advice on the Test Plan as necessary;

(i) grant approval for the Verification Report;

(j) construct an environmental technology verification (ETV) database and make public the results of verification tests.

2. Committee on the Pilot Project for Environmental Technology Verification

The committee on the pilot project for the environmental technology verification will:

(a) be established upon the request of the Director-General of the Environmental Policy Bureau, MoE, to review and offer advice on the official tasks of the MoE and the overall pilot project based on professional knowledge;

(b) evaluate the status and results of the pilot projects.

3. Working Group for Human Waste Treatment Technologies in Mountain Districts

The Working Group (WG) will:

(a) be established by the MoE and consist of experts (academic authorities, user representatives, etc.);

(b) offer advice on the management of the overall pilot project for mountain district human waste treatment technologies;

(c) review and offer advice on the creation of the Protocol and the selection of the verification organization, based on the professional experience of the members;

(d) offer advice on the approval of the Verification Report.

4. Verification Organization

The verification organization:

(a) will retain responsibility for the management and operation of verification project commissioned by the MoE;

(b) will seek bids for and select target verification technologies, and obtain approval from the MoE;

(c) will notify all applicants of the selection results of target technology;

(d) will establish and operate the Technology Panel;

(e) will consult with verification applicants in designing the Test Plan based on the Protocol and submit the same for review by the Technology Panel;

(f) will implement the verification test according to the Protocol and Test Plan and undertake various formalities, including legally required applications and the securing of test sites;

(g) will perform O&M of the verification apparatus based on the "routine operating manual and O&M instructions manual for technical supervisors" created by the verification applicant;

(h) may commission part of the verification test to be performed by external parties when appropriate (in such cases, the verification organization must guide and supervise the work);

(i) will analyze and evaluate the verification test data and prepare a Verification Report;

(j) will register the contents of the Verification Report with the Database operating organization;

(k) may advise the verification applicant to continue observation on his own responsibility when continued observation of an apparatus is deemed necessary.

5. Technology Panel

The Technology Panel will:

(a) be established by the verification organization and consist of experts (academic authorities, user representatives, etc.);

(b) review and advise the verification organization on the solicitation of bids and selection of target verification technology;

(c) review and advise the verification organization on Test Plan design;

(d) review and offer advice on problems arising during implementation of the verification tests;

(e) review and offer advice on preparing the Verification Report.

6. Verification Applicant

The verification applicant:

(a) shall submit an application to the verification organization to be included in the verification test;

(b) shall submit all existing data on technologies;

(c) shall consult with the verification organization during Test Plan design and confirm and grant approval for the Test Plan;

(d) shall submit a letter of consent to the verification organization regarding the contents of the Test Plan;

(e) shall submit an "O&M instructions manual for technical supervisors" and "routine operating manual" to the verification organization;

(f) shall install the verification apparatus at the test site;

(g) shall add supplemental equipment to the apparatus already installed, if necessary for the verification test;

(h) may assist in the operation of and data collection with the apparatus during the verification test based on the Test Plan or by obtaining approval from the verification organization;

(i) shall provide technicians who have received the necessary training to perform O&M for the apparatus;

(j) shall respond swiftly to operational problems, repair the apparatus with the approval (and if possible, with the presence) of the verification organization, and submit a report to the verification organization;

(k) must report any problems upon its discovery without delay;

(l) shall cooperate with the verification organization when requested to do so in the preparation of the Verification Report and confirm the contents of the report.

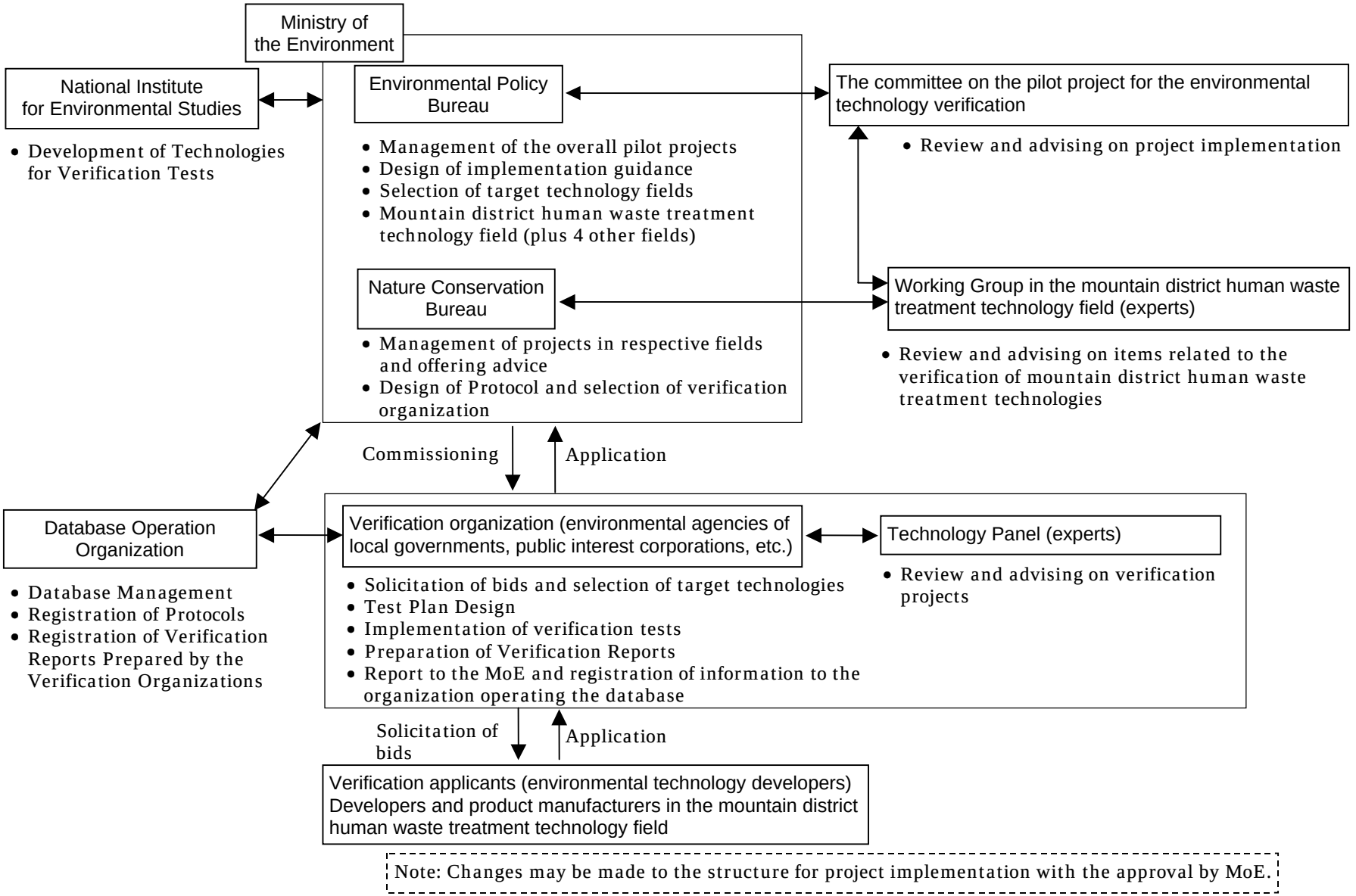


Figure 2. Structure of Verification Test Implementation

III. Selection of Target Verification Technology

1. Application Procedures

The verification applicant may apply for verification of the relevant technology by completing the necessary items on the "Application Form for the Verification of Human Waste Treatment Technologies in Mountain Districts" shown in Appendix 1 and submitting it to the verification organization along with the following documents. The contents of the application are as follows:

(1) Information on the Candidate Verification Test Sites

1) Location

The name of the mountain region and its elevation above sea level will be given for the (candidate) test site, and the locality will be indicated on a map.

2) Natural Environmental Conditions

As much information as possible will be provided, including information on temperature, ground temperature (when the apparatus must be installed underground), duration of exposure to sunlight, wind speed and direction, amount of rainfall, snow cover (including information such as the frequency of avalanches), topography and geology, and regional vegetation.

3) Social Infrastructure Conditions

Information will be provided regarding available transportation in and out of the test site, electric power, water supply, etc.

4) Utilization Conditions

As much information as possible is to be provided regarding the times of the year during which the mountain roads are passable, estimated number of climbers, variations in use conditions (by season, month, time of day, etc.), nearby facilities (privately owned mountain resorts, public restrooms).

(2) Information on the Verification Apparatus

1) Design Concept

Clearly define the general design concept including the water and power supply facilities and their configuration. Provide information on the settings, layout of the apparatus, required electrical capacity and power consumption, required water supply volume, countermeasures against freezing, and potential infiltration of foreign materials.

2) Explanation of Apparatus Structure and Functions

Provide a flowchart illustrating the apparatus structure and functions.

3) Design Standard

Clearly indicate the criteria for treatment capacity and present a design standard that meets the criteria.

4) Standard Plan

Show plan, cross-sectional, and external views.

5) Reference Materials on Past Installation Records

Provide information on past installation records by tabulating installation sites, purpose of installation, year of installation, and scale of waste treatment.

6) Technical Performance Data

If any data exists on technical performance for past installations, submit together with information on operating conditions (including conditions related to the natural environment, social infrastructure, usage conditions, etc.).

7) O&M Instructions Manual for Technical Supervisors

Append an O&M instructions manual for the verification apparatus. Provide instructions for start-up and shutdown of the apparatus.

8) Installation Conditions

Define the operating conditions of the apparatus, or restrictions on installation conditions.

(3) Other

1) Company Profile

2) Reference Materials

2. Selection

The verification organization will select a target technology from those submitted, taking into consideration the results of a review by the Technology Panel, from the following perspectives. The verification organization may select more than one target technology at the same time. However, the resources required for their implementation must be reasonable given budgetary and administrative constraints.

The selection procedures are as follows:

(a) The verification applicants are to be interviewed about their verification apparatus, if necessary, during the selection stage.

(b) The selected technology will be reviewed by the Technology Panel.

(c) Approval will be granted by the MoE.

(d) A "letter of acceptance of the verification application" will be issued to the verification applicant whose technology has been granted approval by the MoE.

(e) The verification applicant will submit a "letter of consent for verification test implementation" to the verification organization.

3. Criteria for Target Technology Selection

The verification organization will make a comprehensive judgment on the selection of the target technology based on comments from the Technology Panel and the following criteria:

(1) Formal Conditions

(a) The technology in the application must fall within the boundaries set for the particular category of target technology.

(b) The technology must be at a stage of development that permits practical application.

(c) The technology must not have undergone evaluation or verification related to other technology evaluation or verification projects.

(2) Feasibility of Verification

(a) The technology must be verifiable given budgetary and administrative constraints.

(b) It must be possible to devise a Test Plan for the technology.

(c) An appropriate test site must exist for the designed verification test.

(d) It must be possible to install the apparatus at the test site.

(e) The conditions of the test site must be comparable to those at the actual site of operations.

(f) Both the owner of the test site and the supervisor of the mountain resort must consent to the verification test.

(3) Environmental Conservation Effects, Etc.

(a) It should be possible to explain the principles and mechanisms underlying the technology.

(b) The technology must not result in secondary adverse effects upon the environment.

(c) The technology must offer reasonable potential for effective environmental conservation.

(d) The technology must be sophisticated, environmentally friendly, and offer likely prospects for actual application.

IV. Preparation for Verification Tests

1. Categorization of Target Technologies

These treatment technologies for human waste in mountain districts consist of biological, chemical, and physical treatment methods applied independently or in combination. The treatment methods are categorized in Table 1 from the viewpoint of verification items. The "Other" category corresponds to treatment methods that do not fall under any of the five categories above it, but are relevant to the target technology shown on page 1. Treatment schemes that are combined methods are categorized under the central treatment method in the scheme.

Table 1. Categories of Human Waste Treatment Methods

No.	Human Waste Treatment Method	Treatment Method
1	Biological Treatment	Microbes are enlisted to treat human waste.
2	Chemical Treatment	Chemicals are used to treat human waste.
3	Soil Treatment	After aerobic and anaerobic treatment, the effluent is passed through an underground distribution pipe and allowed to leach into the ground.
4	Evaporation and Incineration Treatment	Human waste is transformed into powder form by using evaporation and combustion to remove moisture.
5	Composting Treatment	Human waste is mixed into porous materials with high void ratios, such as cedar chips and/or sawdust for storage in voids or decomposition by microbes.
6	Other	Treatment methods that do not fall under any of the above categories

2. Verification Test Checkpoints

Table 2 lists various checkpoints in the implementation of verification tests. Information on actual performance is required to confirm that an apparatus is operating properly, together with information on operating conditions at the installation site and effects on surroundings.

Table 2. Verification Checkpoints

No.	Checkpoints	Description
1	Operating Conditions/Status	The required preconditions for proper operation of the human waste treatment apparatus are to be verified.
2	Maintainability	The maintainability of the apparatus will be verified.
3	Indoor Conditions	Acceptable hygienic and odor-related conditions inside the toilet booth will be verified.
4	Effects on Surrounding Environment	The effects of the apparatus on the surrounding environment will be verified.
5	Treatment Capacity	The treatment capacity of the apparatus will be verified.

Table 3 shows the verification items relevant to the human waste treatment methods shown in Table 1, considered from the perspective of the checkpoints above. Some items are common to all methods, while others pertain only to specific methods. The actual items of the verification tests are to be indicated in the section on verification test methods.

Table 3. Verification Items for Each Human Waste Treatment Method

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Human Waste Treatment Method</th><th colspan="5">Verification Checkpoint</th></tr>
<tr><th>Operating Conditions/ Status</th><th>Maintainability</th><th>Indoor Conditions</th><th>Effects on Surrounding Environment</th><th>Treatment Capacity</th></tr>
<tr><td>1</td><td>Biological Treatment</td><td rowspan="5">Select relevant item</td><td rowspan="5">Common</td><td rowspan="5">Common</td><td rowspan="2">Ground alteration</td><td>Circulating water, sludge, gas emissions, etc.</td></tr>
<tr><td>2</td><td>Chemical Treatment</td><td>Circulating water, sludge, gas emissions, etc.</td></tr>
<tr><td>3</td><td>Soil Treatment</td><td>Ground alteration
Surrounding soil</td><td>Circulating water, sludge, gas emissions, etc.</td></tr>
<tr><td>4</td><td>Evaporation and Incineration Treatment</td><td rowspan="2">Ground alteration</td><td>Ash, carbonized residue, gas emissions, etc.</td></tr>
<tr><td>5</td><td>Composting Treatment</td><td>Sawdust, cedar chips*1, gas emissions, etc.</td></tr>
<tr><td>6</td><td>Other</td><td colspan="5">Examined in Test Plans</td></tr>
</table>

*1 Refers to sawdust and chips remaining after human waste treatment

3. Design of the Test Plan

The verification organization will consult with the verification applicant in designing the Test Plan according to the Protocol, and the Test Plan will be reviewed by the Technology Panel.

The items specified in the Test Plan are shown in Appendix 2.

4. Treatment of Intellectual Property

(1) The verification organization shall not use information relating to the environmental technology of the verification applicant, which may be obtained through the verification test, for any purposes other than the verification of technologies. When providing confidential information relating to the relevant technology to the verification organization, the verification applicant may request the verification organization to execute a confidentiality agreement in a form separately designated by the verification organization.

(2) If the right prescribed by Article 30, Paragraph 1, of the Law on Special Measures for Industrial Revitalization (hereinafter referred to as the "Patent") has been newly acquired as a result of the implementation of the verification test, the Ministry of the Environment may elect that such Patent should not be granted. In this case, the verification organization shall consult with the Ministry of the Environment, if necessary, regarding the treatment of the relevant Patent to ensure the efficient use of the relevant Patent.

(3) Copyrights related to works that may be prepared through the implementation of this project, including but not limited to the Protocol and the Verification Report, shall belong to the Ministry of the Environment.

5. Distribution of Test Expenses

In the FY2004 pilot project for environmental technology verification, the verification applicant will generally bear costs related to transporting to and installing the apparatus at the test site, operating the target technology at the site for verification tests, and removing and transporting the apparatus from the test site. The cost of measuring the environmental effects of the target technology and other costs are to be borne by the Ministry of the Environment.

The verification organization will hold discussions with government agencies and the verification applicant with respect to unexpected costs.

6. Exclusion

(a) The Ministry of the Environment, verification organization, organization operating the database, and other parties participating in the pilot project shall not be liable for any breakdown of or damage to the apparatus during the implementation of this pilot project, except in cases of intentional wrongdoing or gross negligence.

(b) The verification applicant shall be held liable for any damage incurred to a third party resulting from defects in the apparatus, except in cases of intentional wrongdoing or gross negligence by the third party. The Ministry of the Environment, verification organization, organization operating the database, and other parties participating in the pilot project shall not be held liable.

(c) The Ministry of the Environment, verification organization, organization operating the database, and other parties participating in the pilot project shall not be held liable for any disputes arising between the verification applicant and a third party as a result of the public release of the Verification Report.

(d) The data contained in the Verification Report shall not apply in cases where specifications for basic performance of the target technology have been revised.

V. Verification Test Method

Figure 3 shows the verification test procedures.

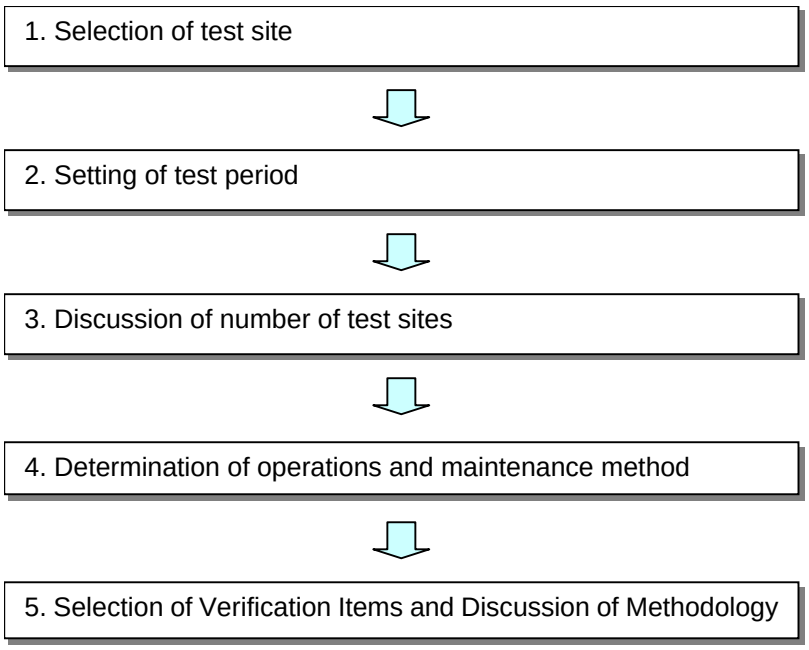


Figure 3. Procedure for Conducting the Verification Test

1. Test Site

The verification tests are to be conducted under one of the two conditions given below.

The test site will be determined through discussions between the Verification Organization and the verification applicant. Test site selection should account for how efficiently verification tests can be performed at the site in question.

(1) Verification of apparatus already installed at the test site and operational

(2) Verification of apparatus to be installed at the verification test site

Since the verification apparatus being tested is to be used in remote areas (mainly in mountain districts) with inadequate access to social infrastructures, the temperature and altitude of the selected test site should be similar to those expected for mountain/foothill regions. The test site location should permit easy periodic maintenance and have stable conditions. The conditions of the test site should not exceed the treatment capacity, operational levels, or limits specified by the verification applicant. Although the human waste influx load may exceed the capacity of the apparatus at times, the load must not deviate excessively from the range specified by the verification applicant.

When an apparatus is to be installed, the verification applicant, the owner of the test site, and the management and operations personnel are to hold discussions to coordinate efforts to secure an environment permitting smooth implementation of the verification test. The test site must also be convenient for the O&M personnel of the apparatus as well as for users. Efforts should be made to harmonize the apparatus with the surrounding scenery. The test site should not be altered unless absolutely necessary. In general, the verification applicant must restore the test site to its original state when testing is complete.

2. Verification Test Period

Verification of mountain-district human waste treatment technology is susceptible to variations in weather conditions. A significant factor in selecting and deploying a treatment technology involves the behavior of the facility when shut down for the off-season and reopened at the beginning of the next subsequent season, as well as wintering performance. For this reason, the duration of the standard unit test for the present technology is set to one year.

For the present verification, the test period will be defined as the one-year period from the start of the verification test. After FY2004, verification testing will be subcontracted again until completion.

3. Number of Test Sites

In general, a single test site is to be specified.

4. Operations and Maintenance Method

The Verification Organization will perform operations and maintenance tasks to maintain stable apparatus operating conditions throughout the test period and to optimize and promote efficient operations. Multiple parties may be involved in the O&M work, depending on content and methods. The Verification Organization coordinates the activities of all the parties and defines the scope of responsibility of those involved in the Test Plan.

An overview of the O&M structure is given below.

(1) Starting the Verification Apparatus

The Verification Organization will perform startup operations for the verification apparatus as described in operations manual and O&M instructions manual for technical supervisors submitted by the verification applicant. Following startup, the Verification Organization will confirm that the operating conditions of the apparatus are sufficiently stable for testing. If the operating conditions are found to be unsatisfactory, revisions and adjustments should be made in Test Plans.

The operating conditions and O&M performance of the apparatus during the startup period should be recorded and included in the Verification Report.

The verification applicant must attach a data plate to a prominent location on all components of the verification apparatus. The data plate must provide the following information:

- Name of target verification apparatus
- Model #, serial number
- Company name, address, person in charge of project, contact in case of problems
- Power supply voltage, phase, current, and frequency
- Precautions for handling and shipping
- Clear and easily understood precautions or warnings
- Treatment capacity, etc.

(2) Routine Operations and Maintenance

The Verification Organization will clean and handle the apparatus for proper O&M during the test period as specified in the "Routine operations manual" prepared by the verification applicant. However, if facilities such as mountain resorts are located near the test site, the Verification Organization may subcontract routine surveys of apparatus operating conditions and maintainability to the managers of such facilities.

In such cases, to guarantee data reliability and impartiality, the subcontractor must always contact the verification applicant through the Verification Organization, except in cases of problems such as machine malfunctions. For more information on responding to problems, see Section 4 "Response to Problems."

(3) Technical Operations and Maintenance

The Verification Organization will perform periodic maintenance, inspections, and the special cleaning procedures required for proper O&M of the apparatus during the test period, as specified in the "O&M instructions manual for technical supervisors" prepared by the verification applicant. Personnel or organizations with experience in human waste treatment and familiar with the tasks will be in charge of the technical O&M. The Verification Organization may subcontract tasks to outside parties when necessary. The verification applicant will be responsible for convening meetings to explain O&M procedures to personnel actually performing the technical work and for providing guidance on actual procedures.

(4) Response to Problems

The Verification Organization is to contact the verification applicant immediately in the event of problems. It shall then devise measures to restore the apparatus to normal operating conditions as indicated by the applicant. In the event of unforeseen events, the Verification Organization and the verification applicant will work together to resolve any problems that arise.

The results of sampling when problems arise will not be treated as valid analysis data in the Verification Report. Nevertheless, they must be included in discussions of sampling results.

Information on problems such as the state of the apparatus and the cause, result, and method of recovery must be included in the Verification Report. However, if the cause remains unknown, or if it is impossible to determine if the condition constitutes a problem, the data sampled during the upset period must be treated as valid data in the Verification Report.

The Test Plans will contain the following items on monitoring and operations and maintenance:

(a) Schedule for monitoring and O&M

(b) Apparatus and components will be monitored to assure stable operation of the apparatus during the test period, in compliance with instructions provided in the routine operating manual and O&M instructions manual for technical supervisors.

(c) Environmental conditions will be monitored as closely as possible. Efforts will be made to maintain environmental conditions within the range of operating conditions specified by the verification applicant.

(d) All monitoring and O&M activities will be reported to the Verification Organization. When individual monitoring and O&M works have been conducted, the name of the sampling location, date, name of personnel, content of work, test site, observation notes of the apparatus, and the results of the work must be indicated. This information must be included in the Verification Report.

5. Verification Test Methods

Observe the following sampling precautions for verification items. Item details are specified in the Test Plan.

- Divide the test period into periods of concentrated use during which the verification apparatus will undergo heavy use and a period of normal use, and evaluate the samples under both conditions.
- If the test site is to be closed off during the winter, no sampling will be performed during that period. Upon starting up the apparatus at the beginning of the new season, confirm the operating conditions of the apparatus and verify the wintering performance of the apparatus.

Below are the methods and frequency of sampling for each verification item, based on verification checkpoints.

(1) Operating Conditions and Status

Table 5 shows the prerequisites for proper use of the verification apparatus for the target technology. From Table 5, the verification organization will select the items that it believes will be required for verification. The sampling method and frequency for each item will be specified in the Test Plan.

The verification data will be calculated based on the results of sampling by general personnel.

The Verification Organization may decide to use verification items not found in Table 5. The Verification Report should also include results of verification for such items.

The conditions of the natural environment at the test site during the test period should be recorded in detail. The operating conditions of the apparatus must be clearly specified. Data on the natural environment should include temperatures, ground temperatures, duration of sunlight, wind velocity and direction, amount of rainfall, and snow conditions (snow cover, etc.).

The above applies as well to (2)–(5).

Table 5. Operating Conditions and Status and the Method and Frequency of Sampling of Verification Items

No	Classification	Verification Item	Method of Measurement	Frequency
1	Treatment capacity	Number of people using toilet	Installation of counter and checking the count at 10:00 AM	Daily
2	Water	Volume of water initially required (t)	Record the volume fed initially	At startup
3		Replenished volume of water (t)	Record the volume per replenishment	At replenishment
4		Consumed volume of water (liters)	Record for each consumption (circulating-type apparatus excluded)	Daily
5	Electric power	Power consumption (kWh/day)	Installation of power meter	Daily
6	Fuel	Type of fuel, volume consumed (l· kg· Nm^3/month)	Record consumption between each meter inspection	Accordingly
7	Raw materials	Type of raw material, cost, volume consumed (l· kg· Nm^3/month)	Record consumption between each meter inspection	Accordingly
8	Temperature	Temperature at site of installation	Automatic data collection	Daily
9	Weather	Weather at site of installation	Record weather conditions	Daily

(2) Maintainability

The Verification Organization will operate and maintain the apparatus as described in the routine operating manual and O&M instructions manual for technical supervisors submitted by the verification applicant. It will also evaluate the user friendliness of the two manuals and verify the accuracy of the descriptions and items of the manuals. Table 6 shows items to be included in the manuals. Survey frequency will depend on the contents of the routine operating manual and O&M instructions manual for technical supervisors. The Verification Organization should discuss the most suitable frequency and system for sampling with verification applicants.

Prepare a maintenance checklist for both routine and technical maintenance tasks in accordance with the following items:

Table 6. Method and Frequency of Measurement of Items for Maintainability Verification

No	Classification	Verification Items	Time of Recording	Frequency
1	Routine maintenance in general	Description of work, required number of personnel and time, ease of work, etc.	During routine work	Follow instructions in the routine operating manual and O&M instructions manual
2	Technical maintenance in general		During technical work	
3	Preparations at closing and opening of mountain season *1		On the closing and opening of the mountain season	At the closing and opening of the mountain season
4	Transporting out end products and their processing and disposal		When transporting end products from the test site	When transporting end products from the test site
5	Troubleshooting		When problems arise	When problems arise
6	Reliability	Clarity and accuracy of entries in manual	At the end of testing	At the end of testing

*1: If the mountain is closed for the winter, confirm the wintering performance of the apparatus by observing its operating status when restarted at the beginning of the following season.

(3) Indoor Conditions

Table 7 shows the verification items for ensuring that use of the facility toilets is pleasant for guests.

Table 7. Verification Items for Indoor Conditions

No	Verification Items		Method	Frequency
1	Temperature		Automatic recording	Daily
2	Humidity		Automatic recording	Daily
3	Acceptable Range*	Pleasantness	Interview user to survey the acceptable range of conditions concerning the pleasantness of the facility (Example: lighting, odor, circulating washwater, etc.).	More than 50 people during the open season
4		User friendliness	Interview user to survey the acceptable range of conditions concerning the user friendliness of the facility (Example: wash method, manual operation buttons, etc.).	

* The acceptable range should be appropriate for indoor conditions in a mountain environment.

(4) Effects on Surrounding Environment

While the target technologies for the present verification are all of the non-discharge type, they may nevertheless have certain adverse effects on the surrounding environment. Treatment of human waste may generate certain gases. Soil treatment technologies require assessment of their effects]on surrounding soil conditions. This section examines the effects of end products of human waste treatment technologies on surroundings as well as the effects on soil. Table 8 shows the currently anticipated verification items. Items other than those listed below that are predicted to affect the surrounding environments are to be examined in the Test Plan.

Table 8. Verification Items for Effects on Surrounding Environment

No	Classification	Verification Items	Measurement Method	Frequency
1	Soil alteration conditions	Surface area of installation, terrain alteration, tree felling, scale of earthwork	Record measurements as indicated by drawings and as determined to be appropriate by on-site observations.	Once/survey period
2	Surrounding soil	Nitrate-nitrogen, chloride ion	See *1.	Once/survey period

*1 Given below is a detailed verification method for assessing effects on the surrounding environment.

- The items to be recorded will be same as for sampling in "1) Items to Record During Sampling" on page 26. The sampling for this item shall be made at the same time as the final sampling during periods of normal use (2) in Fig. 5 of page 26. Samples will be analyzed for nitrate-nitrogen (soil nutrient analysis method) and chloride ions (JIS K 0102 35.1). The sample solution for analysis should be prepared according to the method specified in "Environmental Quality Standards for Soil Pollution (Ministry of the Environment Notification #46)." Figure 4 is an example of apparatus sampling locations. In this case, samples are collected at both points A and B. The samples collected at point B serve as a reference sample to determine whether the effects of the human waste treatment apparatus are evident in the point A sample.

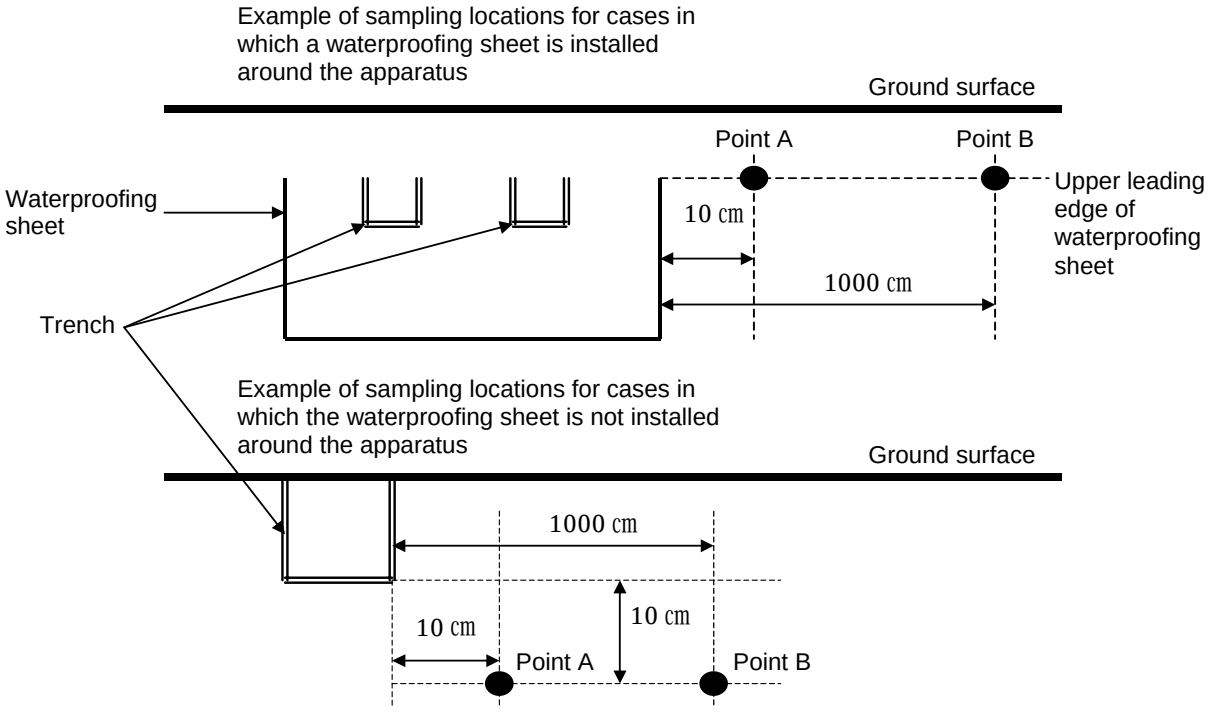


Figure 4. Sampling locations (Example)

(5) Treatment Capacity

Verifying treatment capacity requires monitoring to determine whether a single apparatus unit is working properly (operating status), whether the waste has been properly treated (treatment status), and how much and what kind of end product has been generated (end product status).

Table 9 shows the verification items for operating, treatment, and end product status for a unit apparatus and standard method for analyzing the respective samples. However, if the conditions of installation inhibit proper verification of an item, the items may be changed to suit local conditions. These verification items form the basis for determining whether the verification apparatus is operating properly and whether human waste treatment is proceeding adequately.

The sampling instrument will be specified in the Test Plan. The items to be recorded during sampling will be indicated on page 26 (1), the frequency and timing of sampling on page 26 (2), and sampling locations on page 27 (3). In general, the sampling method should adhere to the procedures defined in JIS or in the Test of Sewage. Specifics will be examined in the Test Plan.

Table 9-1. Verification Items for Treatment Capacity

	Classification	Verification Items	Analysis	Survey and Analysis Methods
1	Operational status of each unit apparatus		—	To be confirmed using configuration and function documents and maintenance manual
2	Circulating water	Increased water volume	—	To be examined in the Test Plan
		Color	—	Visual observation
		Odor	○	Confirmation of odor
		pH	○	JIS K 0102 12
		TOC	○	JIS K 0102 22
		BOD	○	JIS K 0102 21
		Chloride ions	○	JIS K 0102 35.1
		Suspended solids	○	Test of Sewage Volume 2, Chapter 2, Section 12
		Coliform group	○	Test of Sewage Volume 3, Chapter 3, Section 7
		Other	—	
3	Sludge	Color	—	Visual observation
		Odor	○	Confirmation of odor
		pH	○	JIS K 0102 12
		Residue on evaporation	○	Test of Sewage Volume 2, Chapter 4, Section 6
		Loss on ignition	○	Test of Sewage Volume 2, Chapter 4, Section 8
		Sludge volume	○	Test of Sewage Volume 2, Chapter 3, Section 8
		Suspended solids	○	Test of Sewage Volume 2, Chapter 4, Section 9
		Other	—	
4	Sawdust/cedar chips	Mixing and agitation condition	—	Visual observation
		Color	—	Visual observation
		Odor	○	Confirmation of odor
		Residue on evaporation and moisture content	○	Test of Sewage Volume 2, Chapter 4, Section 6
		Loss on ignition	○	Test of Sewage Volume 2, Chapter 4, Section 8
		pH	○	JIS K 0102 12 *1
		TOC	○	JIS K 0102 22 *1
		Electrical conductivity	○	JIS K 0102 13 *1
		Unit volume weight	○	Method adheres to Test of Sewage Volume 2, Chapter 4, Section 4
		Coliform group	○	Test of Sewage Volume 3, Chapter 3, Section 7 *1
		Other	—	

Table 9-2. Verification Items for Treatment Capacity

	Classification	Verification Items	Analysis	Survey and Analysis Method
5	Incineration Ash/Carbonized residue	Accumulated volume	—	To be examined in Test Plan
		Color	—	Visual observation
		Odor	○	Confirmation of odor
		Residue on evaporation	○	Test of Sewage Volume 2, Chapter 4, Section 6
		Loss on ignition	○	Test of Sewage Volume 2, Chapter 4, Section 8
		pH	○	JIS K 0102 12 *1
		TOC	○	JIS K 0102 22 *1
		Electrical conductivity	○	JIS K 0102 13 *1
		Other	—	
6	Gas emission *2	Ammonia	○	Test of Sewage Volume 2, Chapter 5, Section 2
		Hydrogen sulfide	○	Test of Sewage Volume 2, Chapter 5, Section 2
		Other	—	

* If the end product must be transported from the test site, measure the volume of each batch of transported material. Record the accumulated volume even in cases in which the end product does not need to be removed from the test site.

*1 The sample solution for analysis should be prepared according to the method of analysis given in Test Method for Metals Contained in Industrial Wastes (Ministry of the Environment Notification #13).

*2 For evaporation and combustion treatment methods, also examine verification items for SOx, NOx, CO, methyl mercaptan, and dioxin. Specify the corresponding analysis method in the Test Plan.

1) Items to Record During Sampling

Based on the JIS K 0094 "6. Items to Record During Sampling," the following items have been selected for recording during sampling:

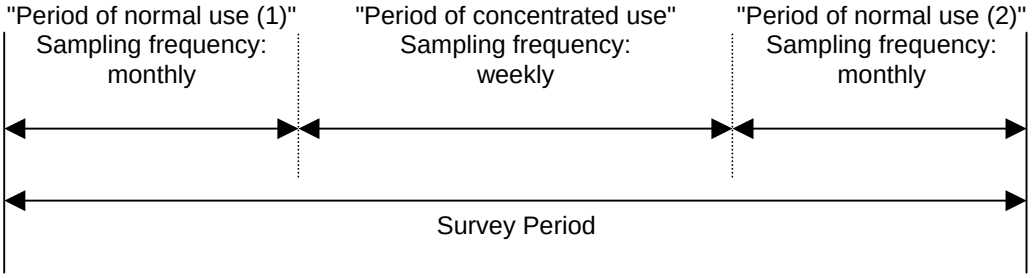
- Sample name and number
- Name of sampling site and location (if sample is not from the ground surface, indicate the sampling depth)
- Date and time of sampling
- Name of person performing the sampling
- Conditions of the sampling site (e.g., a schematic diagram showing the sampling site)
- Temperature of sample and ground temperature upon sampling
- Other details, such as sample appearance (color, turbidity, etc.), presence of odor

2) Frequency of Sampling and Timing of Survey

The test period should be divided into periods of concentrated and normal use, as shown in Fig. 5. Sampling is weekly for the former and monthly for the latter. However, if the technology involves the removal of end products from the test site, perform sampling at the time of removal. The period of concentrated use refers to a 4-week period during which the toilets at the installation site are used at maximum capacity. The actual period is to be specified by the Verification Organization after a review of the test site usage conditions. Periods of normal use refers to periods other than the period of concentrated use.

The sampling will be performed every Monday morning during the period of concentrated use. The sampling should be performed as close to the set time as possible. During periods of normal use, perform sampling on the first Monday of the month, at the same fixed time as during the period of concentrated use. If the Monday is a holiday, perform sampling on the next day.

For evaporation and combustion treatment methods in which human waste undergoes batch processing upon the accumulation of a certain volume, perform sampling simultaneously with such batch processing. Determine an appropriate frequency after considering both the frequency set in the previous paragraph and the operational frequency of the apparatus.



Note: Do not perform sampling during winter months if the test site is closed. However, confirm the operating status of the apparatus on startup at the beginning of the next season to verify wintering performance.

Figure 5. Sampling Frequency

3) Sampling Location

Table 10 shows end product sampling locations.

Table 10. End Product Sampling Locations

No	Classification	Sampling location
1	Circulating water	Washwater to low tank or to toilet bowl, or in the reservoir immediately upstream
2	Sludge	A reservoir set aside for sludge accumulation (for example, a sludge collection tank)
3	Sawdust/cedar chips	Agitation tank
4	Incineration ash/carbonized residue	Reservoir for incineration ash and carbonized residue
5	Gas emission	Mouth of verification apparatus exhaust pipes

VI. Analysis of Verification Test Data

1. Data Quality Management

(1) Precautions for Data Management

The field of mountain-district human waste treatment covers a wide range of technologies, and verification items are also similarly complex and varied. Items range from quantifiable measurements to more subjective observations. Thus, some basic precautions must be heeded to increase the certainty and reliability of the data obtained through these verification tests.

These precautions are given below.

(a) For verification items that require sample analysis, verification must be performed by environmental measurement certification businesses or an organization capable of certifying the same level of data quality control.

(b) The treatment capacity of human waste treatment technology in mountain districts is significantly affected by the natural environment and usage conditions. Data that can be collected automatically such as those for weather and number of users should be processed automatically.

(c) Collect data for verification items that cannot be acquired automatically through careful compliance with the standardized format to minimize inconsistencies in technique from one observation to the next.

(d) Variations in weather conditions and user load will vary from test site to test site. If clearly anomalous values are detected during data processing, the appropriate response will depend on the extent to which they are the end results of weather, usage, and operating factors.

(2) Data Analysis and Presentation

Give due consideration to maintaining confidentiality requested by the verification applicant when disclosing information in the Verification Report on the test site, verification environment, and technical specifications for the verification apparatus.

The data obtained by the verification tests will be analyzed and compiled for easily understandable presentation to a wide range of users, particularly the toilet installation businesses who will be the primary consumers of such human waste treatment technologies in mountain districts. In the sample analysis and discussion of the results, duly consider the operating status of the verification apparatus and the natural environmental and usage conditions at the time of sampling.

Below are the standard analysis and presentation method for each verification checkpoint.

1) Analysis and Presentation Methods for Operating Conditions and Status

(a) Time-series data and a graph showing transitions in number of toilet users, volume of replenished water, volume of consumed water, electrical power consumption, volume of consumed fuel, and temperature

(b) Minimum, maximum and monthly means for the number of toilet users, volume of replenished water, volume of consumed water, electrical power consumption, volume of consumed fuel, and temperatures

(c) Type, volume, and cost of consumed raw materials

2) Analysis and Presentation Methods for Maintainability
   (a) Summary of observations
   (b) Summary of ease of operation of the verification apparatus
   (c) Workability during preparations for opening and closing of mountain and the wintering performance of the apparatus
   (d) Summary of the ease of use during transportation, processing, and disposal of end products, and when problems arise
   (e) Monthly mean of manpower and work time required for both routine and technical O&M
   (f) Summary of required worker skills
   (g) Summary of the user friendliness of the routine operating manual and O&M instruction manual for technical supervisors, and the accuracy of entries and items in the manual

3) Analysis and Presentation Methods for Indoor Conditions
   (a) Time-series data on temperature and humidity and graphs showing transitions in temperature and humidity
   (b) Maximum, minimum, and monthly means for temperature and humidity

4) Analysis and Presentation Methods for Effects on Surrounding Environment
   (a) Summary of observations
   (b) Observations, photographs, and measurements of areas with altered soil surfaces
   (c) Graphs showing changes in analysis results for soil samples from surrounding areas
   (d) Sampling dates and sample numbers of the data shown in graph

5) Analysis and Presentation Method for Treatment
   (a) Summary of observations
   (b) Graph showing changes in sampling results
   (c) A graph showing the correlation between data and the number of toilet users (Also provide graphs on operating factors and status items that show a strong correlation with the data.)
   (d) Sampling dates and sample numbers of the data shown in the graph
   (e) Discussions of results and their correlation to operational and usage conditions

VII. Preparing the Verification Report

The results obtained in the verification test are to be compiled as the Verification Report.

The Verification Organization, verification test organization, and the verification applicant will review the draft for the Verification Report. The final draft of the Verification Report is submitted to the Verification Organization following review by the Technology Panel.

The Verification Report should contain the following information. A concise summary of the report should also be prepared.

- Summary
- Background and Objectives
- Characteristic features and technical specifications of the target technology
- Verification processes
- Profile of the manufacturer (name of organization, name of representative, name of person in charge, address, telephone and fax number, etc.)
- Verification test site and test period
- Conditions for the verification test (the natural environment, infrastructure conditions, utilization conditions, etc.) and layout
- Verification test system (including system for maintenance)
- Verification test method
- Description of verification items and sampling method, sampling conditions, and measurement results
- Routine recording of test conditions
- Sample analysis method
- Results of sample analysis and discussions
- Results of verification test and examination
- References
- Appendix (Verification Test Plan, reference material submitted by verification applicant, sample management and analysis method, monitoring and maintenance records)

Appendix 1: Application form for the Verification of Human Waste Treatment Technologies in Mountain Districts

1. Applicant

Company name	Seal
Address	〒
Tel & Fax number	TEL FAX
E-mail	
Name of person in charge	
Division	

2. Overview of Verification Apparatus

Item	Entry
Name of apparatus	
Waste treatment method	(1) Biological (2) Chemical (3) Soil Treatment (4) Evaporation and Combustion (5) Composting (6) Other ( )
Model number	
Manufacturer	
Contact	Person in charge:
	TEL FAX
	E-mail:
Price (yen)	
Installation requirements	Water: (1) Dependable supply required (2) Only initial volume necessary (t) (3) Not required * Volume of replenishment (t/month)
	Electric power: (1) Required (kWh/d) (2) Not required
	Access to roads: (1) Required (2) Not required
Fuel type	Type of fuel ( ), consumption (l· kg· Nm^3/month)
Required resources	Type of resources ( ), consumption (l· kg· Nm^3/month)
Temperature	Temperature range for normal operations (ºC)
Apparatus type	Design of toilet and treatment apparatus: (1) integrated unit (2) separate units installed close to each other

Dimensions	Integrated unit types: w (mm) × d (mm) × h (mm)
	Separate unit types (specify dimensions only for the treatment apparatus): w (mm) × d (mm) × h (mm)
Weight	Integrated unit types: t Separate unit types (only for the treatment apparatus): t
Treatment capacity	Normal usage conditions: persons/day (liters/day) Concentrated usage conditions: persons/day (liters/day) * Calculate using a unit volume of human waste liters/usage.
Method of final disposal	
Warranty period	years
Amortization period	years
Operating costs	yen/month
Number of devices previously installed	facilities
Miscellaneous (Special notes)	

* Documents to attach to this application form

(1) Information on the candidate verification test site

- Location
- Natural environmental conditions
- Access to social infrastructure
- Condition of use

(2) Information on apparatus

- Design concept
- Explanation of structure and functions
- Design standards
- Standard plans
- Installation records
- Technical performance data
- O&M instruction manual for technical supervisors
- Installation requirements

(3) Other

- Company profile
- Reference materials

Appendix 2. Verification Test Plan

The contents of the Verification Test Plan must be discussed in-depth with the verification applicant, taking into consideration comments and advice from the Technology Panel. The specifics of the Test Plan may differ depending on the target technology and test site. However, they should include at least the following:

1. Cover sheet, approval of verification test participants, table of contents
2. Description and objectives of verification test
3. Participating organizations and the responsibilities of the participants
4. Overview of the target verification technology for mountain-district human waste treatment
   - General features and technical overview specifications of the target technology
   - Design concept
   - Description of system configuration and functions
   - Design standards
   - Standard plan
   - Installation records
   - Results of in-house testing
   - Routine operations manual
   - Installation manual
   - O&M instruction manual for technical supervisors
   - Installation requirements
   - Sources of information on verification test site
   - Company profile
   - Reference materials

   The verification applicant must attach a data plate to a prominent location on all components of the verification apparatus. The data plate must provide the following information:
   - Name of target verification apparatus
   - Model #, serial number
   - Company name, address, person in charge of project, contact in case of emergency
   - Power supply voltage, phase, current, and frequency
   - Precautions for handling and shipping
   - Clear precautionary statements or warnings
   - Treatment capacity, etc.

5. Verification Test Method

(1) Method of verifying treatment performance and effects on surrounding environment

- Verification item
- Name of person performing the sampling
- Frequency and system of sampling
- Sampling method
- Sample storage methods
- Types of analyses
- Specifics of system and location of facility performing analyses
- Analysis methods & instruments
- Analysis schedule
- Method of documentation

(2) Method of verifying O&M

- Routine O&M and technical O&M
  - Person or organization in charge
  - O&M schedule, time, number of persons, system
  - Description of work
  - Surveyed items
  - Recording style

6. Appended Materials

The following materials are to be appended to the Test Plan:

- O&M instruction manual for technical supervisors
- Routine operations manual
- Workplace sanitation and safety plans
- Other documents and reference data

Appendix 3. Review of Developments in the Working Group for Human Waste Treatment Technologies in Mountain Districts

First meeting held on Thursday, June 26, 2003, from 14:30 to 16:55

Agenda

- Outline of the pilot project for environmental technology verification
- Protocol for Verification Tests on Human Waste Treatment Technologies in Mountain Districts (draft)

Second meeting held on Friday, July 18, 2003, from 10:00 to 12:00

Agenda

- Protocol for Verification Tests on Human Waste Treatment Technologies in Mountain Districts (draft)
- Solicitation of verification organization

Third meeting held on Wednesday, October 15, 2003, from 18:30 to 20:00

Agenda

- Distribution of transportation expenses relating to the installation of human waste treatment apparatuses in mountain districts
- Balance between human waste treatment capacity and load of target technology
- Protocol, Test Plan and on-site coordination
- Establishment of an organization to implement a verification process

Fourth meeting held on Thursday, November 25, 2003, from 14:40 to 16:40

Agenda

- Review of issues relating to the future implementation of verification tests on human waste treatment technologies in mountain districts
- Review of Provisional Protocol for Verification Tests on Human Waste Treatment Technologies in Mountain Districts for FY2004 (draft)

Fifth meeting held on Thursday, February 5, 2004, from 13:30 to 15:30

Agenda

- Provisional Protocol for Verification Tests on Human Waste Treatment Technologies in Mountain Districts for FY2004 (draft)
- Solicitation of verification organization for mountain district human waste treatment technologies for FY2004

Sixth meeting held on Tuesday, March 9, 2004, from 13:30 to 16:00

Agenda

- Provisional Protocol for Verification Tests on Human Waste Treatment Technologies in Mountain Districts for FY2004
- Selection of a verification organization (candidate) for mountain district human waste treatment technologies for FY2004

Appendix 4. Revision History of the Protocol for Verification Tests on Human Waste Treatment Technologies in Mountain Districts

First Edition: Published August 8, 2003

Second Edition: Published June 2, 2004

(Content of revisions made to the first edition)

- Technical terms have been organized (overall).
- The information to be provided relating to the (candidate) test site has been stipulated.
- The design concept has been added to the information to be provided relating to the apparatus.
- It has been stipulated in the selection procedures that the verification applicant should be interviewed regarding the target verification apparatus, if necessary, during the selection stage.
- The content of explanations for human waste treatment methods has been modified.
- It has been stipulated that the conditions of the natural environment at the test site should be recorded in as much detail as possible.
- The items necessary to determine the acceptable range have been added to the verification items for indoor conditions.
- The “Treatment of Intellectual Property” section has been added.

Appendix 5. Committee on the Pilot Project for Environmental Technology Verification for FY2003

Members List of Working Group for Human Waste Treatment Technologies in Mountain Districts

Kazumasa Kashiwabara	Kashima-yari Kanko Kaihatsu, Inc. (Tsumetaike cottage, Taneike cottage, Shinkoshi Norikoshi cottage)
Toshiro Sakurai	Plant & Environment Headquarters, Mitsui Engineering & Shipping Co., Ltd.
Tomio Suzuki	Chief Researcher, Nagano Environmental Conservation Laboratory
Naoyuki Funamizu	Professor of Graduate School of Engineering at Hokkaido University
Takeaki Mori	Professor of Department of Electrical and Electronic Engineering at Kanagawa Institute of Technology (Chairman)
Takao Yoshida	Representative of the Environmental Resources Conservation Study Group (NPO)
Takao Watanabe	Executive Researcher at Research and Study Department of Japan Education Center of Environmental Sanitation

(Listed in order of the Japanese syllabary)

[Secretariat (Ministry of the Environment)]

Mitsuo Tsukakoshi	Manager of Division of Park Facilities and Conservation Technology, Nature Conservation Bureau
Yoichi Sakurai	Assistant Manager of Division of Park Facilities and Conservation Technology, Nature Conservation Bureau
Yasuo Ishigaki	Technical Specialist of Division of Park Facilities and Conservation Technology, Nature Conservation Bureau
Nobuhiro Kino	Coordination Specialist of Environmental Technology and Research Office, Environmental Policy Bureau
Takafumi Araya	Section Head of Education and Promotion, Office of Johkasou Management, Waste Management Division, Waste Management and Recycling Department

[Secretariat (Chiiki Koryu Center Kikaku Co., Ltd.)]

Koo Ue	General Manager (Director) of Toilet Research and Planning Division
Takemi Harada	Assistant General Manager of Toilet Research and Planning Division
Atsushi Kato	Chief Researcher of Toilet Research and Planning Division