Reactor Plant Safety Course FY2010
Winter Course

RPSC-Winter Course L-5

Process from Site selection to Construction of Nuclear Power Plant

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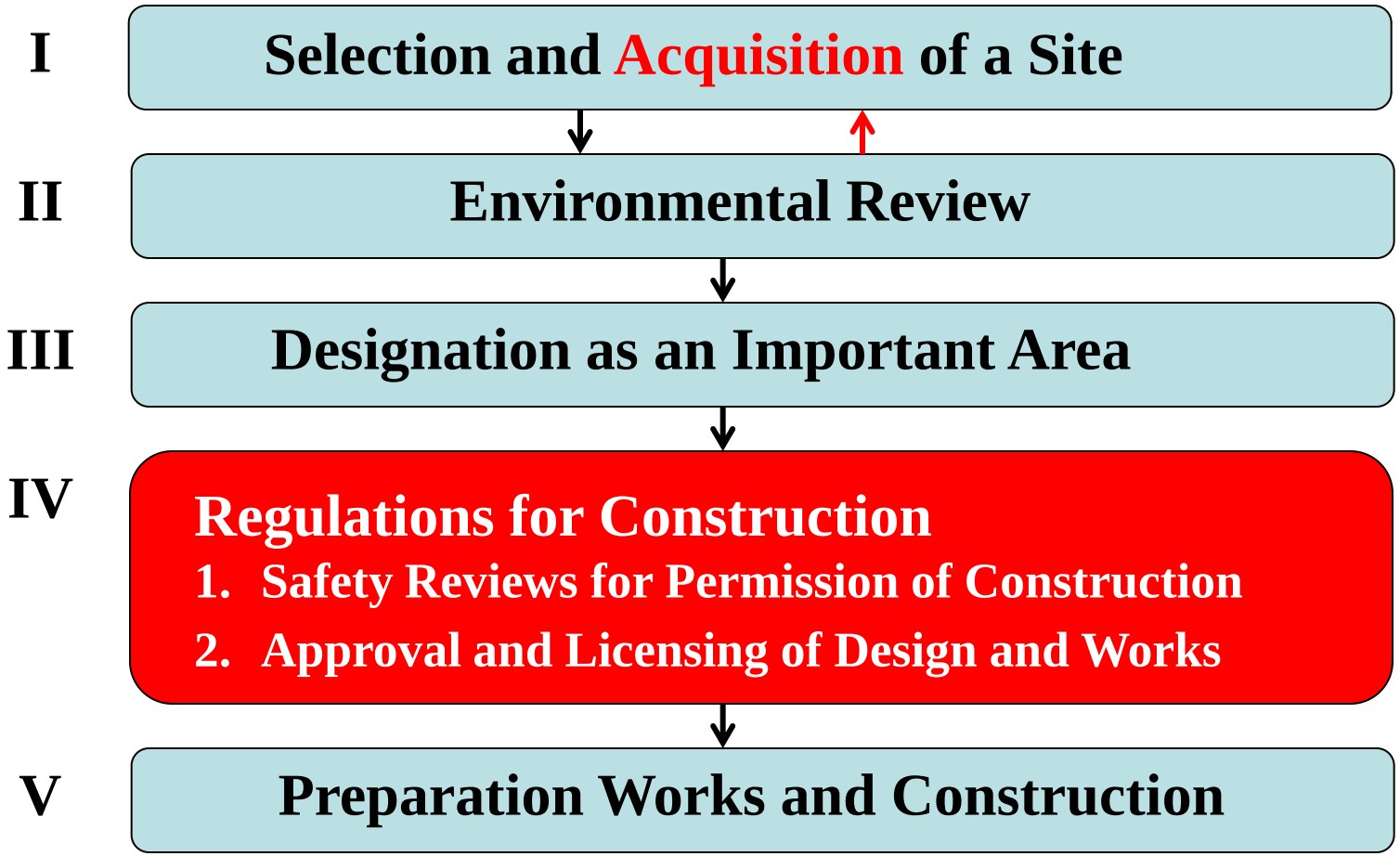
Main flow toward Construction of Nuclear Power Plant



Background

-Structure of Legal System for Nuclear Safety Regulations in Japan-

Atomic Energy Basic Law

- **Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors**
- Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors
- **Law concerning Prevention of Radiation Hazards due to Radioisotopes, etc.**
- **Electricity Utilities industry law (Regulations on Nuclear Power Reactors)**

- Atomic Energy Basic Law -

- Basic policies
  - Peaceful utilization
  - Ensuring safety
  - Democracy and independence
  - Disclosure to the Public
- Establishment of
  - Atomic Energy Commission (AEC)
  - Nuclear Safety Commission (NSC)
- Establishment of Nuclear Research and Development Institutions
  - Japan Atomic Energy Agency(JAEA)
- Regulations for nuclear fuel materials, reactors and others
- Prevention of radiation hazards and others

- Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors -

Objectives:

- Enforce the necessary regulations on
  - manufacture, processing, storage, reprocessing and disposal activities of nuclear source materials, fuel materials and nuclear reactors
  - utilization of nuclear fuel materials and others
  - installation and operation of nuclear reactors to utilize nuclear source materials, fuel materials and reactors exclusively for peaceful purposes
- Ensure the planned enforcement of these regulations
- Prevent disasters due to these materials and reactors
- Protect fuel materials and consequently ensure public safety
- Enforce the necessary regulations on internationally regulated materials to comply with international agreements.

- Electricity Utilities Industry Law -

Objectives:

- **Protect the benefit of electricity comsumers and promote sound development of the electricity utilities industry by making management of electricity utilities industry appropriate and rational.**

- **Ensure public safety and envilonmental preservation by regulating manifacture, works, maintenance and operation for electric equipment, system and plant.**

I. Selection and Acquisition of a Site (for commercial use)

Approaches by Electric Power Supplier (EPS)

Selection of Candidate Sites

- Environmental investigation for each candidate
- Application to Ministry of Economy, Trade and Industry (METI) for Environmental Review for a Site according to the *Electricity Utilities industry law.*
- Approval of the Environmental Review from METI.
- Site acquisition and Agreement on Compensation for Fishery

Selection of Candidate Sites

(1) Enough Cooling Water

- Clean, Stable Supply

  *All Japanese NPPs are built on the coast lines.

(2) Stable Ground

- Existing of stable bedrock near the surface
- **No big active faults** near the Site

(3) Little Influence to Circumference

- Avoiding the place near cities from the viewpoint of Public Exposure and Evacuation Plan (Keep distance between the site and residential area.)

(4) Enough Site Space

- Enough Space for Construction and Accessibility to the Site

(5) Local Consent

* In Japan, getting agreement from local residents is indispensable and is the most important factor.

Original plan of Construction Site of Monju (1/2)
(Haseda area ,1970)

Original plan of Construction Site of Monju (2/2)
(Haseda area ,1970)

Guideline for the Environmental Review

Effect factors and Environmental elements

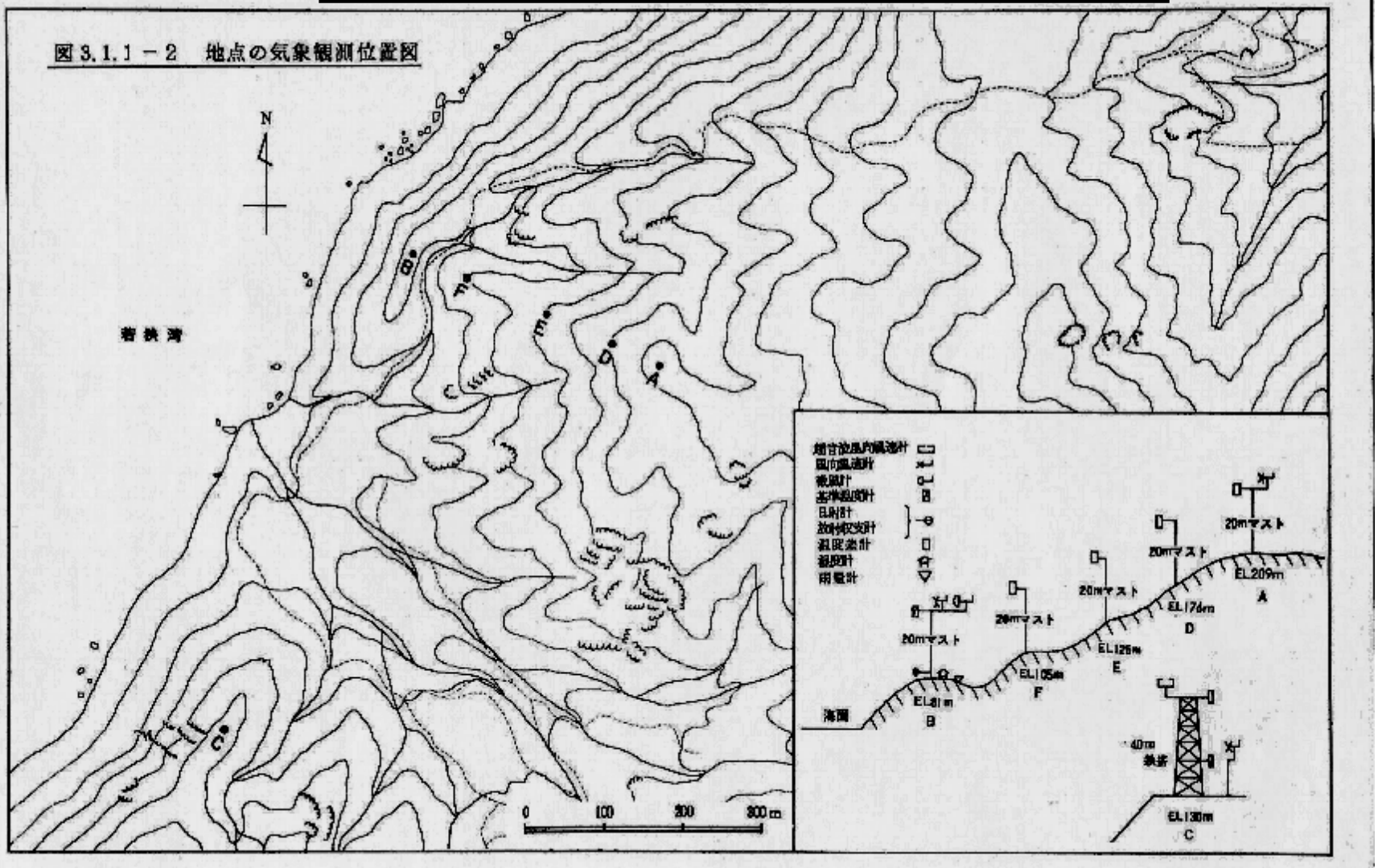
1. Considerations for Construction

- **Preservation of natural elements: Air quality, Noise, Vibration, Water quality, Industrial waste and Waste soil.**

2. Site, Existence of Facilities, and Operation

- **Preservation of natural elements: Atmosphere environment (noise and vibration) , Water environment (contamination, eutrophication, temperature)**
- **Securing biological diversity : Animals (important species, living in the sea), Plants (important species, growing in the sea), Ecosystem (local endemism)**
- **Affluent nature (scenery, rich contacts between people and nature)**
- **Environmental Load (Storage, Transport, and Treatment of waste)**

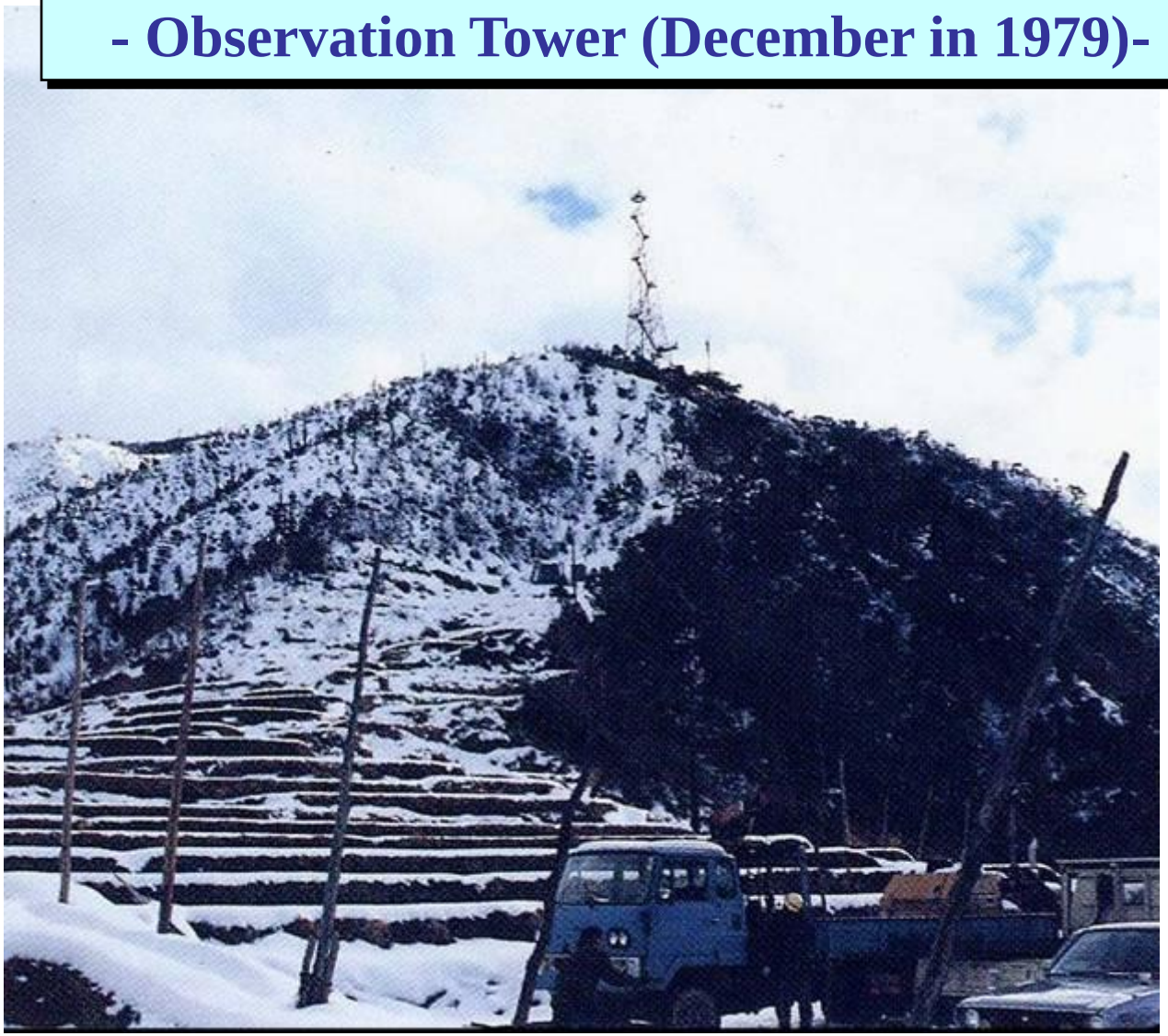
1) Meteorological Observation (1/3)
- Measuring points-



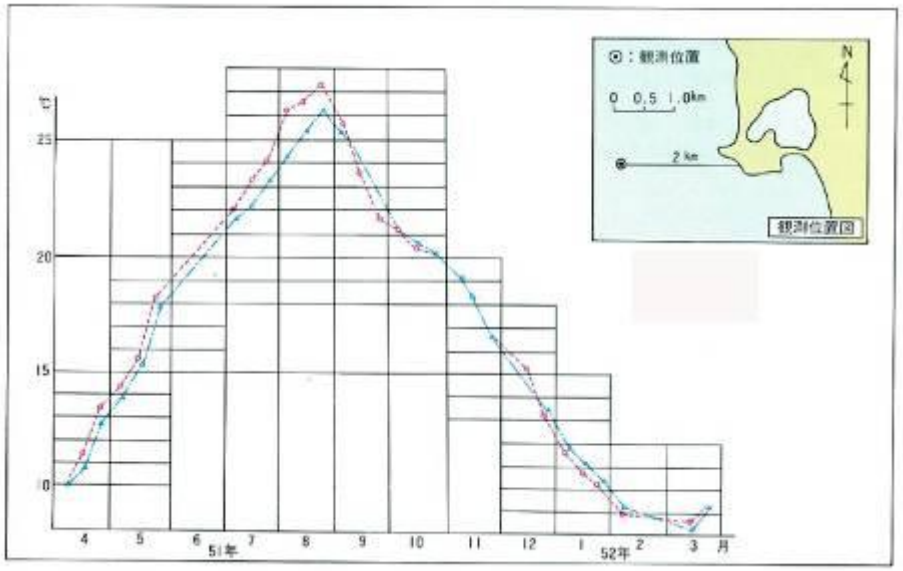
1) Meteorological Observation (2/3)

1) Meteorological Observation (3/3)

- Observation Tower (December in 1979)-



2) Marine Survey (1/2)
- Investigation of Water Temperature and Current in the front of Monju Site (July, 1978) -



Monthly Average Sea Temperature near Mihama NPP (FY. 1976)

2) Marine Survey(2/2)

-Investigation of Living in the sea near Monju Site (July, 1978)-

3) Animal-Plant Survey (1/2)

(A Japanese antelope appeared in the Site, in December 1986)

Animals (Mammals)

9 species of mammals were living.: Asian black bear, raccoon dog, fox, weasel, rabbit, squirrel, monkey, Japanese antelope, etc.

Birds

51 species of birds are observed.

3) Animal-Plant Survey (2/2)

- Plant Investigation near Monju- (June in 1982)

4) Environmental Radioactivity Investigation

-Monitoring Box for Natural Radioactivity (Jan. 1987)-

II. Environmental Review (Evaluation on environmental effect)

Objectives:

Before applying for Construction Permission, investigate and evaluate the effect on environment due to construction and operation.

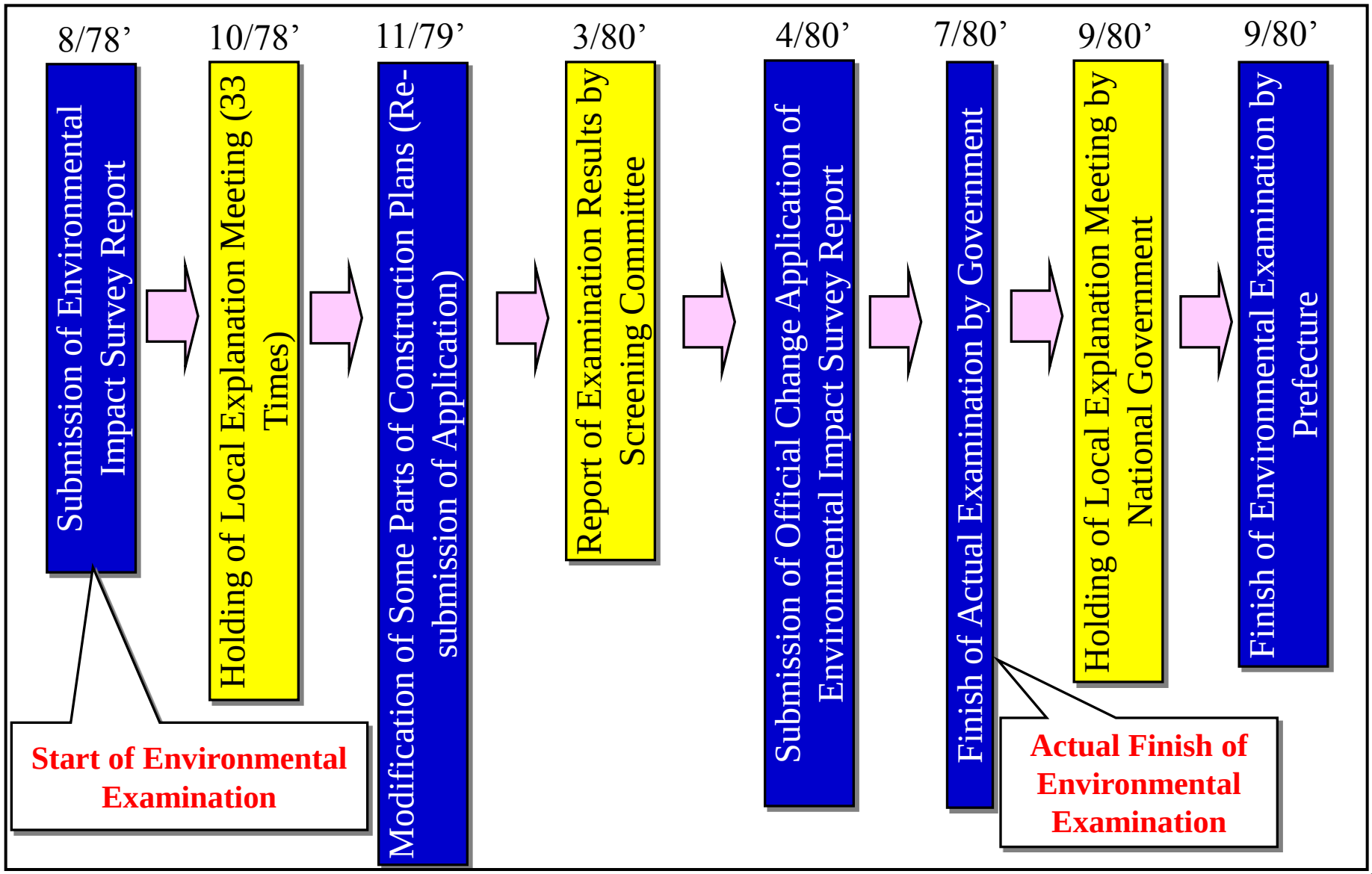
Methods:

Stage-1: Review of the Document on Methods for Evaluating Environmental Effect

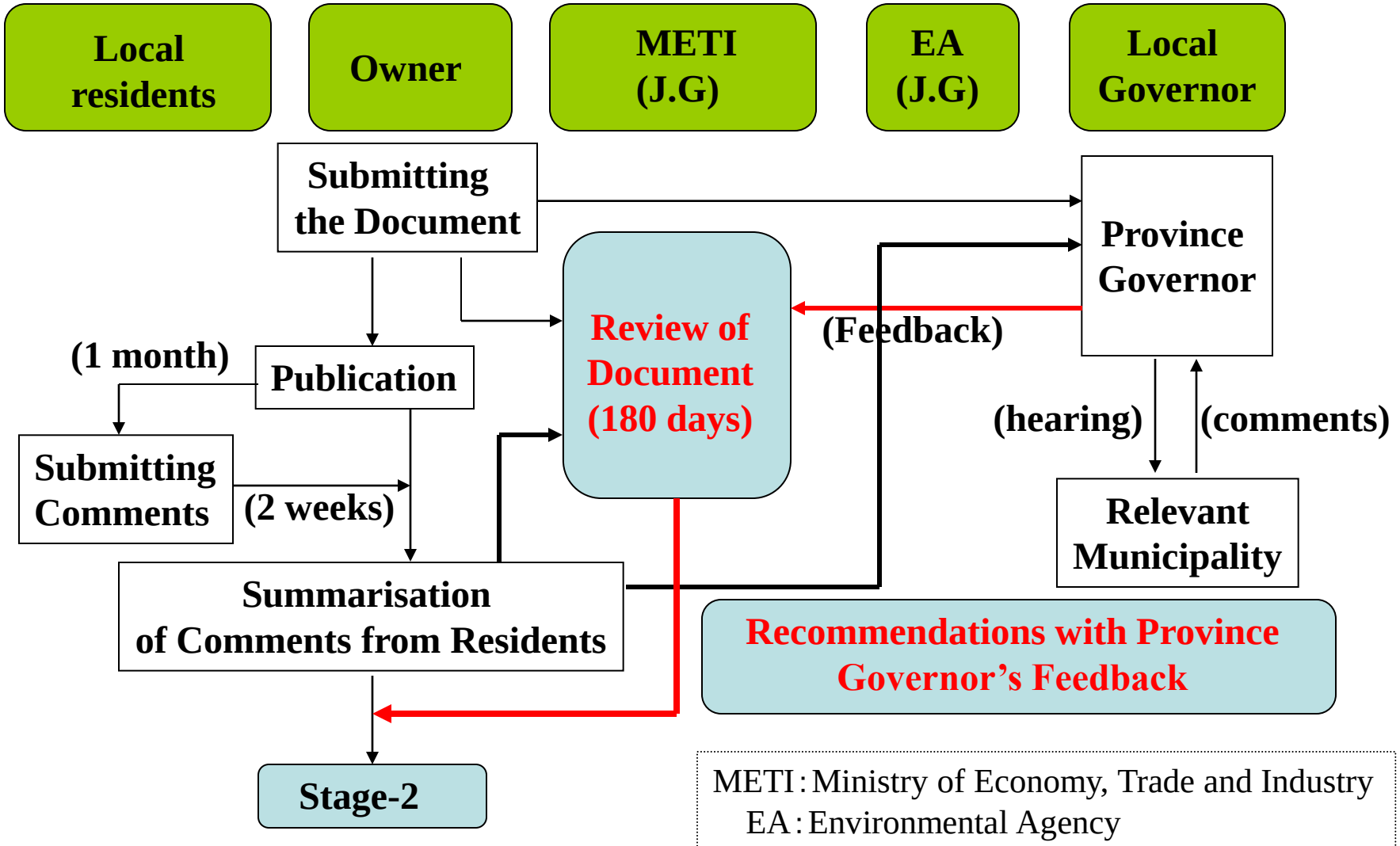
Stage-2: Review of Preparation Document for Evaluating Environmental Effect.

Stage-3: Review of the Evaluation Reports on Environmental Effect.

Milestone of Environmental Examination (for Monju)

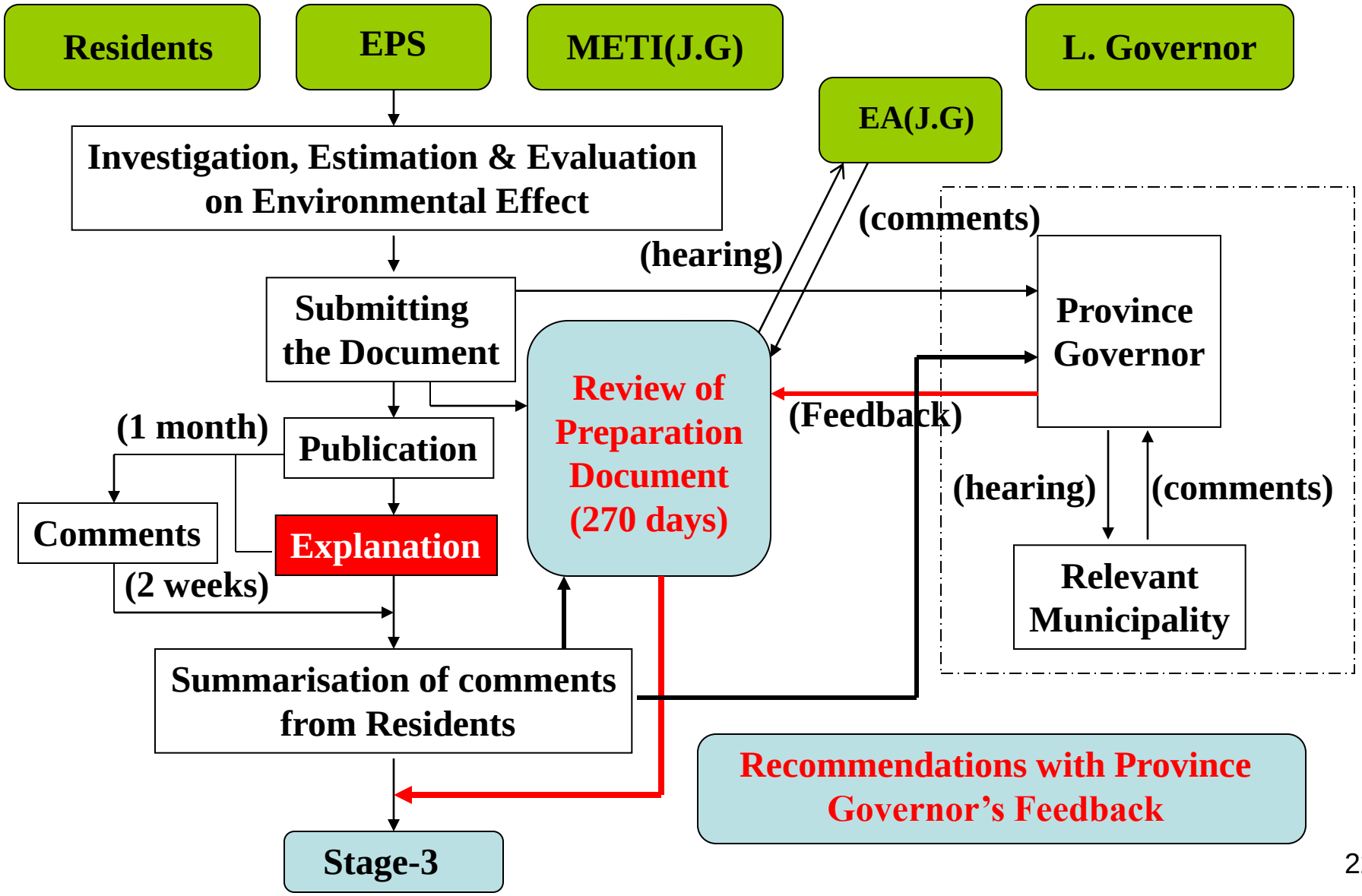


Stage-1. Review of the Document on Methods for Evaluating Environmental Effect



METI : Ministry of Economy, Trade and Industry
EA : Environmental Agency

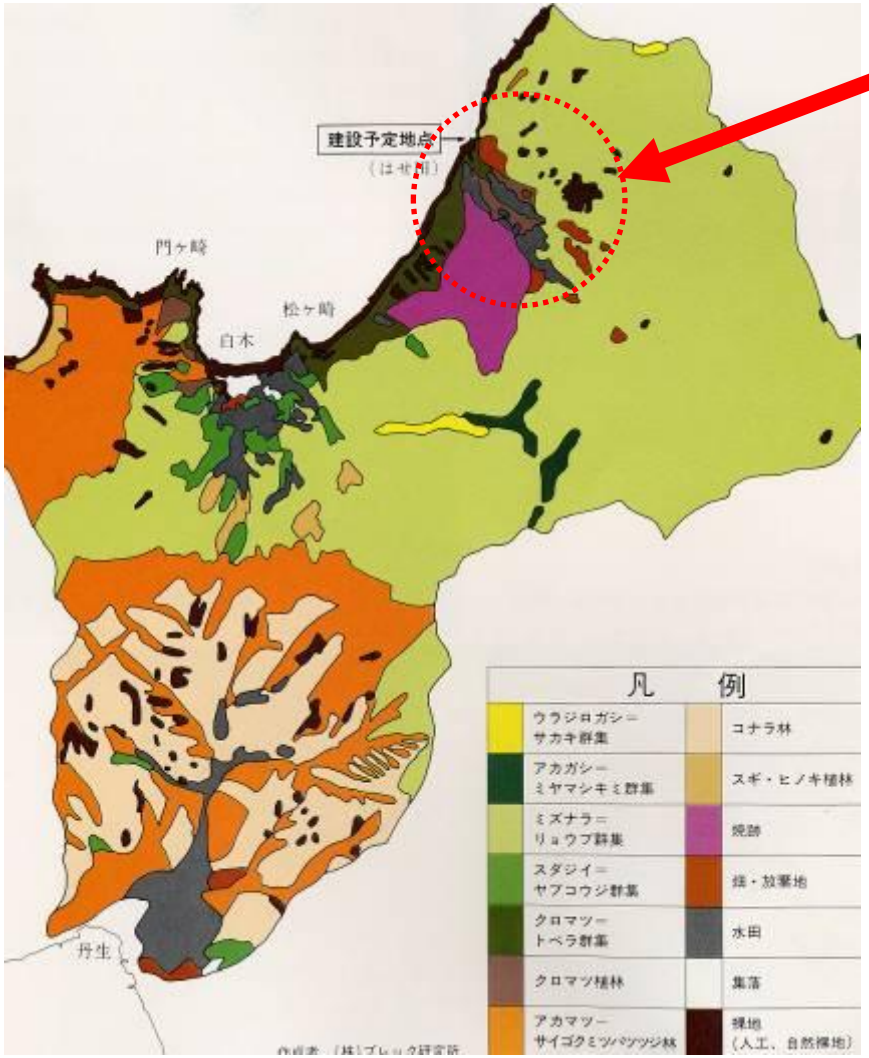
Stage-2. Review of the Preparation Document for Evaluating Environmental Effect



Site investigation for Environmental Review of Monju

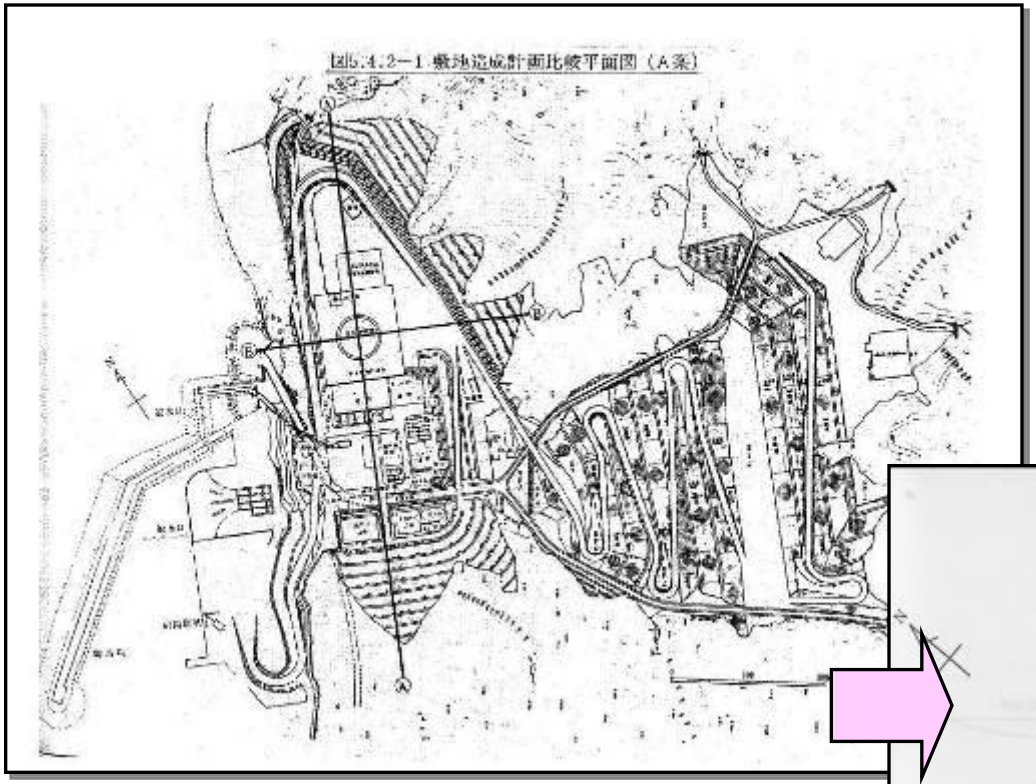
<March 1980>

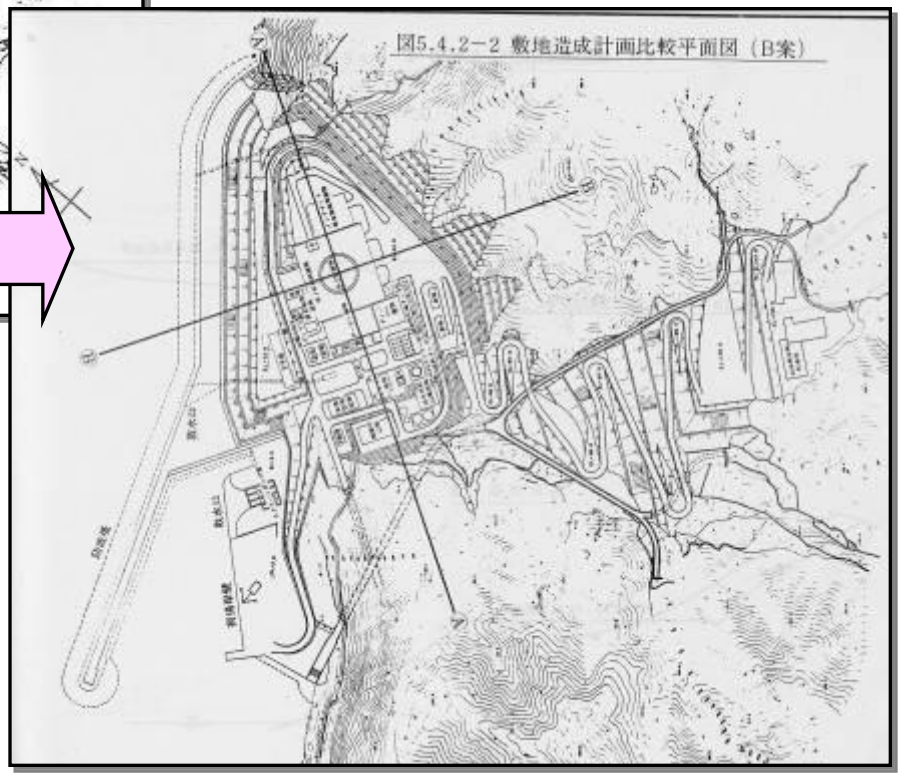
Modification of Construction Plan based on Natural Conservation Law



Preservation of a black pine forest.

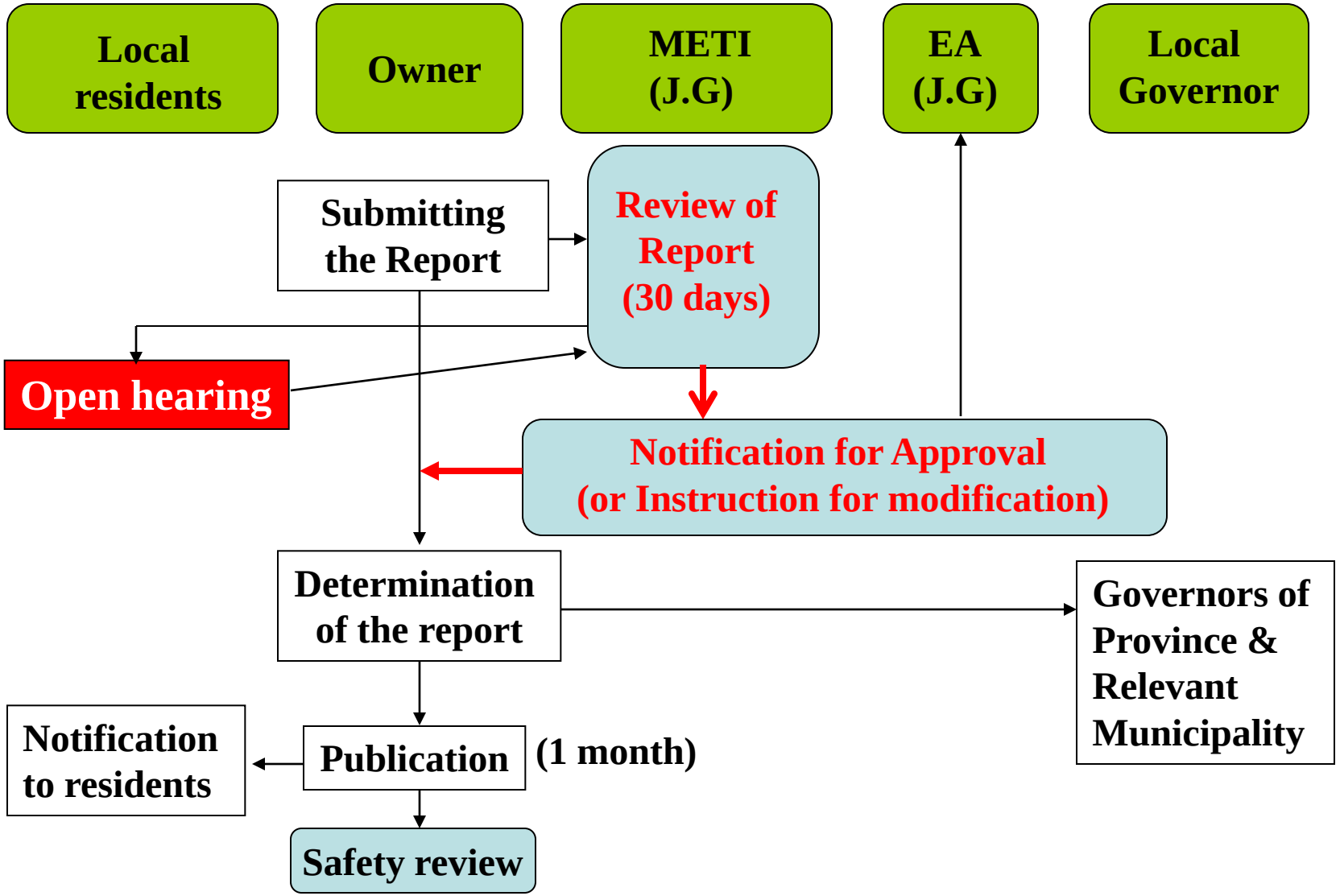
Modification of Site Arrangement of Monju





In order to preserve natural environment as much as possible, site arrangement of Monju was changed.

Stage-3. Review of the Evaluation Reports on Environmental Effect



Local Explanation Meeting for Monju (Open hearing) at Tsuruga City（Sep. 1980）

Environmental Investigation (Preparatory Investigation for Safety Review)

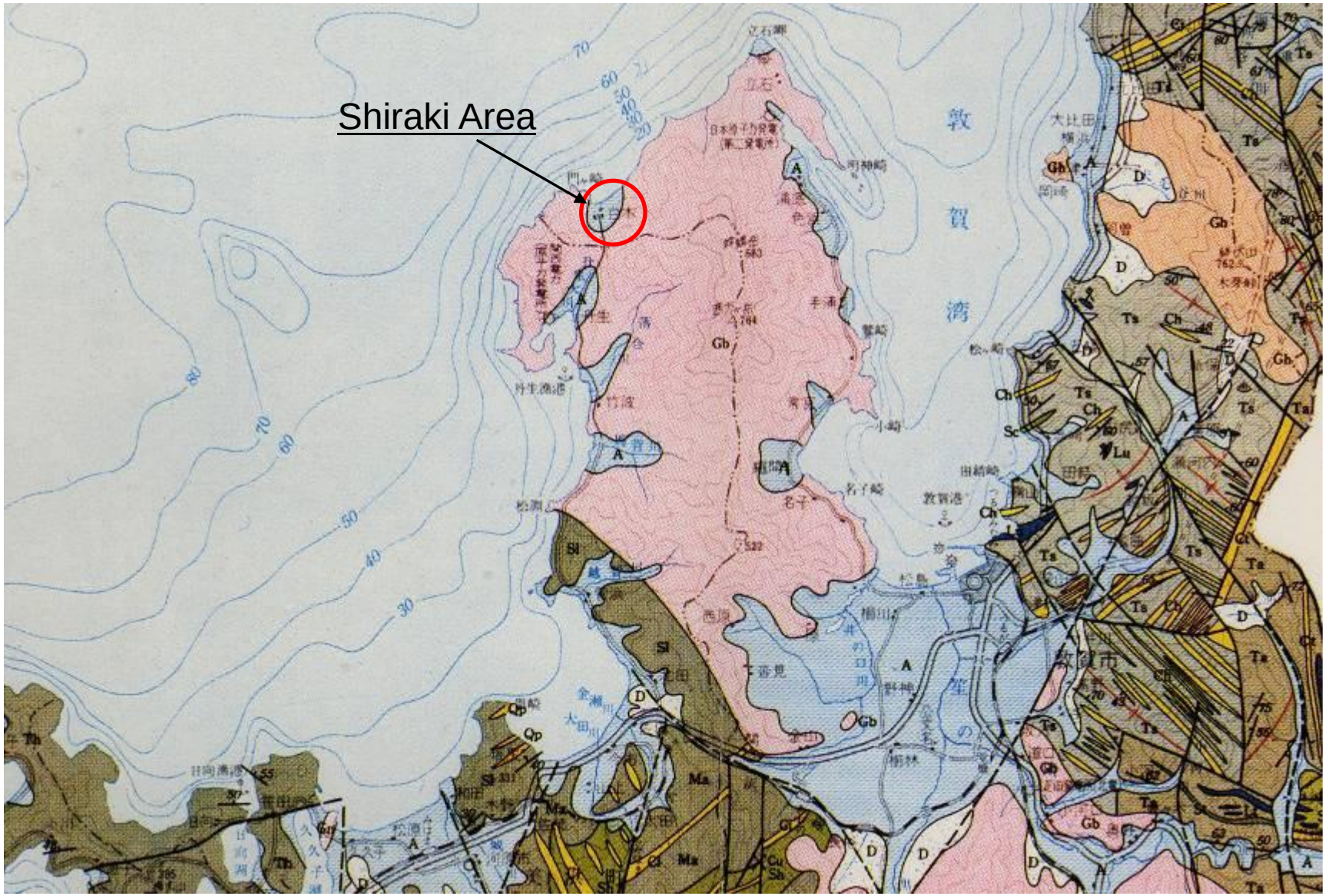
- **Objectives:**

  Prove the site has not any possibility which could cause a significant accident at the nuclear plant.

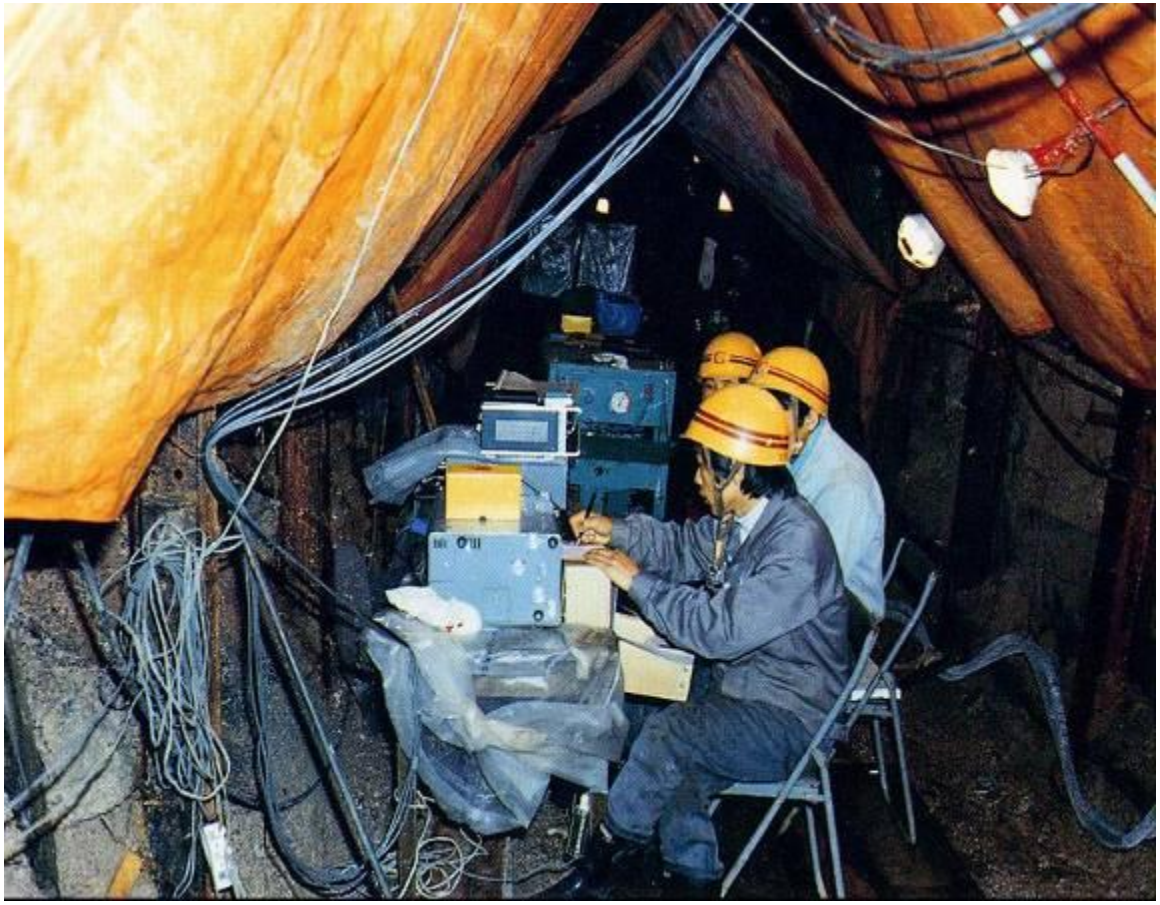
- **Evaluation elements**

  Meteorology, Ground, Hydraulics (groundwater), Earthquake, Social surroundings.

Geological Survey (1/5)



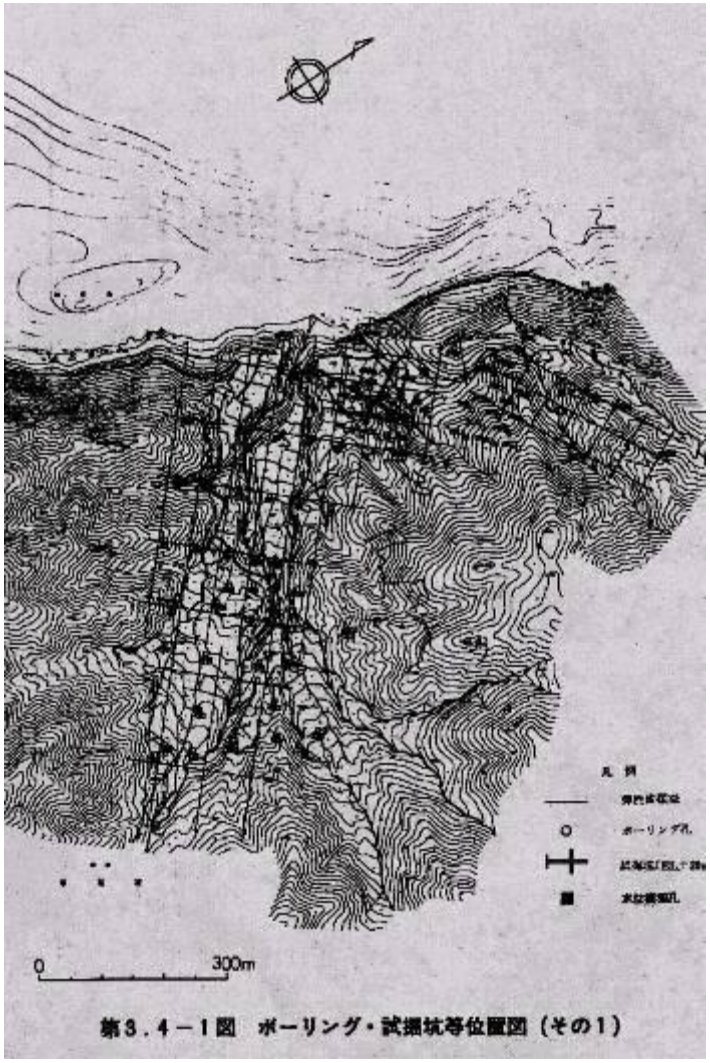
Geological Survey (2/5)
-Investigation on base rock layer (November 1976) -



Geological Survey (3/5)
-Investigation on base rock layer (November 1976) -

- The various tests were carried out in the test pit for the base rock investigation.
- Consequently, it was proved that the superior ground as the foundation of reactor facility existed.

Geological Survey (4/5)
- Bowling Survey Points -



第3.4－1図　ボーリング・試掘坑等位置図（その1）

Geological Survey (5/5)

The seismography recorder was installed near the planned construction place since October 1976.

Past Earthquake Investigation

- The earthquakes which caused significant damage to Local in the past were investigated by literature research.
- Consequently, there are a total of ten significant earthquakes.

Active Fault Investigation

- Active fault investigation is the most important item in seismic investigation.
- In recent years, precise active fault data can be acquired by development of bowling surveillance technology.

Seismic Observatory

III. Designation as an Important Area

- Government Policy for Electric Power Development-

October 2004:

Cabinet council approved ***"For Designation of the Area for Electric Power Development"*** instead of the *"Electric Power Development Plan"* based on *"Electric Power Development Promotion Act"*.

February 2005:

"Stipulation for Designation of the Important Area for Electric Power Development" was established by Ministry of Economy, Trade and Industry (METI).

Objectives:

Facilitating agreement with the local area, and the approval & licensing by relevant ministries by designating the proposed sites from electric power suppliers as an important areas for Electric Power Development.

Designation as an Important Area

- **The minister of METI** designates important areas based on cabinet council approval according to the request from electric power suppliers.
- **Intended Electric Power:** Long term stationary and **no CO_2 emission power** such as Nuclear, Hydraulic and Geothermal.
- **Contents:** Address of the Site, Method, Power Output.
- **Procedures:** Hearing from the Province Governor and negotiation with relevant ministries.
- **Purposes:**

  1) Facilitating the agreement with the local area and the approval & licensing by the relevant ministries.

  2) Premium state subsidies based on the laws for electric power development to the local bodies.

IV. Regulations for Construction:

- **Before construction:**
  IV-1. Review for Construction Permission (Safety Review)
  IV-2. Review for Approval and Licensing of Design, manufacture and Works

- **During Construction (until Commercial Operation Start)**
  - Pre-service Inspection for Manufacturing, Works and Performance.
  - Review of Safety regulations for Operation of each Power Station (before fuel loading into the core)

- **After Commercial Operation Start**
  - Periodical Inspection

Nuclear Safety Regulatory Organizations in Japan - Regulating Areas by METI -

Organisation responsible for ensuring safety in utilisation of atomic energy
- Nuclear and Industrial Safety Agency (NISA) -

- **Commercial power reactors**
- **Refining of fuel resources**
- **Processing**
- **Reprocessing**
- **Disposal of wastes**
- **Reactors in research and development phase (FBR Monju and ATR Fugen)**
  - Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors.
- **Response to nuclear disasters**
  - Special Law of Emergency Preparedness for Nuclear Disaster

Nuclear Safety Regulatory Organizations in Japan - Regulating Areas by MEXT -

Organisation responsible for ensuring Nuclear Safety in the field of science and technology
-Nuclear Safety Division, Science and Technology Policy Bureau -

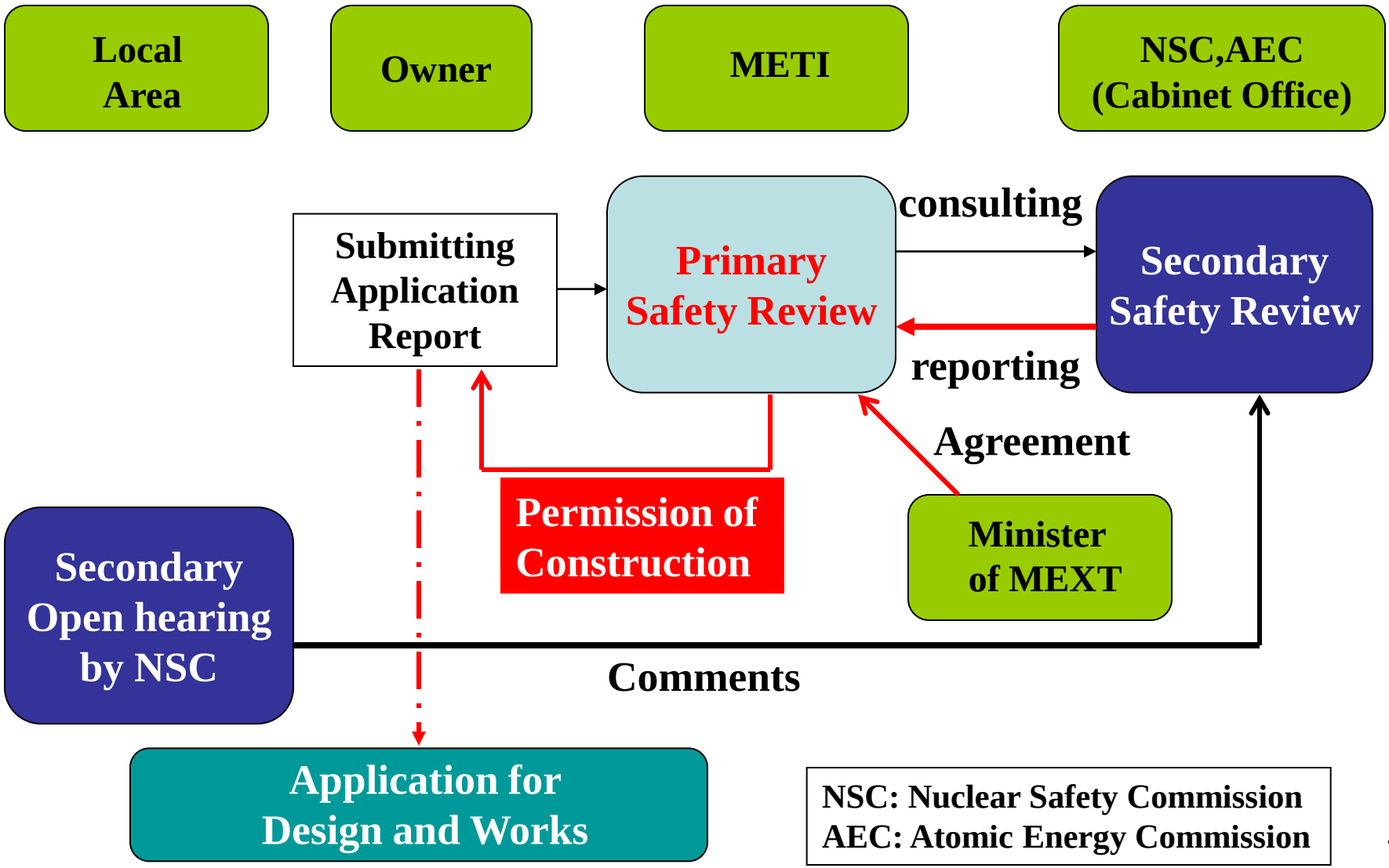
- **Radioisotopes**
- **Generating equipment**
  - **Law concerning Prevention of Radiation Hazards due to Radioisotopes, etc.**
- **Response to nuclear disasters**
  - **Special Law of Emergency Preparedness for Nuclear Disaster**
- **Experimental and research reactors**
- **Reactor in Research and development phase**
- **Use of nuclear source material, fuel material and others**
- **Implementation of safeguards under International agreement**
  - **Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors**

IV-1. Review for Construction Permission (Safety Reviews)

Contents

1. Name of organisation and the representative, and address
2. Objectives of usage (Generation and/or Research)
3. Type of Reactor, Thermal Output and Number of units.
4. Address and Name of station or factory where reactors are installed.
5. Location, structure and equipment of reactors and other attached facilities.
6. Schedule of works for Reactor facility
7. Main attachments for detail explanation
   - Assessment results on Meteorology, Ground, Hydraulics, Earthquake, Social surroundings.
   - Safety Design for reactor facility
   - Methods for radiation control and radiation-waste treatment
   - Evaluation of effect due to the accidents of reactor caused by failures of machines and equipment, earthquake and fire.

Process of Safety Review



NSC: Nuclear Safety Commission
AEC: Atomic Energy Commission

IV-2. Review for Approval and Licensing of Design and Works by responsible ministry

Contents

- Design conditions
  - temperature, pressure, fluid, earthquake, irradiation, design life and functions.
- Materials
- Structure and its strength
  - Size
  - Stress evaluation due to loads of machine, heat, and earthquake.
  - Other evaluations
    (vibration, corrosion & erosion, irradiation effect)
- Functions
- Methods of Manufacture including welding
- Methods of Installation works

V. Preparatory Works and Construction

Preparatory Works and Construction of Monju

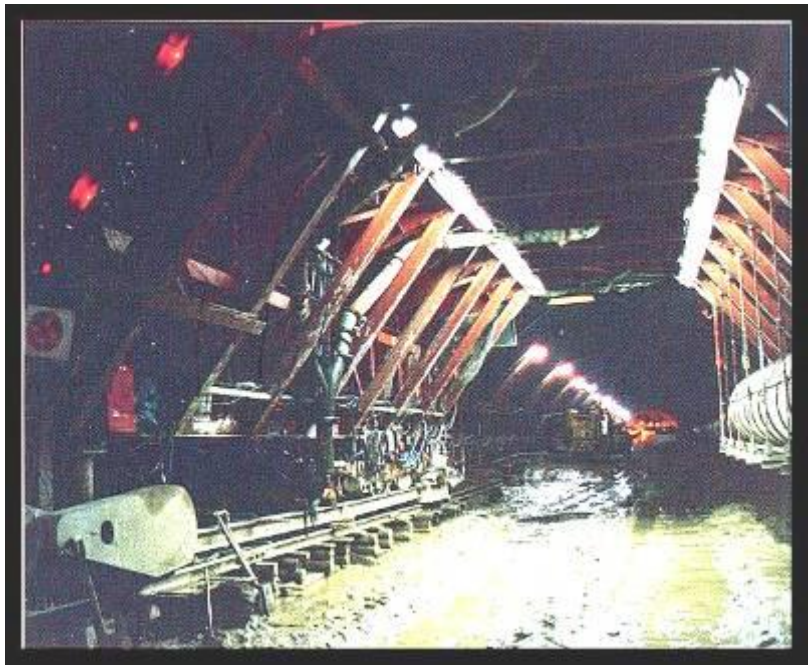
- **Preparatory Works started in January 1983 following Construction permission (Safety Reviews).**

- **Construction started in October 1985.**

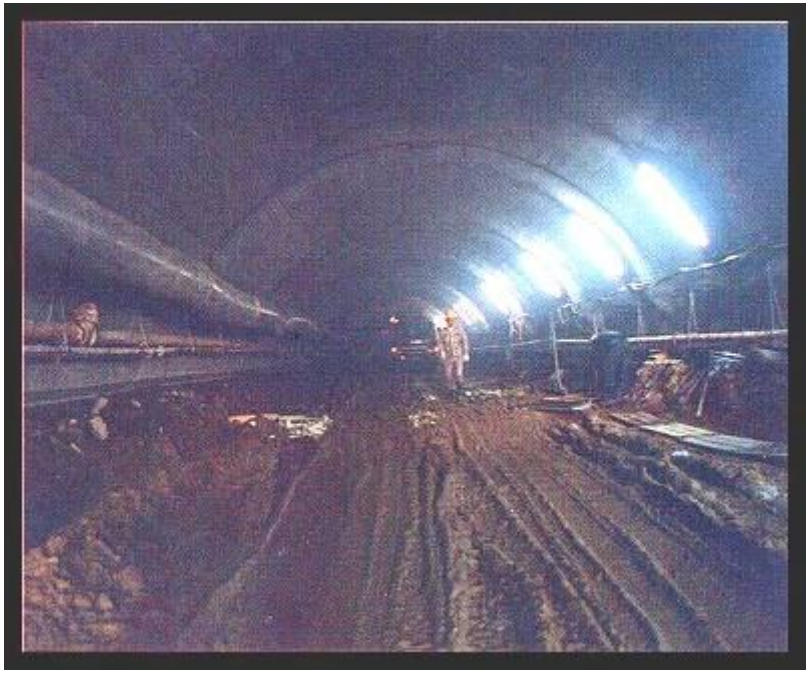
Outline of Preparatory Work for Monju

Initial Access Road

Outline of Preparatory Work for Monju



-Shiraki Tunnel in Oct. 1983-



-Monju Tunnel in March 1984-

Outline of Preparatory Work for Monju

Installation of Outlet of Seawater（May 1985）
(19m width, 18m3/sec)

Outline of Preparatory Work for Monju

Main data

Site area:1080km^2

Preparation area:360km^2 (EL=+21.0m)

Excavated soil:2300km^3

Usage of soil

1000km3: land up of mountain side

Others: reclaiming of sea and around the buildings

Site preparation (April 1983 - October 1985)

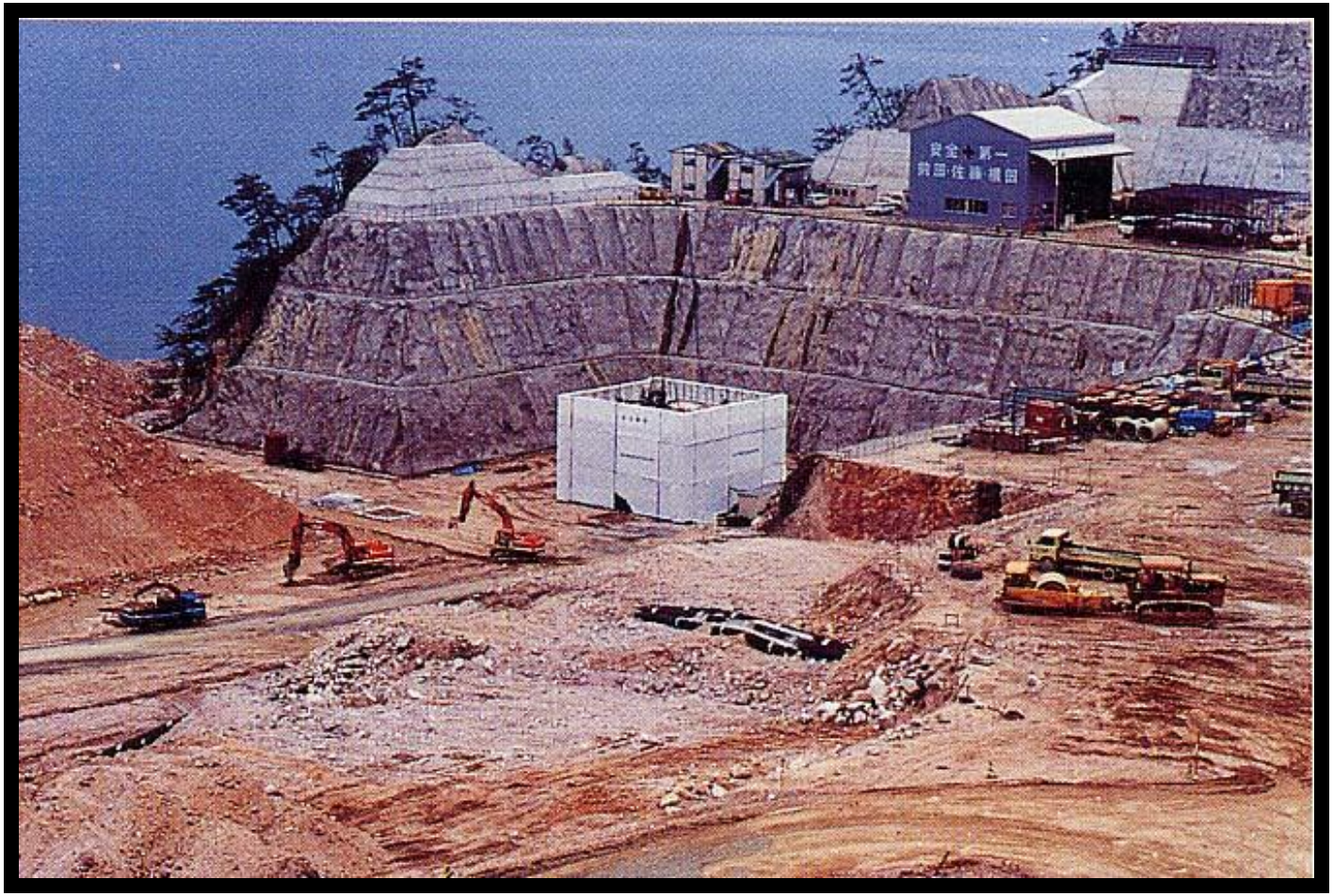
Outline of Preparatory Work for Monju

Bank Protection Works against Waves

(April 1983 - September 1985)

- Concrete caissons (800 tons/piece) and Wave absorbing blocks were installed-

Outline of Preparatory Work for Monju

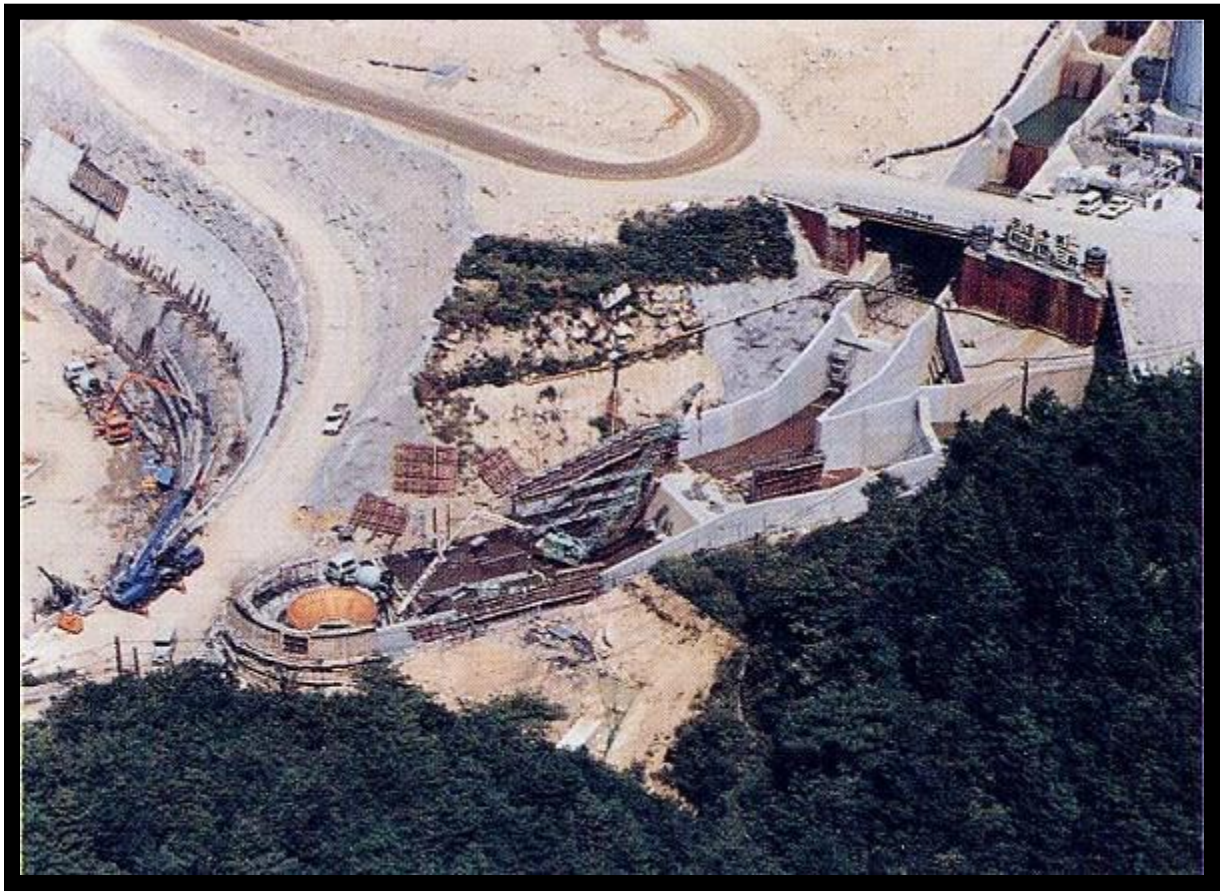


Site vibration test June 1985

-Sample the characteristic data of the ground for seismic design of buildings-

(Concrete block of 12m × 12m × 9m was installed as a mock up)

Outline of Preparatory Work for Monju



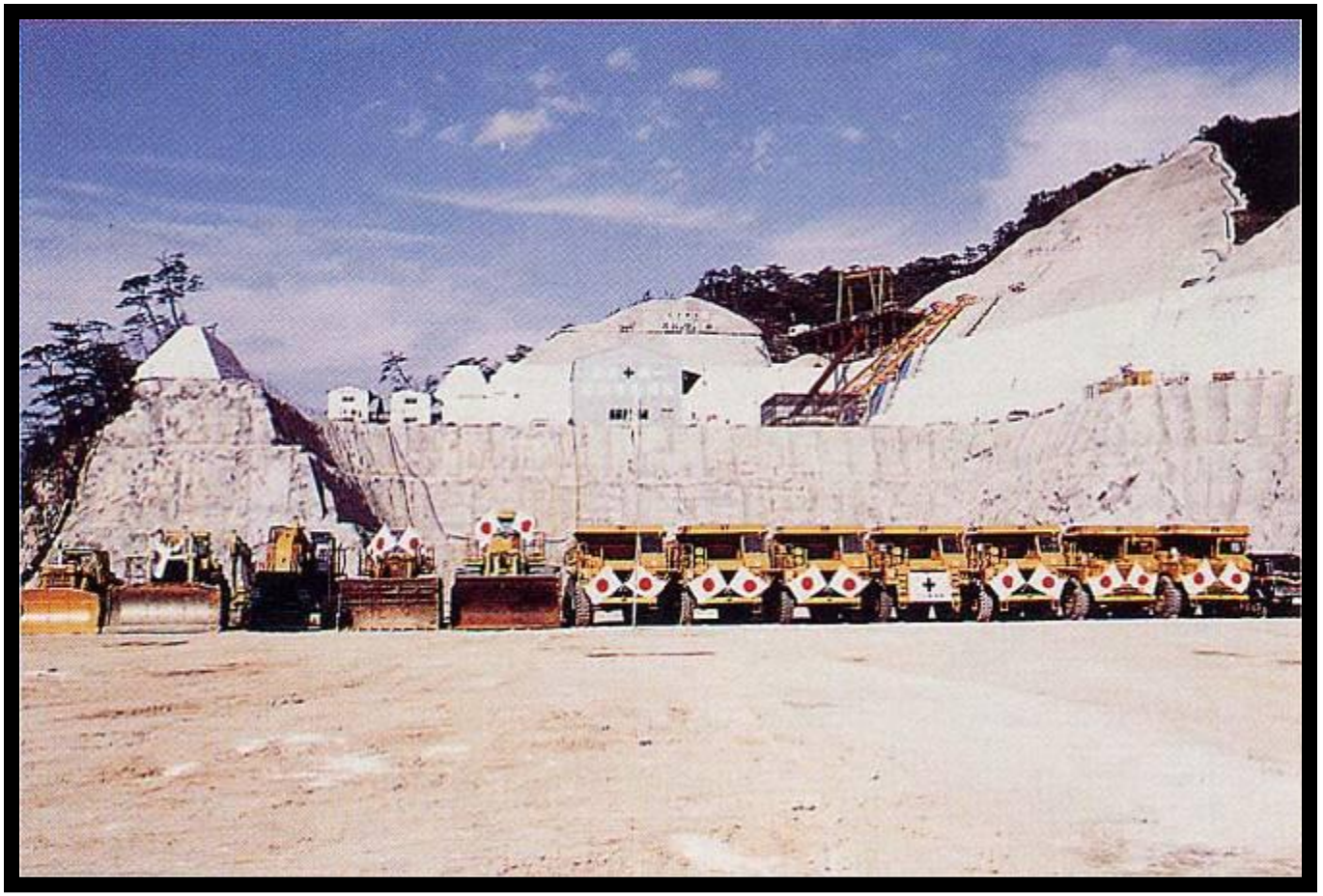
Main Water ditch（August 1985）

- Collect and release water from mountain safely -

(design rainfall rate: 83mm/h, probabity:1/200years)

Start of Construction of Monju (October 1985)

Commencement ceremony of Monju (28 Oct. 1985)



-Start of Excavation from EL+21.0m to EL+5m for foundation of Reactor facility-

References

- Monju Kensetsu no Ayumi No.1
  -from Site selection to Construction-
- Flow of procedure, power station environmental assessment information service, METI
- Guideline of environmental assessment for power station, NISA, METI
- Structure of Legal System for Nuclear Safety Regulations in Japan, MEXT (Website)