

Case of Immediate Appeal Against the Decision of Dismissal of the Petition for Provisional Disposition Order for an Injunction Against the Operation of Unit 3 of the Ikata Nuclear Power Plant

Hiroshima High Court 2019 (Ra) No. 48

Decision by the Fourth Division on January 17, 2020

(Original Decision: Iwakuni branch, Yamaguchi District Court in 2017 (Yo) No. 5)

## Decision

Indication of the Parties: As shown in Exhibit “List of the Parties”

## Main text of the judgement

1. The Original Decision<sup>1</sup> shall be rescinded.
2. The adverse party<sup>2</sup> may not operate Unit 3 reactor of the Ikata Nuclear Power Plant at 40-3 Kouchi, 3 Kochiwaki, Kucho, Ikata, Nishiuwa, Ehime, Japan until the rendering of a judgment in the first instance on the merits of the Case.

## Reasons

### I. Overview of the Case

#### 1. Overview of the petition

The Case is a case in which the appellants<sup>3</sup> filed a petition for a provisional disposition order for an injunction against the operation of Unit 3 reactor (the “Reactor”) and its auxiliary facilities (the “Reactor Facilities” together with the Reactor) of the Ikata Nuclear Power Plant, which is a nuclear power reactor facility installed and operated by the adverse party (the “NPP”), by asserting the right to seek prevention of interference based on the personal rights as the right to be preserved, and by asserting that there is a specific risk that the operation of the Reactor Facilities may result in a serious accident, thereby causing the release of a large amount of radioactive substances and causing infringement on the material legal interests (e.g., lives and bodies) of the appellants due to the Reactor Facilities’ lack of safety against earthquakes, volcanic eruptions, etc.

The Original Decision dismissed all the petitions for the provisional disposition order filed by the appellants on the grounds that it cannot be said that there is a specific risk that the Reactor Facilities may discharge a large amount of radioactive substances, thereby causing infringement on the material legal interests (e.g., lives or bodies) of the appellants, as a result of any event as asserted by the appellants (e.g., earthquakes and volcanic eruptions). In response thereto, the appellants filed the Appeal because they were dissatisfied with the Original Decision.

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<sup>1</sup> *Editor’s note: the original decision (Iwakuni branch, Yamaguchi District Court) rejected the plaintiff’s claim to enjoin the operation of the nuclear power plant, holding that there were no specific danger to the plaintiff’s lives or bodies caused by such operation.*

<sup>2</sup> *Editor’s note: an utility company, “Shikoku Electric Power Company, Incorporated.”*

<sup>3</sup> *Editor’s note: the residents near the Ikata Nuclear Power Plant.*

2. Object of the Appeal is to the same effect as that of the main text of the judgement above.

3. Outline of the facts

Other than the correction made below, the outline of the facts remains the same as described in Section 3 of the column entitled "Reasons" in the Original Decision, which are therefore cited as follows:

(1) The words "at 40-3" in line 6 of page 5 of the Original Decision shall be replaced with "that is a nuclear power reactor in the NPP located at 40-3".

(2) The word "mean ..." in line 3 of page 6 of the Original Decision shall be replaced with "mean ... that fall roughly into two types".

(3) The word "3," shall be added immediately after "Defendant" in line 8 of page 10 of the Original Decision.

(4) The words "the Nuclear Safety Commission was abolished, which had been tasked with planning, deliberating and determining matters in respect of ensuring safety of nuclear energy until then"

shall be added immediately after "in light of the Fukushima Accident," in line 11 of page 10 of the Original Decision.

(5) The words "Article 12" shall be added immediately before "of the supplementary provisions to the Act" in line 17 of page 10 of the Original Decision.

(6) The words "prepared by the NRA on January 9, 2013" shall be added immediately after "stipulates ...," in line 1 of page 11 of the Original Decision.

(7) The words "Ordinance on the Standards for Installation Permission" in line 7 of page 14 of the Original Decision shall be replaced with "Ordinance on Standards for the Location, Structure, and Equipment of Commercial Nuclear Power Reactors and Their Auxiliary Facilities (the "Ordinance on the Standards for Installation Permission)".

(8) The words "in the seismic design at the time of construction of the Reactor Facilities" shall be added immediately after "obligor..." in line 7 of page 21 of the Original Decision.

(9) The words "hereinafter referred to as" in line 10 of page 22 of the Original Decision shall be replaced with "it used to be Defendant 25 but revised and renumbered thereafter as Defendant 149; hereinafter referred to as".

(10) The word ", 50" shall be added immediately after "39" in line 20 of page 26 of the Original Decision.

(11) The words "for the purpose of utilization by reviewers, etc., to strictly verify the adequacy of the standard ground motion, in full consideration of the object of the Ordinance on the Standards for Installation Permission and the Interpretation of the Ordinance on the Standards for Installation Permission, in the review concerning the seismic design policy at the stage of installation permission for light water nuclear power reactor facilities" shall be added immediately after "the NRA," in line 9 of page 27 of the Original Decision.

(12) The words "in the Earthquake Guide," shall be added at the beginning of line 9 of page 28 of the Original Decision.

(13) The words ", 6-5-131" shall be added immediately after "6-5-31" in line 3 of page 30 of the Original Decision.

(14) The text that begins with "as the base case" in line 13 and ends at line 15 of page 31 of the Original Decision shall be replaced with "assuming a vertical case as the base case as well as a case of a fault dip angle of 30° to the north (intended to take uncertainty into account), evaluated the response spectrum of each case in combination with the aforementioned four cases concerning the fault length."

(15) The words "p. 95" in line 23 of page 31 of the Original Decision shall be replaced with "p. 95, pp. 111-142, pp. 194-197, pp. 222-228".

(16) The words “p. 23” in line 8 of page 32 of the Original Decision shall be replaced with “p. 23, p.44”.

(17) The words “, 6-5-69” shall be added immediately after “6-5-33” in the last line of page 32 of the Original Decision.

(18) The text that begins with “response spectrum” in line 16 and ends at the end of line 18 of page 36 of the Original Decision shall be replaced with “enveloped the response spectrum, and formulated the response spectrum for design taking into consideration the margin, and then, on the basis thereof, formulated the standard ground motion of Ss-1 (Wave 1) (Defendant 13 [p. 6-5-48, p. 50, p. 51, pp. 107-109, p. 197, p. 199, p. 200, p. 233] and Defendant 36 [pp. 93-142, pp. 221-228]).”.

(19) The text that begins with “per eruption” in line 12 and ends at the end of line 15 of page 39 of the Original Decision shall be replaced with “the scale is divided into nine stages as a whole, from VEI 1 to VEI 8, in which each interval on the scale represents a tenfold increase in erupted volume (e.g., VEI 0 is defined as eruptive volume per eruption of less than  $10^4 \text{ m}^3$  ( $0.00001 \text{ km}^3$ ); VEI 1, less than  $10^6 \text{ m}^3$  ( $0.001 \text{ km}^3$ ), and VEI 8,  $10^{12} \text{ m}^3$  ( $100 \text{ km}^3$  or greater))”.

(20) The words “(Defendant 324 and 382)” shall be added at the end of the last line of page 39 of the Original Decision.

(21) The words “ $150 \text{ km}^3$ ” in line 6 of page 40 of the Original Decision shall be replaced with “ $50 \text{ km}^3$ ”.

(22) The text from line 16 through line 18 of page 40 of the Original Decision shall be replaced with the following:

“The NRA prepared the Assessment Guide of Volcanic Effects to the Nuclear Power Plant (the “Volcano Guide”) to exemplify the methods of assessing whether the design, as required by the New Regulatory Requirements, secures the nuclear reactor safety against volcanic effects, as a reference for reviewers, etc., in determining the adequacy of the assessment of volcanic effects, the details of which are as follows (Plaintiff 966, Defendant 322)”.

(23) The words “and, for the volcano in question, only the assessment of its effect shall be made.” shall be added immediately after “shall not be subject to individual assessment,” in line 16 of page 41 of the Original Decision.

(24) The word “761,” shall be added immediately after “Defendant” in line 17 of page 46 of the Original Decision.

(25) The text that begins with “a certain volume of” in line 3 and ends in “has been ....” in line 5 of page 49 of the Original Decision shall be replaced with “means the effects that necessarily emerge as a result of being exposed to a certain dose of radiation. If a person is exposed to radiation all at once in a short period of time, many cells will die, thereby potentially causing the loss of one’s life-sustaining ability to repair DNA and cells, in addition to the functional deterioration of tissues and organs”.

(26) The words “(Defendant 73)” in line 19 of page 49 of the Original Decision shall be deleted.

(27) The words “(Defendant 73)” shall be added at the end of line 22 of page 49 of the Original Decision.

(28) The word “Uchicocho” in line 5 of page 52 of the Original Decision shall be replaced with “Uchicocho”.

#### 4. Issues and assertions of the parties

The issues are as follows: [1] modality of judicial review (Issue 1), [2] necessity of the Reactor (Issue 2), [3] safety against earthquake (Issue 3), [4] safety against effects of volcanic events (Issue 4), [5] evacuation plans, etc. (Issue 5) and [6] necessity of preservation (Issue 6). The assertions of the parties are as described in Section 5 of the column entitled “Reasons” of the Original Decision, which are therefore cited as follows:

In this instance, the major issues were the evaluation of the Median Tectonic Line (“MTL”) and the issues related thereto in Issues 1, 4 and 5, and Issue 3. For these issues, the supplementary assertions by the appellants in this instance are as described in the provisional disposition application, Briefs 1-9, Supplements 1-5 to Briefs 1, 2 and 7, Supplements 1-3 to Brief 3, Supplements 1-5 to Brief 4, the application for correction of Supplement 3 to Brief 4, Supplements 1-4 to Brief 5, Supplements 1-3 to Brief 6, Briefs (corrected documents), Supplement 1 to Brief 8, the corrected document (Brief 8 (Supplement 1)), Statement of Reasons for the Appeal 1 and Supplement 1 thereto, Statement of Reasons for the Appeal 2 and Supplements 1 and 2 thereto, Statement of Reasons for the Appeal 3 and Supplements 1, 3 and 4 thereto (2 is a missing number), Statement of Reasons for the Appeal 4 and Supplement 1 thereto, and the supplementary assertions by the adverse party in this instance are as described in the written answer dated as of April 7, 2017 (Original Decision), Briefs (1)-(7), Supplements (1) and (2) to Brief (1), Supplements (1) to Brief (2), Supplements (1)-(4) to Brief (3), Supplements (1)-(7) to Brief (4), Supplements (1)-(3) to Brief (5), Supplement (1) to Brief (7), the written response to the matters clarified by the Court, the written response to the obligees’ request for clarification, the written answer as of June 28, 2019 (for this instance), immediate appeal Briefs (1)-(6), and therefore these documents will be cited as follows:

## II. Judgment of the Court

### 1. Modality of judicial review

#### (1) Findings

Other than the correction made below, the findings remain the same as described in Section VI.1(1) in the column entitled “Reasons” in the Original Decision, which are therefore cited as follows:

A. The text “It is pointed out that the fundamental reason of the Fukushima Accident is considered to be that, in the relationship between the successive regulatory authorities and Tokyo Electric Power Company Holdings, there was a collapse in the former’s functions of monitoring and supervising nuclear safety due to the reversal of the roles of the regulator and the regulatee,” shall be added at the beginning of line 18 of page 124 of the Original Decision.

B. The words “(Plaintiff 212, 228, 237 and 293, the entire import of court hearing)” shall be added at the end of line 17 of page 125 of the Original Decision.

C. The words “(Defendant 115 [pp. 45-51] and 450 [pp. 45-51])” shall be added at the end of line 12 of page 126 and the end of line 5 of page 128 of the Original Decision, respectively.

D. The words “[pp. 1-4]” in line 17 of page 129 of the Original Decision shall be replaced with “[pp. 1-4, pp. 51-52] and 450 [pp. 1-4, pp. 51-52]”.

E. The words “(Defendant 115 [pp. 52-54] and 450 [pp. 52-54])” shall be added at the end of line 14 of page 131 of the Original Decision.

F. The words “(Defendant 115 [pp. 54-56] and 450 [pp. 54-56])” shall be added at the end of line 2 of page 133 of the Original Decision.

G. The words “Defendant 115 [p. 56, p.129, p. 233] and 450 [p. 56, p. 139, p. 279]” shall be added at the end of line 16 of page 134 of the Original Decision.

H. The words “the IAEA Report” shall be added immediately after “(A)” in line 2 of page 136 of the Original Decision.

#### (2) Requirements for seeking an injunction based on the personal rights<sup>4</sup>

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<sup>4</sup> *Editor’s note: “Personal rights” means “Jinkaku-Ken” in general, which is an inclusive interest regarding to each person’s personality.*

In this case, the appellants seek a provisional disposition order for an injunction against the operation of the Reactor based on the personal rights by asserting that there is a specific risk of infringement on lives, bodies, etc., of the appellants due to the operation of the Reactor installed by the adverse party. The right to be preserved asserted by the appellants is the right to seek an injunction as the right to prevent an interference. Needless to say, a person's life and body constitute material legal interests to be protected, and it should also be said that

sustaining his/her life in the living environment in which he/she has ever lived and not being unilaterally and involuntarily deprived of such environment are also the basis for living as an individual and constitute material legal interests to be protected. The rights related to the aforementioned legal interests to be protected such as life, body and living of any person are understood to have exclusivity as the personal rights as is the case of real rights. Hence, it is reasonable that,

if such personal rights are or likely to be unlawfully infringed, such person may seek an injunction to stop the relevant act of infringement based on such personal rights in order to eliminate the ongoing unlawful act of infringement (i.e., claim for elimination of interference) or prevent any future act of infringement (i.e., claim for prevention of interference).

In the meantime, as described in the outline of the facts (i.e., Section 3 of the column entitled "Reasons" that is cited herein upon the aforementioned correction; the same applies hereinafter), nuclear power reactor facilities necessarily generate radioactive substances in the course of their operation because they generate power utilizing energy generated by nuclear fission reaction. At nuclear power reactor facilities (including the Reactor Facilities), it is intended to contain radioactive substances within such facilities even under abnormal circumstances and prevent circumstances in which a large amount of radioactive substances are released into the environment by taking safety assurance measures for the prevention of accidents using the equipment with important safety functions for the "shut-down" and "cooling" of nuclear reactors and the "containment" of radioactive substances. Nevertheless, the failure to shut down or cool the reactor as well as contain radioactive substances due to the failure of the aforementioned safety assurance measures will result in the release of a large amount of radioactive substances into the external environment. Also, as described in the outline of the facts,

it can be said that the effects of radiation exposure on a person's life and body are significant and irreversible because, if such person is exposed to radiation all at once in a short period of time, many cells will die, thereby potentially causing the loss of his/her life-sustaining ability to repair DNA and cells, in addition to the functional deterioration of tissues and organs. Also, according to the findings in paragraph (1) above, in the Fukushima Accident that caused the release of a large amount of radioactive substances into the external environment, the number of residents who evacuated following the government's evacuation orders reached about 150,000, and there were about 112,000 evacuees in the entire Fukushima area even about four years and three months had elapsed since the Accident. Even in light of the experience, it is clear that, the occurrence of such accident will destroy the local residents' livelihood foundations (e.g., by radioactive contamination of the surrounding environment) and cause many difficulties in the recovery of such foundations. Hence, due to the lack of safety in a nuclear power reactor facility, if the operation of the facility causes the release of a large amount of radioactive substances into the surrounding environment, it is likely that the lives and bodies and livelihood foundations of the surrounding residents will be seriously and irrevocably affected. When it is found that such residents have a specific risk of suffering such serious damage, the residents may seek an injunction as a claim for the

prevention of interference based on the personal rights, asserting that the operation of such nuclear power reactor facility is likely to infringe their personal rights.

(3) Specific risk as a requirement for seeking an injunction

A. It is considered that there are various causes that the release of radioactive substances from a nuclear power reactor facility may cause serious damage to its surrounding residents, which ranges from defects in the design or construction of such facility to natural phenomena, including terrorism, etc. Also, there is no dispute between the parties regarding the facts that it is impossible at least with the current level of science and technology to ensure the safety that prevents the release of radioactive substances from a nuclear power reactor facility into the surrounding environment whatever event occurs, and it cannot therefore be completely denied that such event may occur during the operation period of such facility (i.e., the period in which nuclear fuel materials exist therein).

B. Then, the issues are whether risks that cannot be addressed with the current level of science and technology are allowed and to what extent such risks are allowed; the course of events that led to the preparation of the current regulatory standards for installation and operation of nuclear power reactor facilities is as follows:

As described in the outline of the facts, and in the correction of the findings in Section VI.1(1) of the column entitled "Reasons" of the Original Decision cited herein upon the aforementioned correction (the "Findings" in this Section), in Japan, the installation and operation of nuclear power reactor facilities have been permitted before the Fukushima Accident after the review of the safety of reactor facilities that requires the comprehensive determination based on the latest wide-ranging and highly advanced scientific, specialized and technical knowledge. However, responding to the consequences that the Fukushima Accident caused extensive damage to the material legal interests (e.g., lives and bodies) of many people living, etc., in the areas surrounding the Fukushima Daiichi Nuclear Power Plant, the government and the Diet carried out detailed investigation and analysis of the causes of the occurrence of the Fukushima Accident and causes of the expansion of the damage arising therefrom, which was followed by the consideration at the newly established Nuclear Regulation Authority (the "NRA") concerning the details of regulatory standards for installation and operation of nuclear power reactor facilities, and then, based on the results thereof, the formulation and enforcement of the so-called New Regulatory Requirements (e.g., the Ordinance on the Standards for Installation Permission). Also, the Act on Control of Nuclear Reactors, etc., was revised to strengthen measures against serious accidents by reflecting the latest scientific and technical knowledge in the rules thereof and introducing the so-called backfit system that requires the permitted nuclear power reactor facilities, etc., to conform to the standards that are based on such rules, which requires, in addition to the prevention of the occurrence of accidents, wide-ranging and multifaceted measures to prevent the development of circumstances leading to the release of radioactive substances into the surrounding environment at an abnormal level

even if a serious accident (e.g., with significant damage to the reactor core) occurs.

Thus, it can be said that, by learning lessons from the Fukushima Accident, the government has revised the Act on Control of Nuclear Reactors, etc., and formulated the New Regulatory Requirements, and brought out the policy to operate only the nuclear power reactor facilities that conform to the standards reflecting the latest scientific and technical knowledge under the enhanced safety regulations on the assumption that safety will be enhanced along with the control of risks. Also, in light of the process and details of the revision of the Act on Control of Nuclear Reactors, etc., and the formulation of the New Regulatory Requirements, it is understood that the

revised Act on Control of Nuclear Reactors, etc., requires the reflection of the latest knowledge in the safety regulations for nuclear power reactor facilities, etc., as well as, on the assumption that scientific and technical methods have limitations, requires the enhancement of measures against serious accidents in order to prevent development into serious accidents such as the release of radioactive substances into the surrounding environment even in circumstances where the soundness of a nuclear power reactor facility is damaged due to the occurrence of an unexpected event.

In light of the aforementioned process and details of the revision of the Act on Control of Nuclear Reactors, etc., the Act requires [1] the ensuring of the safety of nuclear power reactor facilities on the assumption of natural disasters of the scale that can be reasonably expected in light of the latest scientific and technical knowledge, and [2] on the basis of that, the response in case of occurrence of a situation which is more serious than assumed. The “disasters” in Article 43-3-6, paragraph (1), item (iv) of the Act means the natural disasters mentioned in [1] above.

Moreover, it can be said that, for the specific risk as a requirement for seeking an injunction, the important yardstick will in principle be whether the facility in question ensures the safety required under the Act on Control of Nuclear Reactors, etc., in light of the aforementioned process and details of the Act. However, on the other hand, there is no denying that the scope of acceptable risks has to be determined based on the conventional wisdom.

C. In this regard, the appellants assert that the level of safety required for nuclear power reactor facilities is not the absolute safety (i.e., with zero risk), but the limited absolute safety (i.e., no severe accidents like the Fukushima Accident shall be allowed to occur) or the highly advanced safety that is almost equivalent to the absolute safety, and more specifically, that, a business operator should be judged by the standard that the safety shall be deemed not to have been ensured if such operator [1] not only conforms to engineering rules of thumb but also excludes a merely scientific (theoretical) assumption or calculation in order to exclude scientific uncertainty, etc., [2] depends on dominant or prevailing views and fails to consider all the alternative scientific knowledge, or [3] adopts a conservative assumption and fails to consider uncertainty remaining in a risk survey or risk assessment.

Out of the aforementioned assertions made by the appellants, their idea that the advanced safety (i.e., no severe accidents like the Fukushima Accident shall be allowed to occur) should be required for nuclear power reactor facilities is worth heeding. However, the specific criteria for judgement (in particular, [1] and [2] above) asserted by the appellants, if understood literally, will end up in requiring difficult tasks that all the theories or calculations provided (e.g., one’s own views, etc., that are not supported by other experts) should be considered, and cannot be adopted under the Japanese legal system that allows the peaceful use of nuclear energy by controlling its safety in light of the latest scientific and technical knowledge as described in paragraph B above.

Nevertheless, as described above, the idea that the advanced safety (i.e., no severe accidents like the Fukushima Accident shall be allowed to occur) should be required for nuclear power reactor facilities should be respected, and it must be said that this idea goes along the same line with the revision of the Act on Control of Nuclear Reactors, etc., and the formulation of the New Regulatory Requirements as we saw in paragraph B above, in the sense of requiring not only the prevention of accidents but also the enhancement of various types of measures to prevent development into a serious accident such as the release of radioactive substances into the environment even in circumstances where the soundness of a nuclear power reactor facility is damaged due to the occurrence of an unexpected event. Hence, even if it is practically impossible to directly apply the specific criteria for judgement asserted by the appellants based on the

aforementioned idea, there is no denying that, in determining the existence of a specific risk associated with nuclear power reactor facilities, it will be necessary to interpret and apply the criteria based on such idea or spirit. If there are conflicting views about an issue among experts, a non-conservative view must not be adopted merely by reason that it is dominant or prevalent. This applies in general terms, but the application of such ideas or spirits should be considered individually on an issue-by-issue basis.

(4) Burden of assertions and proof (assertions and a prima facie showing)<sup>5</sup>

A. As described in paragraph (2) above, because the petition is seeking a provisional disposition order for an injunction against the operation of the Reactor based on the personal rights by asserting that there is a specific risk that the operation of the Reactor installed by the adverse party may interfere with the appellants' lives, bodies, etc., the appellants are responsible for the burden of assertions and proof with respect to the existence of the aforementioned specific risk.

However, as described in the outline of the facts, in light of the fact that, in installing and operating a nuclear power reactor facility, such facility is required to go through various reviews of its safety to obtain licenses, permissions, etc., from the NRA in accordance with the Act on Control of Nuclear Reactors, etc., the fact that the Act, as one of the requirements for the permission for installation of nuclear power reactor facilities, requires that the licensee of nuclear power reactor operation has sufficient technical capabilities required for taking necessary measures to prevent the occurrence and expansion of serious accidents (e.g., serious damage to the reactor core of a nuclear power reactor) and any other sufficient technical capability to perform the operation of nuclear power reactors (Article 43-3-6, paragraph (1), item (iii) of the Act on Control of Nuclear Reactors, etc.), and the fact that the licensee of nuclear power reactor operation is required to perform by itself the safety assessment of the nuclear power reactor facility and notify the NRA of such assessment results, etc., and to publicize such assessment results, etc., notified by the licensee of nuclear power reactor operation to the NRA (Article 43-3-29 of the Act), it can be said that the business operator who installs and operates the nuclear power reactor facility has sufficient specialized and technical knowledge and materials on the safety of the nuclear power reactor facility. On the other hand, it cannot be said that the residents surrounding the nuclear power reactor facility have sufficient specialized and technical knowledge and materials on the safety of such facility. Then, in consideration also of the facts such as that it can be understood that Article 43-3-6, items (ii) through (iv) of the Act on Control of Nuclear Reactors, etc., concerning the standards for the permission for installation of nuclear power reactors contains the object that the safety of the lives and bodies, etc., of the residents who live in areas surrounding a nuclear reactor facility and are assumed to suffer direct and serious damage due to a disaster caused by an accident involving the release of radioactive substances into the surrounding environment, etc., should be protected as their personal interests (although a case concerning Article 24, paragraph (1) of the Act, see Supreme Court 1989 (Gyo-Tsu) No. 131, Judgement of the Third Petty Bench on September 22, 1992, Minshu Vol. 46 No. 6, p. 1090), if an obligee makes a prima facie showing in a petition for a provisional remedy related to an injunction against the operation of a nuclear power reactor facility that he/she lives in the

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<sup>5</sup> *Editor's note: After the judgment of the Supreme Court of Japan ("Ikata case"), which was regarding to the same nuclear power plant with this Hiroshima Appellate case, although the supreme court's case was not private injunction case but an administrative case as to the operation license of the NPP, Japanese courts have adopt this transference of the burden of proof.*

area where he/she is assumed to suffer direct and serious damage to his/her life, body or livelihood foundation due to an accident such as the release of radioactive substances into the surrounding environment caused by the lack of safety of a nuclear power reactor facility, then the obliger (business operator) who is the entity installing and operating the nuclear power reactor facility must make an assertion and a prima facie showing based on substantial evidence and materials that there is no specific risk that the obligees (i.e., persons who live, etc., in the areas surrounding the nuclear power reactor facility) suffer serious damage to their lives, bodies and livelihood foundations from radiation exposure due to the release of radioactive substances into the surrounding environment arising from the operation, etc., of the nuclear power reactor facility. It should be said that, if the obliger fails to make an assertion and a prima facie showing in this connection, the existence of such specific risk is effectively assumed.

B. Considering the Case in light of the above, as described in the outline of the facts, and taking into account that all the appellants live in the area about more than 30 km and less than 45 km away from the Reactor Facilities over the sea, that the Reactor is a reactor with the output of 890,000 kw, and that, in the Fukushima Accident, the area in which the air dose rate was likely to be 5mSv or more per year was 1,778 km<sup>2</sup> and the area in which the air dose rate was likely to be 20mSv or more was 515 km<sup>2</sup> (Plaintiff 621 [p. 330]), it can be said that, even considering the difference in electric-generating capacity between the Reactor and Units 1 through 4 of the Fukushima Daiichi Nuclear Power Plant that caused accidents (Plaintiff 621 [p. 61, p. 125]), the appellants are the persons living in the areas where they are assumed to suffer direct and serious damage to their lives, bodies and livelihood foundations in the event of the occurrence of an accident related to the Reactor Facilities involving the release of radioactive substances into the surrounding environment.

Hence, in this petition, the adverse party as a business operator must make an assertion and a prima facie showing based on substantial evidence and materials that there is no specific risk that the appellants suffer serious damage to their lives, bodies and livelihood foundations from radiation exposure due to the release of radioactive substances into the surrounding environment arising from the operation, etc., of the Reactor Facilities.

C. Nevertheless, as described in the outline of the facts, with respect to the installation and operation of nuclear power reactor facilities, the Act on Control of Nuclear Reactors, etc., sets forth multi-step regulations such as the permission for the installation of a nuclear power reactor facility and for change in such installation, approval of the construction plan, pre-operational inspection, approval of operational safety programs, and regular inspection of facilities, for the purpose of preventing the occurrence of accidents, and, in case of the occurrence of an accident, preventing circumstances such as the release of a large amount of radioactive substances into the surrounding environment. Also, the setting of specific review standards and the review of conformity thereto require the comprehensive determination based on the latest wide-ranging and highly advanced scientific, specialized and technical knowledge in the fields that include nuclear engineering as well as natural sciences, and, as described in the outline of the facts and the Findings, the reviews at each stage shall be conducted by the NRA in which the chairperson and commissioners shall be appointed out of those who have expertise and experience in safety assurance in the utilization of nuclear energy and required to exercise their authority independently. Moreover, the Act on Control of Nuclear Reactors, etc., has reflected the latest scientific and technical knowledge therein and introduced the system that requires the already licensed and permitted nuclear power reactor facilities to conform to the standards that reflect such knowledge (i.e., the backfit system). Based on the aforementioned laws and regulations, if the NRA

has determined that a nuclear power reactor facility to be installed and operated by a business operator conforms to the specific review standards used by the NRA, it should be said that, if the business operator makes an assertion and a prima facie showing, based on substantial evidence and materials, [1] that there is no unreasonableness in such specific review standards in light of the current level of science and technology, and [2] that there is no unreasonableness (e.g., there is no unignorable error or omission in the course of the NRA's investigations, deliberations and determination) with respect to the NRA's determination that the nuclear power reactor facility conforms to such review standards,

then such operator can say that it has made an assertion and a prima facie showing, based on substantial evidence, that there is no specific risk as described in paragraph A above.

On the other hand, although the adverse party asserts that it is sufficient for the business operator to make an assertion and a prima facie showing that its nuclear reactor facility has been installed and operated, etc., under the current safety regulations by receiving the prescribed permissions and approvals, etc., from the NRA, such assertion cannot be accepted in light of the fact that the business operator has sufficient specialized and technical knowledge and materials on the safety of the nuclear power reactor facility, while on the other hand the surrounding residents have no such specialized and technical knowledge and materials.

In response to an assertion and a prima facie showing made by the obliger (i.e., the business operator), the surrounding residents (i.e., the obligees) may make a prima facie showing (rebuttal evidence) to rebut such prima facie showing made by the obliger (i.e., the business operator). If the obliger (i.e., the business operator) fails to make an assertion and a prima facie showing with respect to the aforementioned points, or such prima facie showing does not succeed as a result of the rebuttal evidence made by the obligees, the obliger (i.e., the business operator) will have to make an assertion and a prima facie showing, separately from the NRA's decision, that there is no specific risk that the obligees suffer serious damage to their lives, bodies and livelihood foundations from radiation exposure due to the release of radioactive substances into the surrounding environment arising from the operation, etc., of the nuclear power reactor facility.

D. Responding to paragraph C above, the appellants assert [1] that the reasonableness of the standards or of the determination of conformity to the standards are merely part of indirect facts that there is no specific risk of infringement of the personal rights, and it is unreasonable that the nuclear reactor facility is immediately considered to have no specific risk merely because the standards, or the determination of conformity to standards, are reasonable, [2] that it is unreasonable that, if such alternative prima facie showing is allowed, the business operator will bear no responsibility for making prima facie showing about the specific risk (i.e., issue of evacuation plans) that is not subject to consideration in the New Regulatory Requirements, [3] that such framework for the determination that allows the obligor (i.e., business operator) to make an alternative prima facie showing by a shift in responsibility for making prima facie showings from the obligor to the obligee is a method originally used in administrative lawsuits, which therefore should not be used for a civil lawsuit to seek an injunction, or a lawsuit seeking a civil provisional remedy based on the personal rights, and [4] that it should be understood that, if the necessity of nuclear power generation is low, there will be less room for acceptable risks due to the nuclear power reactor facility, and there will be greater possibility that seeking an injunction against the operation will be successful.

Then, considering first the point [1] above, the existence of the reasonableness of the standards, and the existence of the reasonableness of the determination of conformity

to the standards, are part of indirect facts that there is no specific risk of infringement of the personal rights, which do not by logical necessity constitute the facts that need to be proved, as asserted by the appellants. However, the purport of Article 43-3-6, paragraph (1), item (iv) of the Act on Control of Nuclear Reactors, etc., that provides that the Ordinance of the NRA shall specify the standards for reviewing that the location, structure and equipment of nuclear power reactors will not hinder the prevention of disasters, is understood to leave the formulation of specific standards of review to the scientific, specialized and technical knowledge-based reasonable determination of the NRA composed of academic experts, etc., in various subject fields in safety assurance in the utilization of nuclear energy, in light of the fact that the setting of specific review standards and the review of conformity thereto require the comprehensive determination based on the latest wide-ranging and highly advanced scientific, specialized and technical knowledge in the fields that include nuclear engineering as well as natural sciences. Then, if it can be said that there is no unreasonableness in the specific review standards formulated in the aforementioned manner, and that there is no unreasonableness both in the procedure and in process of the NRA's determination that the nuclear power reactor facility in question conforms to such specific review standards, it should in principle be said that it can be evaluated that there is no specific risk of infringement of the personal rights.

With respect to the point [2], even when following the framework for the determination described in paragraph C above, the business operator is required to make a prima facie showing that it is not unreasonable that the points pointed out by the appellants are not covered by the specific review standards. If the business operator fails to make such prima facie showing, the business operator will have to once again make an assertion and a prima facie showing that there is no specific risk that the obligees suffer serious damage to their lives, bodies and livelihood foundations from radiation exposure due to the release of radioactive substances into the surrounding environment arising from the operation, etc., of the nuclear power reactor facility. Hence, the appellants' assertion that the business operator will bear no responsibility for making prima facie about the specific risk that is not taken into consideration in the New Regulatory Requirements is unfounded.

With respect to the point [3], there is no denying that the aforementioned framework for the determination is similar to that of the so-called supreme court judgement in the case seeking to suspend the disposition of permission for installation of the Ikata Nuclear Power Plant (Supreme Court 1985 (Gyo-Tsu) No. 133, Judgement of the First Petty Bench on October 29, 1992, Minshu Vol. 46 No. 7, p. 1174) that is an administrative lawsuit. The Supreme Court judgment uses the framework for the determination which is the same as or similar to that of administrative lawsuits, not because it overlooked the difference between administrative lawsuits and civil lawsuits, but because such supreme court case and the Case commonly question whether the installation and operation of the nuclear power reactor facilities, and therefore, commonly require the comprehensive determination based on the latest wide-ranging and highly advanced scientific, specialized and technical knowledge in the fields that include nuclear engineering as well as natural sciences.

Also, although the appellants in this connection assert that the court should apply the lower standard of proof in a case, like this one, of petition for the provisional disposition order for an injunction for a nuclear power reactor facility, the Court cannot accept their assertion because even their supporting document (Plaintiff 650) in the first place does not necessarily clarify to what extent the obligees should make a prima facie showing with respect to the existence of the right to be preserved.

With respect to the point [4], the issue of the Case is whether there is any specific risk that the personal rights of the appellants are infringed due to the operation of the Reactor.

If such risk is found, it is illegal for the adverse party to continue to operate the Reactor, and it is unacceptable that the adverse party continues to operate the Reactor on the grounds that nuclear power generation is of a high necessity and public benefit. On the other hand, even if the necessity or public benefit of nuclear power generation is low, the injunction against the operation of the Reactor will not be acceptable only for that reason.

It should be said that the degree of the necessity or public benefit of nuclear power generation does not influence on whether there is a specific risk.

E. Furthermore, the appellants assert that the New Regulatory Requirements lack reasonableness with respect to their procedural and substantive aspects (i.e., such Requirements do not include the method of probabilistic risk assessment and do contain many unclear standards such as “large-scale natural disasters,” “appropriate” and “adequate.” However, the Court also finds, like the Original Decision, that this assertion made by the appellants cannot be accepted. Other than the correction made below, the reasons for the above remain the same as described in Sections VI.1(6) and VI.1(7) in the column entitled “Reasons” in the Original Decision, which are therefore cited as follows.

(A) The text from “Thus” in line 7 through “formulated” in line 8 of page 143 of the Original Decision shall be replaced with the following:

“as described above, the basic events concerning the occurrence and development of the Fukushima Accident are largely clarified, and the New Regulatory Requirements were formulated in light thereof. In addition, according to the Prima Facie Material (Defendant 450), for instance, because it is considered that there are countless specific causes for the loss of functions of alternating current power sources (emergency diesel generators) required as the facilities subject to the design standards, and because it is inappropriate to consider that it is possible to identify all such causes and eliminate the possibility of the loss of such functions, the New Regulatory Requirements purposefully assume the loss of safety functions of the facilities subject to the design standards, and, even in this case, require the prevention of significant damage to the reactor core and of the failure in the containment vessel by utilizing the facilities, etc., used to address serious accidents, etc., and it is found that it was considered that the clarification itself of the specific equipment and parts damaged in the Fukushima Accident was not necessarily required in formulating the New Regulatory Requirements. Hence”.

(B) The words “there is no reason for determining that the former assessment is more reasonable than the latter one, and it cannot be said that it is unreasonable even if different countries adopt different assessment methods depending on the difference in the quantities, etc., of data for disasters such as earthquakes. Also,” shall be added immediately after the word “however,” in line 22 of page 144 of the Original Decision.

#### (5) Summary

As described above, if the NRA has determined that a nuclear power reactor facility to be installed and operated by a business operator conforms to the specific review standards used by the NRA through the permission for change in the installation, the approval of the construction plan, etc., based on the Act on Control of Nuclear Reactors, etc., it will be sufficient for the business operator to make an assertion and a prima facie showing based on substantial evidence and materials that there is no unreasonableness in such specific review standards, and that there is no unreasonableness in the NRA’s determination that the nuclear power reactor facility conforms to such review standards,

in light of the current level of science and technology.

Considering the Case in light of the above, the adverse party, as described in the outline of the facts, received from the NRA the permission for change in the installation of the nuclear power reactor for the Reactor Facilities on July 15, 2015, the approval of its construction plan on March 23, 2016, and the approval of change in its safety regulations on April 19, 2016, and the NRA determined that the Reactor Facilities conform to the New Regulatory Requirements; therefore, the adverse party should make a prima facie showing that there is no unreasonableness in the New Regulatory Requirements, and that there is no unreasonableness in the NRA's determination that the Reactor Facilities conform to the New Regulatory Requirements.

Also, if it is found that there is any unreasonableness in the New Regulatory Requirements or that there is any unreasonableness in the NRA's determination that the Reactor Facilities conform to the New Regulatory Requirements, the adverse party must, nevertheless, make an assertion and a prima facie showing based on substantial evidence and materials that there will be no specific risk that the appellants suffer serious damage to their lives, bodies and livelihood foundations from radiation exposure due to the release of radioactive substances into the surrounding environment arising from the operation, etc., of the Reactor Facilities.

## 2. Safety against earthquake

### (1) Findings

Other than the correction made below, the findings remain the same as described in Section VI.3(2)A in the column entitled "Reasons" in the Original Decision, which are therefore cited as follows:

A. A new line shall be started immediately after the end of line 20 of page 153 of the Original Decision, and the following text shall be added:

"(Defendant 13 [pp. 6-3-65 through 66, pp. 6-3-70 through 73, pp. 6-5-24 through 25, pp. 6-5-31 through 32])".

B. The words "(Defendant 13 [pp. 6-3-59 through 60])" shall be added immediately after "thought..." in lines 19 through 20 of page 154 of the Original Decision.

C. The words "that the significant cumulateness of displacement is found" shall be replaced with "that the cumulateness of displacement (i.e., the degree of deformation is significant in a deeper (i.e., older) fault), which indicates the existence of an earthquake source fault that has been repeatedly active in the same place".

D. The words "(Defendant 13 (pp. 6-3-64 through 65))" shall be added immediately after "thought..." in line 7 of page 155 of the Original Decision.

E. The words "(Defendant 13 [pp. 6-3-70 through 73 and 126])" shall be added immediately after "determined..." in line 12 of page 155 of the Original Decision.

F. A new line shall be started immediately after the end of line 12 of page 155 of the Original Decision, and the following text shall be added:

"e. The case of consideration of the base case (i.e., the dip angle of the earthquake source fault in the MTL fault zone is set at 30° to the north) in combination with other uncertainties

In reviewing the influence of the revision of the Long-term Evaluation of the MTL Fault Zone on the seismic evaluation around April 2019, the adverse party also reviewed the seismic evaluations which respectively considered [1] the uncertainty about setting the amount of stress drop at 1.5 times or to 20MPa, [2] the uncertainty concerning the plan position of asperity, or [3] the uncertainty concerning the fracture propagation speed, by setting the base case in which the length of the fault in the MTL fault zone is 87 km and the dip angle of the earthquake source fault is 40° to the north, the results of which are as described in Appendix Figures 1 through 3 of the Decision. According to this, the uncertainty in [1] above, in which the assessed seismic ground motion will be the largest,

has not exceeded the standard ground motion of Ss-1 as assumed by the adverse party.”

G. A new line shall be started immediately after the end of line 13 of page 155 of the Original Decision, and the following text shall be added, and accordingly, the single-letter prefixes from “a” through “g” (from line 14 of page 155 through line 21 of page 169 of the Original Decision) shall be replaced with those from “b” through “h”:

“a. Statement of the Long-term Evaluation of the MTL Fault Zone (partially revised) (Plaintiff 792 [p. 23], Defendant 38 [p. 23])

The dip angle of the underground fault plane in the MTL fault zone is estimated to be 15°-45° to the west at the depth of about 300 m or less on the eastern margin of the east end of the Kongo Mountains, 15°-45° to the north at the depth of 1 km or less in the area ranging from the southern margin of the Izumi Mountains via the Kitan Strait to southern Awaji Island, and 30°-40° to the north at the depth of 5 km or less, if the geological boundary in the southern margin of the Sanuki Mountains in Shikoku is an active fault plane. However, because it is considered that, in the cases of active strike-slip faults such as the MTL fault zone (excluding the eastern margin of the Kongo Mountains), the dip angle of the fault plane is considered to be generally high from a mechanical point of view, it is necessary to study such cases in the future. It is estimated that, with respect to the zone to the west of the aforementioned zone, the dip angle of the zone ranging from the northern margin of the Ishizuchi Mountains to western Ehime Prefecture is high, if limited to the ground surface and the area near the sea bottom, but there are no materials available for deep underground. Also, the dip angle is likely to be high to the north at the depth of 2 km or less in the Iyo-nada Sea.”

H. The words “Yufuin (湯布院 in Japanese)” in line 1 of page 156 and line 22 of page 161 of the Original Decision shall be replaced with “Yufuin (由布院 in Japanese)”, respectively.

I. The words “; however, there is a reverse fault in which the western side of the fault is relatively upthrown against the eastern part in [1] the eastern margin zone of the Kongo Mountains at the easternmost edge of the fault zone, and there is a normal fault in which its northern side mainly declines in [10] the zone ranging from the Hōyo Strait to Yufuin at the westernmost edge of the fault zone.” shall be added immediately after “accompanied by...” in line 4 of page 156 of the Original Decision.

J. The words “from 30° to 50°” in line 14 of page 160 of the Original Decision shall be replaced with “from 35° to 50°”.

K. A new line shall be started immediately after the end of line 12 of page 161 of the Original Decision, and the following text shall be added:

“{3} In addition, the expressions similar to {2} above can be found in the part entitled “Toward the future” in the conclusion of the Long-term Evaluation of the MTL Fault Zone (Second Edition) (Plaintiff 973 [pp. 3-4], Defendant 343 [pp. 3-4]), i.e., “although, as to the dip angle of the deep part of the fault which is important for the estimation of seismic ground motion, it is found that the dip angles are likely to be moderate in almost all the zones; however, both views are presented here because there is no solid proof that denies the possibility that there are high angle faults.”; and “[9] in the Iyo-nada Sea zone, the fault is located in the sea area, which requires the survey of the coastal shallow waters near the shore. In order to clarify the dip angle in the deep part of the fault zone (NB: meaning the MTL fault zone), it is desirable to directly confirm the deeper extension of the fault by boring survey, etc.””.

L. The words “p. 224, p. 227” in line 17 of page 163 of the Original Decision shall be replaced with “p. 223, p. 224, p. 227”.

M. The words “in the near offshore” shall be added immediately after “in the north coast of the Sadamisaki Peninsula”

N. The word “variation” in line 21 of page 167 shall be replaced with “displacement”.

O. The words “whether the dip angle of the earthquake source fault is high or moderate” shall be replaced with “whether the earthquake source fault causing the strike-slip fault movement is an earthquake source fault with an almost vertical dip angle suitable for the strike-slip fault movement, or whether the geological boundary fault with a moderate dip angle because of the strength, friction coefficient, etc., of the faults are lower than those of other faults can per se cause the strike-slip fault movement as an earthquake source fault”.

P. The words “although a submarine canyon (i.e., depression terrain) is found in the coastal area, it is considered that the terrain is not an active fault but is formed by denudation by coastal currents because there is no deformation in the D fault that is the lower fault of the depression terrain. Moreover,” shall be added immediately after “Also,” in line 3 of page 173 of the Original Decision.

Q. The word “p. 15” in line 12 of page 173 of the Original Decision shall be replaced with “p. 8, pp. 15-16”.

R. The words “variation of land tax” in lines 12 through 13 of page 174 of the Original Decision shall be replaced with “displacement of faults”.

S. A new line shall be started immediately after the end of line 14 of page 174 of the Original Decision, and the following text shall be added:

{1} Results of experiment by researchers of Shikoku Electric Power Company, Incorporated, Shikoku Research Institute Incorporated, etc. (Defendant 432)

In 1992, the group consisting of researchers of Shikoku Electric Power Company, Incorporated and Shikoku Research Institute Incorporated, conducted the oblique-slip (right-lateral strike-slip component + normal fault component) fault model laboratory experiment in the areas that contain unconsolidated overburden in order to clarify how the ground surface and unconsolidated overburden deform due to displacement of the basement fault at the time of an earthquake, or to assume the characteristics of earthquake faults of the basement based on the information on the surface deformation which has already been obtained, and in 1998, reported on the results thereof and the relationship with the deep structure of the MTL fault zone as follows:

(a) The group conducted four ways of experiment assuming two cases where the fault dip angles in the batholith are 30° and 75° and two cases where the ratio between the displacement component on right-lateral strike-slip fault and the displacement component on normal fault are 5:1 and 1:1, and combining them, the results of which are as follows:

[1] Case of a dip angle of 30° with a horizontal to vertical ratio of 5:1

When the fault displacement amount in the batholith reaches a certain amount, shear surfaces will appear due to the slip displacement on the marker on the ground surface and the height difference of the sand ground surface. The shear surfaces are “Riedel shears” that indicate the en echelon array that is specific to the right-lateral strike-slip fault, and a depression grows while changing its width in the area immediately above the fault sandwiched between periodically developing “Riedel shears”. The shear surfaces grow in pairs also inside the ground from the fault top in the batholith, which, according to the increase in the fault displacement amount in the batholith, has reached to the ground surface. The area sandwiched between the shear surfaces forms a depression, which can be confirmed as normal fault forms on the profile surface.

[2] Case of a dip angle of 30° with a horizontal to vertical ratio of 1:1

When the strike-slip displacement amount of the batholith reaches a certain degree, shear surfaces are identified, in which case the shear surfaces are in the first place formed on the footwall side (i.e., the side which is relatively rising ), but are linear, without clear appearance of the en echelon array that can be found in the right-lateral

strike-slip faults. Subsequently, in line with the increase in the fault displacement amount, the shear surfaces are formed also in the hanging wall side (i.e., sinking side) in parallel, and a depression is formed in the area immediately above the fault sandwiched between two shear surfaces. The shear surfaces grow in pairs also inside the ground from the fault top in the batholith, which, according to the increase in the fault displacement amount in the batholith, has reached to the ground surface. The area sandwiched between the shear surfaces forms a depression, which can be confirmed as normal fault forms on the profile surface.

[3] Case of a dip angle of  $75^\circ$  with a horizontal to vertical ratio of 5:1

When the fault displacement amount in the batholith reaches a certain amount, shear surfaces will appear due to the slip displacement on the marker on the ground surface and the height difference of the sand ground surface. The shear surfaces are identified as "Riedel shears" that indicate the en echelon array that is specific to the right-lateral strike-slip fault. In line with the increase in the fault displacement amount in the batholith, the shear surfaces grow, and, as in the same manner as the strike-slip fault model experiment, a series of the principal displacement shears are identified immediately above the fault surface. The shear surfaces are formed also inside the ground in the sand stratum on the hanging wall side in an arc form from the fault top of the batholith, which, according to the increase in the fault displacement amount in the batholith, reach to the ground surface. The shape of this cross-section is almost the same as that of the normal fault with the steep fault dip angle in the batholith.

[4] Case of a dip angle of  $75^\circ$  with a horizontal to vertical ratio of 1:1

When the fault displacement amount in the batholith reaches a certain amount, shear surfaces will appear due to the slip displacement on the marker on the ground surface and the height difference of the sand ground surface. The shear surfaces are extremely linear and do not indicate any en echelon array that can be found in the right-lateral strike-slip faults. In addition, because the deformation form in this case was almost the same as the one found in the normal fault model experiment, no observation is conducted for the process of deformation occurred inside the model ground.

(b) If the experiment results above are compared with the deformation form in the MTL active fault system in the Iyo-nada Sea area, there is a consistency between the deformation form of the seafloor surface (in the Iyo-nada Sea area) and that of the case (a)[1] above because the parallel or intermittent linear fault line in the former shows an en echelon array, and because the fault with the en echelon array in the former is accompanied by a rift. Also, according to the explanation drawing of the deep geological structure in the Iyo-nada Sea area, the forms of deformation at depth at the westernmost survey line and at the central survey line have consistency with those in the case (a)[1] or (a)[2] above, and in the case (a)[3] or (a)[4], respectively; therefore, both are assumed to have been accompanied by not only the right-lateral strike-slip fault movement but also the normal fault component in which the northern part of the fault sinks. (In addition, because only two sets of experiments were conducted for fault dip angles, it is considered that those experiments are not by nature suitable for discussing actual fault dip angles in the Iyo-nada Sea area, but rather showing a trend.) On the other hand, no vertical deformation was identified at the easternmost survey line, other than inside the rift, unlike the oblique-slip fault model experiment conducted at this time. Because a model experiment conducted in the past only for strike-slip proved the formation of partial depressions on the model ground surface, it is considered that the fault movement occurred at the survey line above was mainly the strike-slip one.

(c) If the fault dip angle in the batholith is gentle and the strike-slip component dominates,

“Riedel shears” in the en echelon array will be identified on the sand ground surface, and depressions of various widths are identified in the area sandwiched between such shears.

It is clearly identified that the shear surfaces are also formed in a pair inside the ground from the fault top in the batholith up to the ground surface, and that depressions are formed in the area sandwiched between those shear surfaces. On the other hand, when the fault dip angle in the batholith is steep and the strike-slip component dominates, “Riedel shears” in an en echelon array are identified on the sand ground surface, but no depression is formed, and the shear surfaces are also formed inside the ground from the fault top in the batholith up to the ground surface, but the form of their occurrence is almost the same as that of a normal fault in the case where the fault dip angle in the batholith is steep. In addition, regardless of the fault dip angle in the batholith, the ratio between the displacement component on the right-lateral strike-slip fault and the displacement component on the normal fault is 1:1, the deformation form (excluding, but not limited to, the right-lateral strike-slip deformation) is generally the same as that in the case of the normal fault.

If this is applied to the MTL active fault system in the Iyo-nada Sea area, it is found that the parallel or intermittent linear fault line shows the en echelon array; that a boundary fault (i.e., the MTL itself) is assumed to exist immediately below the MTL active fault system, the surface of which dips to the north, that the MTL active fault system in the Iyo-nada Sea area forms a rift at the sea bottom and the rift is convergent into the underground boundary fault, and that, as to the activity of the MTL, the right-lateral strike-slip fault movement has been dominant in the eastern Iyo-nada Sea area since early times while the normal fault movement is also identified in the central-western Iyo-nada Sea area. This indicates that, with respect to the activities of the MTL, the Iyo-nada Sea area is a place located on the boundary between the zone from Beppu Bay to the west where the normal fault movement dominates and the zone in Shikoku where the right-lateral strike-slip fault movement dominates.

(D) Handling, etc., of active faults in the New Regulatory Requirements

a. In the New Regulatory Requirements, with respect to “seismic ground motions to be formulated by identifying the earthquake source on a premise-by-premise basis” in evaluating an active fault to be considered as a source of the earthquake for investigation selected with respect to the inland crustal earthquake, depending on the geological and geographical conditions of the survey area, it is required to consider that the location, geometry, activity, etc., of an active fault shall be clarified based on the comprehensive assessment of the results of research that was conducted with a proper combination of the survey of existing literature, tectonic geomorphological survey, geological survey, geophysical survey, etc., taking advantage of the characteristics thereof (Article 4, paragraph (5), item (ii)[2] of Appendix 2 of the Interpretation of the Ordinance on the Standards for Installation Permission). Also, such Requirements require the detailed review of the adequacy of the geometry and location of the earthquake source model, the location of the premises and the facilities installed therein, and the adequacy of the setting of the earthquake source characteristics parameter, in consideration of the entire fault with displacement on the ground surface if the earthquake source is extremely close to the premises out of the earthquakes for investigation, as well as the formulation of the standard ground motion with a further sufficient margin, being mindful of the applicability of the assessment methods in consideration of the review results above, conducting more detailed assessment of the impact of various types of uncertainty on the seismic ground motion evaluation, and taking account of the latest scientific/technical knowledge concerning the characteristics

of the seismic ground motions in the very near field of the earthquake source. (Article 4, paragraph (5), item (ii)[6] of Appendix 2 of said Interpretation above).

b. Also, the Earthquake Guide prepared for the purpose of utilization by reviewers, etc., to strictly verify the adequacy of the standard ground motion in the review concerning the seismic design policy at the stage of installation permission for light water nuclear power reactor facilities, in full consideration of the objects of the Ordinance on the Standards for Installation Permission and the Interpretation of the Ordinance on the Standards for Installation Permission (Plaintiff 783, Defendant 43) clarifies the policy that, with respect to “earthquake ground motions to be formulated by identifying the earthquake source on a premise-by-premise basis,” the priority should be given to the fault-model-based method for the earthquake with the earthquake source which is close to the premises, and with the destructive process which is considered to exert significant influence on the seismic ground motion evaluation (3.1(2)), and requires to: confirm that, with respect to the selection of the earthquake for investigation, the evaluation of the geometry, etc., of the fault to be assumed as the earthquake source is properly conducted through various surveys and observations, etc., for the inland crustal earthquake (3.2.2(1)); confirm that, with respect to the seismic ground motion evaluation by the fault-model-based method, the appropriateness of the geometry and location of the earthquake source model, the location of the premises and the facilities installed therein, and the appropriateness of the setting of the earthquake source characteristics parameter is reviewed in detail in consideration of the entire fault with displacement (from the surface earthquake fault to the earthquake source fault) on the ground surface in the case where the earthquake source is extremely close to the premises; confirm that, following the description similar to the Interpretation of the Ordinance on the Standards for Installation Permission, specifically, that the rupture scenario is appropriately considered taking into consideration uncertainty in the setting of the parameter concerning the intensity of strong motion generation (e.g., the amount of stress drop in strong motion generation areas (i.e., asperity) existing in the near field of the evaluation point), the time lag in the starting time of rupture between strong motion generation areas or the rupture development patterns; confirm that the short- and long-period seismic ground motions, and the permanent displacement, based on the earthquake source model have been sufficiently explained (in particular, that the actual phenomena of the permanent and non-permanent displacement have been properly reproduced), by conducting an appropriate reproduction analysis of the seismic ground motion records in the very near field of the source of earthquakes with ground surface displacement causing domestic and international damage, using the method that has adopted the latest scientific/technical knowledge of characteristics of seismic ground motions in the very near field of the earthquake source; review the influence that the heterogeneity in the development of the fault slip on the shallow part may have on the seismic ground motion evaluation and confirm that the uncertainty of the fault slip on the shallow part is sufficiently assessed; and confirm that the influence of the rupture propagation effect on seismic ground motions is sufficiently scrutinized, and that the evaluation of vertical components, in addition to that of horizontal components, is appropriately conducted (3.3.2(4)).

c. There is the following study by the NRA that supports the statements about the case where an earthquake source is extremely close to the premises as referred to in the provisions of Appendix 2 of the Interpretation of the Ordinance on the Standards for Installation Permission paragraph a above and the description in the Earthquake Guide mentioned in paragraph b above. That is, in January 2015, NRA published its study results in the Improvement of the Earthquake Ground Motion Evaluation in the Very Near Field of the Earthquake Source in light of the Fukushima Daiichi Accident

(Defendant 296, the “Earthquake Ground Motion Evaluation in the Very Near Field of the Earthquake Source”) reporting that, as to the influence of the activity of the shallow ground from the surface earthquake fault to the earthquake source fault (i.e., a relatively soft ground that will not be an earthquake source fault), the influence of the shallow ground can be ignored if the premises are 2 km away from the earthquake source, but the influence cannot be ignored, even the activity of relatively soft ground, if the shallow ground within about 2 km away from the premises is displaced. The Earthquake Ground Motion Evaluation in the Very Near Field of the Earthquake Source contains the following statements.

(a) Purpose and prerequisites of research

In performing the seismic ground motion evaluation by the fault-model-based method for the inland crustal earthquake, the model of an earthquake source fault in the seismogenic layer with the depth of about a few to 15 km is adopted based on theoretical or empirical relational expressions between various fault parameters (e.g., the active fault length and the seismogenic layer thickness). Because it is generally considered that the strong motion that causes damage to constructions, etc., is dominated by the fault rupture in the seismogenic layer, the earthquake wave released from the ground shallower than such layer (i.e., subsurface ground) used not to be considered; however, the New Regulatory Requirements newly introduced the provisions for the seismic ground motion evaluation in the case where an earthquake source is extremely close to the premises. However, due to lack of the earthquake observation records in the very near field of the earthquake source that serve as reference, the NRA conducted the quantitative evaluation in an analytical manner, and, in order to understand the characteristics of seismic ground motions in the very near field of the earthquake source, conducted the dynamic fault rupture simulation to reproduce the rupture of the entire fault up to the ground surface, conducted the strong motion evaluation using the analytical results thereof, and evaluated the influence of the earthquake source area of the subsurface ground on earthquake ground motion analysis, for vertical strike-slip faults and reverse faults with a dip angle of 60° by setting the asperity to the seismogenic layer.

(b) Seismic Ground Motion Evaluation in the Very Near Field of the Earthquake Source for strike-slip faults

The NRA performed the calculation of the seismic ground motions at various parts of the ground surface based on the dynamic rupture simulation by setting a rectangle fault plane with a length of 25 km and a width of 18 km for the geometry and location of the fault plane and using a horizontally layered model having the subsurface ground with a thickness of 3 km and the seismogenic layer with a thickness of 15 km as the ground model for the analytical area, thereby gaining the seismic ground motion calculated by adding the seismic ground motion that caused a rupture in the earthquake source area in the deep underground and the seismic ground motion that caused a rupture in the earthquake source area in the subsurface ground, and conducting a theoretical waveform analysis for the evaluation points in the near field of the fault (i.e., eight points which are 0.05 km, about 0.1 km, about 0.2 km, about 0.5 km, about 1.0 km, about 2.2 km, about 4.7 km and 10 km away in the horizontal distance from the surface fault, respectively) by dividing the contributions from earthquake source areas of the subsurface ground and the seismogenic layer, respectively, using the wavenumber integration method, the earthquake ground motions in the seismogenic layer constituted about 90% of the entire fault normal (FN) component, and the seismic ground motions in the earthquake source area of the subsurface ground constituted almost 100% of the entire fault parallel (FP) component, in the very near field of the fault. Also, the influence from the earthquake source area of the subsurface ground will decrease to a negligible

extent at a point 2 km or more away from the fault. The up-down (UD) component has almost the same trend as the FP component, but with the smaller magnitude of seismic ground motion.

(c) Seismic Ground Motion Evaluation in the Very Near Field of the Earthquake Source for reverse faults

The NRA performed the calculation of the seismic ground motions based on the dynamic rupture simulation by selecting the reverse fault with a length of 25 km and a dip angle of 60°, using a model in which the fault top reaches the ground surface, and assuming, in the depth direction, as with the strike-slip fault, the subsurface ground with a depth of 0-3 km and the seismogenic layer with a depth of 3-18 km and setting the depth of the asperity top at 5 km, thereby calculating the theoretical waveform based on the wavenumber integration method and looking into contributions of the seismic ground motions in the subsurface ground and the seismogenic layer from respective earthquake source areas, and found that, in the FN component, the seismic ground motion from the deep earthquake source area dominates regardless of the distance from the surface fault and the influence of the seismic ground motions from the earthquake source area of the subsurface ground is of a negligible degree, and, as to the FP component, the seismic ground motion from the deep earthquake source area largely dominates, compared with the seismic ground motion from the subsurface ground, within the range of 0.2-1 km from the surface fault, while, as to the UD component, if the distance from the surface fault is 2 km or less, the seismic ground motion from the earthquake source area of the subsurface ground partially exceeds the seismic ground motion from the deeper earthquake source area. However, if the distance from the surface fault is 2 km or more, the influence from the earthquake source area of the subsurface ground decreases to a negligible degree. Thus, it can be said that the seismic ground motions in the very near field of the earthquake source in the reverse fault, unlike the strike-slip fault, is subject to smaller influence of seismic ground motions from the earthquake source area of the subsurface ground.

(d) Conclusion

In the case of strike-slip faults, in the very near field of the fault, the fault normal component and the fault parallel component are influenced by the earthquake source areas of the seismogenic layer and those of the subsurface ground, respectively. With respect to the influence of earthquake source areas on the seismic ground motions, it is shown under the conditions of this investigation that the influence of the earthquake source area in the subsurface ground decreases to a neglectable degree at the point about 2 km away from the fault, and that, in the case of the reverse fault, the seismic ground motions from the earthquake source area in the seismogenic layer are largely dominant and the influence from the earthquake source area in the subsurface ground is small.”

(2) Dip angles of the earthquake source faults

A. The adverse party, as described in the outline of the facts, made respective applications for the permission for change in the installation of the Reactor, and for the approvals for the construction plan for the Reactor and for the change in the safety regulations for the Reactor on the assumption that there is a vertical earthquake source fault below the junction between the Sambagawa zone and the Ryoike zone in earthquake source faults in the MTL fault zone within easy reach of the NPP premises, and the NRA issued the permission for and approval of these respective applications because they meet the standards under applicable laws and regulations.

B. At the time of the aforementioned respective applications and of the corresponding permission and approvals, the Long-term Evaluation of the MTL Fault Zone (Second Edition) and the Shikoku Long-term Evaluation had not been published. The Long-term

Evaluation of the MTL Fault Zone (partially revised) publicly available at that time pointed out, as described in the findings in Section VI.3(2)A in the column entitled “Reasons” in the Original Decision that is cited with corrections in paragraph (1) above (the “Findings” in this paragraph), that the geological boundary of the southern margin of the Sanuki Mountains, located to the east of the NPP premises, is potentially an active fault plane,

but noted that further investigation is required because, in the case of an active strike-slip fault such as the MTL fault zone, it is considered that the dip angle of the fault plane is generally high from a mechanical point of view. Also, it is assumed that, in the west side of the aforementioned zone, the dip angle of the zone ranging from the northern margin of the Ishizuchi Mountains to western Ehime Prefecture, if limited to the ground surface and the area near the sea bottom, is high. However, because there are no materials available for deep underground, and because it is only pointed out that the angle of the area at the depth of 2 km or less in the Iyo-nada Sea close to the NPP premises is potentially high to the north. Based on such statement in the Long-term Evaluation of the MTL Fault Zone (partially revised), it cannot be said that the aforementioned applications made by the adverse party on the assumption that the dip angle of the earthquake source fault in the MTL fault zone within easy reach of the NPP premises is vertical based on the mechanical viewpoint, and on the results of an acoustic survey of active faults in shallow underground and of the offshore acoustic survey, are unreasonable. Hence, it can also be said that the NRA’s determination that these applications meet the standards under applicable laws and regulations was not unreasonable.

However, in an action seeking an injunction and a case seeking a provisional disposition order based on the personal rights, the reasonableness of specific review standards and the NRA’s determinations should be determined according to the current level of science and technology, as described in paragraph 1 above; at this time, the Long-term Evaluation of the MTL Fault Zone (Second Edition) and the Shikoku Long-term Evaluation are publicly available. Also, as described in the outline of the facts, the Long-term Evaluation of the MTL Fault Zone (Second Edition) is published by the Earthquake Research Committee as the revision of the Long-term Evaluation of the MTL Fault Zone (partially revised), which is therefore found to be the summary of the results that were reviewed by the Earthquake Research Committee in light of the statement in the Long-term Evaluation of the MTL Fault Zone (partially revised).

Then, as a matter of the current level of science and technology, the review should be made based not on the Long-term Evaluation of the MTL Fault Zone (partially revised), but on the Long-term Evaluation of the MTL Fault Zone (Second Edition); therefore, the reasonableness of the determination by NRA must be determined according to the statement in the latter.

C. Then, considering the statement of the Long-term Evaluation of the MTL Fault Zone (Second Edition) and the Shikoku Long-term Evaluation, the Long-term Evaluation of the MTL Fault Zone (Second Edition) contains a statement, as described in the Findings, that it is determined that the dip angle of the deep part of the fault of the MTL, in particular, the area between [2] the Gojoya zone and [9] the Iyo-nada Sea zone is highly likely to be moderate, on the following grounds: that the comparison between the basis of an argument for a moderate angle (about 40°) and the basis of an argument for a high angle (or almost vertical) as pointed out thus far suggests that the MTL itself has a moderate dip angle leading to the deep underground; that, in spite of pointing out that both arguments agree that the MTL fault zone (active faults) has a high dip angle, no facts have been confirmed in the publicly available seismic reflection profile to indicate the fact that the high-angle MTL fault zone cuts off the lower side of the moderate-angle

MTL; that the fault activities in the MTL are assumed to have been active over tens of millions of years and the strength, friction coefficient, etc., of the faults are imagined to be lower than other faults; that a moderate-angle strike-slip fault is theoretically possible and, although it is an overseas case, an actual case in which a moderate-angle fault moved in a strike-slip motion has been reported; that, in view of the facts that active fault zones run parallel to the MTL only in the very near field, the idea that the MTL fault zone on the shallow part is formed and grown associated with activities of the moderately angled MTL is supported; and that there are almost no active faults to the south of the MTL, and that the distribution of its extensions immediately below the MTL suggests the difficulty in the formation of high angle faults.

Then, in order to say that the adverse party's assertion contrary to the above and the NRA's determination that the above is justifiable are not unreasonable, the adverse party must make an assertion and a prima facie showing on this point, based on substantial evidence and materials.

D. The adverse party has provided the following specific bases for its assumption that there is a vertical earthquake source fault below the junction between the Sambagawa zone and the Ryoke zone: [1] a mechanical viewpoint that it is highly unlikely that the fault plane with a moderate dip angle moves in a strike-slip motion, [2] the fact that, because the cumulativeness of displacement is significant in an almost vertical active fault at the point about 8 km offshore where there is the junction between Ryoke granite rocks and Sambagawa metamorphic rocks and which indicates the existence of an active earthquake source fault that repeats seismic activity, it is considered natural that the earthquake source fault in the deep underground is vertical, and [3] the offshore acoustic survey results that indicate the possibility that, on the lower side of a high angle fault found on the shallow part of the sea bottom, the geological boundary with a high angle to the north is displaced by such high angle fault.

However, with respect to the point [1] above, the adverse party draws a conclusion that

the dip angle of the MTL fault zone is highly likely to be moderate, on the following grounds: that, as described in paragraph C above, the moderate-angle strike-slip fault is theoretically possible because it is assumed that faults in the MTL have been active over tens of millions of years, and because it is imagined that the strength, friction coefficient, etc., of the faults are lower than other faults; and that, although it is an overseas case, an actual case in which a moderate angle fault moved in a strike-slip motion has been reported, as a result of the consideration given in the Long-term Evaluation of the MTL Fault Zone (Second Edition) in light of the statement in the Long-term Evaluation of the MTL Fault Zone (partially revised) that pointed out, in the very same manner as asserted by the adverse party, that, if it is an active strike-slip fault such as the MTL fault zone, the dip angle of the fault plane is considered to be generally high from a mechanical point of view. Therefore, it cannot be said that the point [1] above is sufficient ground to say that the adverse party's assertion is not unreasonable.

Also, the point [3] above is an assertion that is not consistent with the statement in the Long-term Evaluation of the MTL Fault Zone (Second Edition) that no facts have been confirmed in the publicly available seismic reflection profile to indicate the fact that the high-angle MTL fault zone cuts off the lower side of the moderate-angle MTL, and the adverse party's assertion itself indicates the possibility that the geological boundary with a high angle to the north is displaced by the high angle fault, rather than pointing out that there are clear offshore acoustic survey results that support the adverse party's assertion; therefore, it is also impossible to say that the point [3] above is sufficient ground to say that the adverse party's assertion is not unreasonable.

On the other hand, the Long-term Evaluation of the MTL Fault Zone (Second Edition) contains no statements that conflict with the point [2] above. However, the Long-term Evaluation of the MTL Fault Zone (Second Edition) sees that the dip angles of faults in the MTL are highly likely to be moderate based on multiple grounds such as that, as described above, no facts have been confirmed that indicate that the high-angle MTL fault zone cuts off the lower side of the moderate-angle MTL, that it is imagined that the strength, friction coefficient, etc., of the faults in the MTL are lower than other faults, and that the moderate-angle strike-slip fault is theoretically possible, as well as that, in view of the facts that active fault zones run parallel to the MTL only in the very near field, the idea that the MTL fault zone on the shallow part is formed and grown associated with activities of the moderately angled MTL is supported, and that there are almost no active faults to the south of the MTL, and that the distribution of its extensions immediately below the MTL suggests the difficulty in the formation of high angle faults; therefore, the point [2] above does not deny the above-stated facts. Also, regardless of these facts that are considered to indicate that the dip angle of the MTL fault zone is moderate, it must be said that it is difficult to determine that the dip angle of the MTL fault zone is high or almost vertical only on the basis of the point [2] above (the adverse party rather asserts that, in the case of strike-slip fault, experiment results proved that the moderate-angle earthquake source fault causes to generate a high angle active fault in its shallow part, which can be said to be a fact supporting that the dip angle of the MTL fault zone is moderate). Also, other than above, there appear to be no circumstances other than above suggesting that the dip angle of the MTL fault zone is high or almost vertical.

E. In light of the above, as described in the Long-term Evaluation of the MTL Fault Zone (Second Edition), the dip angle of the earthquake source fault in the MTL fault zone should be said to be highly likely to be moderate, and it is difficult to say that the adverse party's assertion contrary to the above is reasonable.

Nevertheless, the Long-term Evaluation of the MTL Fault Zone (Second Edition) does not deny the possibility that the dip angle of the deep part of the fault is vertical. Also, assuming that there is a possibility that the dip angle of the earthquake source fault in the MTL fault zone is moderate to the north, and taking into consideration such possibility as uncertainty, the adverse party has formulated the standard ground motion (Outline of the Facts 7(6)A(B)b, 7(6)A(C)b). Hence, whether the adverse party's assertion can be said to be unreasonable will depend on whether it can be said to be reasonable to have considered, only as uncertainty, the possibility that the dip angle of the earthquake source fault of the MTL is moderate by setting the base case to an assumption that the dip angle of the MTL fault zone is high or almost vertical.

Then, this point will be considered in the following.

(3) Whether it is reasonable to have considered, only as uncertainty, the possibility that the dip angle of the earthquake source fault of the MTL is moderate

A. Seismic ground motion evaluation based on the response spectrum

In evaluating the seismic ground motion based on the response spectrum, the adverse party, as described in the outline of the facts (7(6)A(B)b, B(B), C(B), F(A)), the adverse party, for the dip angle of the earthquake source fault in the MTL fault zone, set the base case to the vertical dip angle case, taking into consideration as uncertainty the case of a dip angle of 30° to the north, evaluated the response spectrum of each case (i.e., the above two cases in combinations with the four assumed cases concerning the fault length), and formulated the standard ground motion Ss-1 based on the response spectra for design formulated by enveloping the response spectra and the response spectra concerning interplate earthquakes and oceanic interplate earthquakes and by taking into consideration the margin. Thus, although the fact that the fault dip angle is

moderate is taken into consideration as uncertainty, it can be said that, in the evaluation of the response spectra, there is no difference from the vertical dip angle case (i.e., the base case), and that both are equally evaluated, and there is no unreasonableness in the consideration process.

Hence, it is found that nothing will be affected by considering, only as uncertainty, the fact that the dip angle of the earthquake source fault in the MTL fault zone is moderate without setting the base case to such fact.

#### B. Seismic ground motion evaluation by the fault-model-based method

(A) In performing the seismic ground motion evaluation by the fault-model-based method, as described in the outline of the facts (7(6)A(C)b), the adverse party considers the faults with a length of about 480 km, about 130 km and about 54 km, respectively, as the base earthquake source models in the same manner as the seismic ground motion evaluation based on the response spectrum, while considering, as to the fault dip angle, the vertical dip angle as the base earthquake source model, and takes into consideration the case of a dip angle of 30° to the north as uncertainty in being overlapped with the standard source model, that is, independent uncertainty. As a result, that the earthquake fault has a dip angle of 30° to the north is considered in combination with the respective four cases of the fault length, but not considered in combination with [1] the uncertainty about setting the amount of stress drop at 1.5 times or to 20MPa, [2] the uncertainty concerning the fracture propagation speed, and [3] the uncertainty concerning the plan position of asperity that are considered as independent uncertainty in addition to the fault dip angle.

(B) The appellants assert that, because the influence of the consideration of the uncertainty in [1] above is, in particular, overwhelming, it is unreasonable not to consider both such uncertainty and the earthquake source fault with a dip angle of 30° in combination.

However, the Long-term Evaluation of the MTL Fault Zone (Second Edition), as described in the Findings, points out, as to the view that the dip angle of the earthquake source fault is moderate, whether the moderate-angle MTL is capable of causing the strike-slip dominant movement, and explains the above on the grounds that the fault activities in the MTL are assumed to have been active over tens of millions of years, and that the strength, friction coefficient, etc., of the faults are imagined to be lower than other faults. Thus, as pointed out in the Long-term Evaluation of the MTL Fault Zone (partially revised), although, in the case of an active strike-slip fault such as the MTL fault zone,

the dip angle of the fault plane is considered to be generally high from a mechanical point of view, it can be considered that, in the case of the MTL fault zone, its moderate angle fault plane is the fault plane because the moderate angle fault plane is more likely than the high angle fault plane to cause the strike-slip movement, that is, the strength, friction coefficient, etc., of the fault are relatively lower (Hiroshi Sato and others (2017) "Geophysical characterization of the seismogenic source faults of the MTL Active fault system" (Defendant 430) is also in a similar vein to this).

Thus, in the case where the dip angle of the earthquake source fault in the MTL fault zone can be said to be moderate, the strength, friction coefficient, etc., of the fault plane are considered to be relatively lower. Hence, it cannot be said that the adverse party's seismic ground motion evaluation is unreasonable on the grounds that the uncertainty about setting the amount of stress drop (i.e., energy released by the earthquake source fault slipping) at 1.5 times or to 20MPa is not considered in combination with the uncertainty about setting the dip angle of the earthquake source fault in the MTL fault zone at 30° to the north.

(C) The appellants assert that the adverse party should have performed the seismic ground motion evaluation in combination with the consideration of the uncertainty about setting the dip angle of the earthquake source fault at 30° to the north and the uncertainty other than the amount of stress drop (i.e., the fracture propagation speed and the plan position of asperity mentioned in (A)[2] and (A)[3] above).

However, the appellants admit that the influence of the consideration of these uncertainties is smaller than the influence of the consideration of the uncertainty about the amount of stress drop. As described in the Findings, in reviewing the influence of the revision of the Long-term Evaluation of the MTL Fault Zone on the seismic ground motion evaluation around April 2019, the adverse party also reviewed the seismic ground motion evaluation which respectively considered [1] the uncertainty about setting the amount of stress drop at 1.5 times or to 20MPa, [2] the uncertainty concerning the plan position of asperity, or [3] the uncertainty concerning the fracture propagation speed,

by setting the base case in which the length of the fault in the MTL fault zone is 87 km and the dip angle of the earthquake source fault is 40° to the north, the results of which were as described in Appendix Figures 1 through 3 of the Decision. There are no circumstances suggesting that there is any unreasonableness in the aforementioned review. Thus, in light of the fact that the seismic ground motion obtained from the evaluation is still less than the standard ground motion assumed by the adverse party even if the uncertainty about the amount of stress drop and the uncertainty about setting the dip angle of the earthquake source fault at 30° dip angle to the north are in combination taken into consideration, it is not found that the seismic ground motion obtained from the evaluation exceeds the standard ground motion assumed by the adverse party even if the uncertainty about setting the dip angle of the earthquake source fault at 30° to the north and the uncertainty about anything other than the amount of stress drop are in combination taken into consideration.

(D) Then, it is not found that, with respect to the seismic ground motion evaluation by the fault-model-based method, there is any influence on the evaluation of the standard ground motion only because that the dip angle of the earthquake source fault in the MTL fault zone is moderate was not set as the base case, but taken into consideration only as uncertainty.

C. In light of the above, it cannot be said that it is unreasonable that the adverse party took into consideration only as uncertainty the possibility that the dip angle of the earthquake source fault in the MTL fault zone is moderate.

(4) Active faults along the coast of the Sadamisaki Peninsula

A. As described in the Findings, Appendix 2 of the Interpretation of the Ordinance on the Standards for Installation Permission requires the clarification of the location, geometry, activity, etc., of active faults with respect to the earthquake for investigation that is selected with respect to the inland crustal earthquake, as to “seismic ground motions to be formulated by identifying the earthquake source on a premise-by-premise basis.” Also, the Appended Interpretation 2 and the Earthquake Guide require to: review in detail,

in the case where an earthquake source is extremely close to the premises, the adequacy of the geometry and location of the earthquake source model, and the locations of the premises and the facilities installed therein, and the adequacy of the setting of the earthquake source characteristics parameter, in consideration of the entire fault with displacement on the ground surface, as well as evaluate in more detail the impact of various types of uncertainty on the seismic ground motion evaluation while being mindful of the applicability of assessment methods in consideration of the review results above, and formulate the standard ground motion with a further sufficient margin

taking account of the latest scientific/technical knowledge concerning the characteristics of seismic ground motions in the very near field of the earthquake source; confirm that, with respect to the seismic ground motion in such case, the adequacy of the geometry and location of the earthquake source model and the locations of the premises and the facilities installed therein, and the adequacy of the setting of the earthquake source characteristics parameter are reviewed in detail in consideration of the entire fault (covering from the surface earthquake fault to the earthquake source fault) with displacement on the ground surface; specifically, confirm that the rupture scenario is appropriately considered taking into consideration uncertainty in the setting of the parameter concerning the intensity of strong motion generation (e.g., the amount of stress drop in strong motion generation areas (i.e., asperity) existing in the near field of the evaluation point), the time lag in the starting time of rupture between strong motion generation areas and the rupture development patterns, confirm that the short- and long-period seismic ground motions, and the permanent displacement based on the earthquake source model have been sufficiently explained (in particular, that the actual phenomena of the permanent and non-permanent displacement have been properly reproduced), by conducting an appropriate reproduction analysis of the seismic ground motion records in the very near field of the source of earthquakes with the ground surface displacement causing domestic and international damage, using the method that has adopted the latest scientific/technical knowledge of characteristics of seismic ground motions in the very near field of the earthquake source; review the influences that the heterogeneity in the development of the fault slip on the shallow part may have on the seismic ground motion evaluation, and confirm that the uncertainty of the fault slip on the shallow part is sufficiently assessed; and confirm that the influence of the rupture propagation effect on seismic ground motions is sufficiently scrutinized, and that the evaluation of the vertical component, in addition to that of the horizontal component, is appropriately conducted.

The adverse party determined that there is no active fault in the north coast of the Sadamisaki Peninsula, and that the evaluation of the case of an active fault extremely close to the premises is unnecessary, and has not performed the seismic ground motion evaluation of such case, and has no specific figures thereof; therefore, if the above determination by the adverse party is unreasonable, it will be suspected that the adverse party's seismic ground motion evaluation by the fault-model-based method is unreasonable as a whole. Hence, the determination itself that the figure of the seismic ground motion evaluation by the fault-model-based method does not exceed that of the seismic ground motion evaluation based on the response spectrum (by extension, the adverse party's seismic ground motion evaluation itself) will be unreasonable, in which case the NRA's determination that such adverse party's seismic ground motion evaluation is justifiable will also be unreasonable.

Then, with respect to the Reactor Facilities, it is necessary to consider whether there is an active fault in the north coast of the Sadamisaki Peninsula, and whether, in the case where the earthquake source is extremely close to the premises, the seismic ground motion evaluation is necessary (i.e., whether the Reactor Facilities fall under "the case where an earthquake source is extremely close to the premises").

B. the adverse party asserts that there is no active fault in the north coast of the Sadamisaki Peninsula, saying that it has confirmed the non-existence of any active fault in the coastal area of the NPP premises as a result of the detailed offshore acoustic survey.

On the other hand, the appellants assert that [1] the description in the Long-term Evaluation of the MTL Fault Zone (Second Edition), "It is considered necessary to take into consideration the possibility that the MTL shallower than the junction between the

Sambagawa zone and the upper surface of the Ryoike zone is also an active fault. The MTL in the southern margin of the Iyo-nada Sea and the coast of the Sadamisaki Peninsula has not been recognized as an active fault because such MTL has not been surveyed up to the present. Future detailed survey is required.”, suggests the determination that the adverse party’s survey is insufficient, [2] the scope and accuracy of the survey are questionable because the adverse party’s offshore acoustic survey is too rough to recognize an active fault, because the acoustic survey by the National Institute of Advanced Industrial Science and Technology (“AIST”), etc., did not discover the MTL fault zone discovered by another group, and because there have been no surveys in the central area of the Sadamisaki Peninsula located offshore of the NPP and no surveys of the coastal area in such central area, and [3] that it cannot be said that the adverse party’s survey has confirmed the non-existence of any active fault in the place extremely close to the NPP premises, by pointing out that whether there is an active fault should in principle be finally determined by a marine sediment survey (e.g., boring).

Then, considering the above, as described in the Findings, the adverse party performed a survey using various acoustic sources in the sea area in front of the NPP premises. Also, in the Iyo-nada Sea, acoustic surveys using various acoustic sources with different depths for survey and resolutions by the adverse party and research organizations (e.g., AIST, the Geospatial Information Authority of Japan, and university groups). The results of these acoustic surveys are collected in Shikoku Electric Power Company, Incorporated (2014), which shows the view that it can be confirmed that there is no active fault in the north coast of the Sadamisaki Peninsula on the grounds that no deformation is found in the D fault that is assumed to be a fault equivalent to the middle-to-late-Pleistocene fault.

However, as described in the Findings, the Long-term Evaluation of the MTL Fault Zone (Second Edition) states that the adverse party performed a detailed survey of the Iyo-nada Sea area, while on the other hand stating that the MTL in the southern margin of the Iyo-nada Sea and the coast of the Sadamisaki Peninsula “has not been recognized as an active fault because such MTL has not been surveyed up to the present. Future detailed survey is required”. According to this, it can be found that the statement on whether there is an active fault in the coast of the Sadamisaki Peninsula is based on the insufficiency of the aforementioned acoustic surveys by the adverse party and others.

In this regard, the adverse party asserts that the aforementioned statement in the Long-term Evaluation of the MTL Fault Zone (Second Edition) remains a personal view of a committee member who expressed such view, and is not a conclusion adopted at the time of the revision, and that such committee member overlooked the results of the adverse party’s offshore acoustic survey, as well as Professors q1 and q2 who were involved in the formulation of the Long-term Evaluation of the MTL Fault Zone (Second Edition) also go along the same line with this (Defendant 344 and 442). However, as stated in the Findings, the statement that stresses the necessity of a survey of the coastal shallow waters near the shore in the Iyo-nada Sea zone is also found in the conclusion part of the Long-term Evaluation of the MTL Fault Zone (Second Edition); therefore, it cannot be found that this remains a personal view of some committee members. Also, it is unlikely that the statement that still overlooked the adverse party’s offshore acoustic survey results was retained in the formulation of the Long-term Evaluation of the MTL Fault Zone (Second Edition). On the other hand, Professor q2 comments that, because the Earthquake Research Committee basically evaluates academic articles, there is an aspect that the adverse party’s offshore acoustic survey results presented as examination materials of nuclear power plants, in particular, those presented for hearings rather than formal review meetings (Defendant 442) might, in

part, not be properly taken into consideration. The Long-term Evaluation of the MTL Fault Zone (Second Edition) also includes the statement that explains the Iyo-nada Sea zone sea area in the MTL fault zone based on the adverse party's acoustic survey, and states, in light of the above, the MTL in the southern margin of the Iyo-nada Sea and the coast of the Sadamisaki Peninsula has not been surveyed up to the present (in addition, it is "Shikoku Electric Power Company, Incorporated (2015)" (Defendant 119) that is described in such Edition, which also refers to the acoustic surveys by the adverse party and other organizations described above); therefore, it cannot be determined that the Earthquake Research Committee evaluates only academic articles.

Also, as to whether acoustic surveys performed by the adverse party and others are sufficient in determining that there is no active fault in the coast of the Sadamisaki Peninsula, experts have different opinions: Professors q1 and q2 submitted positive comments while on the other hand Professors q3 and q4 submitted negative comments. Although in determining such sufficiency, the above survey results must be evaluated in light of specialized knowledge, it cannot be determined that the aforementioned survey has sufficiently been conducted, in light of the fact that the Long-term Evaluation of the MTL Fault Zone (Second Edition) determines that the MTL in the coast of the Sadamisaki Peninsula has not been surveyed up to the present, and that it can hardly be found that

the NRA determined that, based on the review of the aforementioned statement in the Long-term Evaluation of the MTL Fault Zone (Second Edition), the adverse party's determination of non-existence of an active fault in the coast of the Sadamisaki Peninsula is reasonable (according to Defendant 431, 457 and 458, it is found that the NRA reviewed the content of the Long-term Evaluation of the MTL Fault Zone (Second Edition) after the publication thereof; however, the NRA, at the time, merely reviewed the length of the MTL fault zone, the revision of its active fault zones, and dip angles of its active faults and there is no indication that the NRA reviewed whether there is an active fault in the coast of the Sadamisaki Peninsula).

C. In the meantime, the provisions of Appendix 2 of the Interpretation of the Ordinance on the Standards for Installation Permission, and the description in the Earthquake Guide, as described in paragraph A above, specify special provisions for the case where it is found that "the earthquake source is extremely close to the premises"; however, the adverse party asserts that, because the earthquake source fault is at or below the junction between Sambagawa metamorphic rocks and Ryoke granite rocks, and the part above the junction is a relatively shallow soft ground, such ground, unlike the case where hard, deep grounds are displaced together, cannot become an earthquake fault, which needs to be considered separately from the earthquake source fault. Then, we will examine the meaning of the words "the earthquake source is extremely close to the premises" in the provisions of Appendix 2 of the Interpretation of the Ordinance on the Standards for Installation Permission, and the description in the Earthquake Guide, as described in paragraph A above as follows:

With respect to the evaluation in the case where the earthquake source is extremely close to the premises, as described in the Findings, there is a research outcome of the Seismic Ground Motion Evaluation in the Very Near Field of the Earthquake Source stating that, if the premises are 2 km or more away from the surface fault, the influence of the earthquake source area of the subsurface ground (relatively soft ground that does not become an earthquake source fault) can be ignored, but that, if the subsurface ground within about 2 km from the premises is displaced, the influence cannot be ignored, even that of the activity of relatively soft ground. As a result of examination of the cases of a strike-slip fault (it is found that the research assumes the vertical fault) and of a reverse fault (with a dip angle of 60°), the research outcome shows that: with

respect to the strike-slip fault, while there will be greater influence of the earthquake source area of the subsurface ground on the place close to the fault, such influence will be smaller and negligible at places 2 km or more away from the fault; with respect to the reverse fault, while the influence of the earthquake source area of the subsurface ground will not be as great as that of the strike-slip fault, the influence from the earthquake source area of the subsurface ground at places 2 km or less away from the surface fault will partially exceed the seismic ground motions from the deeper earthquake source area; and the influence from the earthquake source area of the subsurface ground at places 2 km or more away from the surface fault will be reduced to the negligible extent. With respect to the case of the strike-slip fault, the aforementioned starting point for measuring a 2 km distance is merely mentioned as a "fault," which is, however, considered to mean that there was no need to clarify whether the distance should be measured from the point immediately above the earthquake source area or from the surface fault because of the assumption of a vertical fault. In consideration also of the description on the case of the reverse fault, it is reasonable to understand that the words "earthquake source" in the above research outcome does not refer to the earthquake source area in the seismogenic layer, but the earthquake source area of the subsurface ground.

Then, the provisions of Appendix 2 of the Interpretation of the Ordinance on the Standards for Installation Permission, and the description in the Earthquake Guide, as described in paragraph A above which are supported by the above research outcome should also be interpreted in the same manner, and it is reasonable to understand that "the case where the earthquake source is extremely close to the premises" in the aforementioned provisions or description means the case where the distance from the earthquake source area of the subsurface ground to the premises is within 2 km.

As mentioned above, although it is not found that the survey on whether there is an active fault in the coast of the Sadamisaki Peninsula has been conducted sufficiently, we will consider whether, if the active fault is found in such coast as a result of the survey, such active fault will fall under "the case where the earthquake source is extremely close to the premises" in the above understanding.

D. The appellants assert that the MTL itself as a geological boundary is potentially an active fault, and that, at least at any point shallower than the junction between Sambagawa metamorphic rocks and Ryoke granite rocks, the geological boundary between Sambagawa metamorphic rocks and Izumi Group is potentially an active fault. Also, in considering faults associated with activities of the MTL itself, the Long-term Evaluation of the MTL Fault Zone (Second Edition) states that it is considered to be necessary to take the possibility into consideration that the MTL at and under the junction between the Sambagawa zone and the Ryoke zone, which corresponds to the appellants' assertion above.

A further consideration of the aforementioned assertion by the appellants shows that the appellants adduce the following three points as the evidence of the assertion above: [1] in the MTL, the normal fault movement still continues to form a half-graben; [2] according to the gravity anomaly survey results, it is clear that the MTL is active again; and [3] there is an active fault in the parts of the MTL as a geological boundary that exist at both ends of the area close to the NPP premises.

(A) Normal fault movement that forms a half-graben

a. The appellants assert that there is an ongoing movement that forms a half-graben in the Iyo-nada Sea area close to the NPP premises, with the accumulation of fan-shaped layered displacement, which may, in the case where the main fault does not take the typical arc-like form, generate a secondary fault to eliminate distortion generated in the basin, thereby generating a depression around the secondary fault, in which case,

although there can be found some cumulateness of fan-shaped layered displacement on the near field side of the shore, the MTL fault zone forms such secondary fault in the Iyo-nada Sea area close to the NPP premises; therefore, even if there cannot be found any cumulateness of fan-shaped displacement on the near field side of the shore (the south side), it is undeniable that the normal fault movement continues in the MTL.

Then, considering the above, although it cannot be found in the drawing pointed out by the appellants (Defendant 442 [p. 13] listed as Appendix Figure 4 in the Decision) that there is any accumulation of fan-shaped layered displacement in the Iyo-nada Sea area close to the NPP premises, in particular on the near field side of the shore, as asserted by the appellants, according to the Prima Facie Material (Plaintiff 1056 [p. 17], Defendant 480 [p. 17], Defendant 484 [p. 195]) and the entire import of court hearing, it is found that, also in the normal fault movement forming a half-graben, a secondary fault is generated around it to eliminate distortion generated in the basin, and, on the nearer field side of the shore than the secondary fault, there may be found no cumulateness of fan-shaped layered displacement (Appendix Figure 5). In this regard, the adverse party asserts that

it is found that, in the displacement of the normal fault near the master fault in Appendix Figure 5, there is a structure in which the sedimentary layer becomes thicker in fan shape towards the master fault side, which differs from the topographical structure of the Iyo-nada Sea area close to the NPP. In Appendix Figure 5, some places have a structure in which the sedimentary layer becomes thicker in fan shape towards the master fault side and other places do not; therefore, it cannot be determined that the structure in which the sedimentary layer becomes thicker in fan shape towards the master fault side can also be found in the case where a secondary fault is generated. Also, there is no denying that the structure of the MTL fault zone is similar to the secondary fault in Appendix Figure 5. Hence, the aforementioned assertion by the adverse party cannot be accepted. In addition, the Long-term Evaluation of the MTL Fault Zone (Second Edition) also states,

in discussing the dip angle of the deep part of the fault in the area from the Gojoya zone to the Iyo-nada Sea zone of the MTL, that the Headquarters for Earthquake Research Promotion supports, as its own view, the idea that the MTL fault zone (active fault) in its shallow part is formed and grown associated with activities of the moderately angled MTL, which means that the MTL is still active and corresponds to the appellants' assertion that there still continues the movement forming a half-graben in the Iyo-nada Sea area close to the NPP premises.

b. On the other hand, the adverse party asserts that the appellants' assertion that the normal fault movement has continued in the MTL is in conflict with the clear statement by the Long-term Evaluation of the MTL Fault Zone (Second Edition) that strike-slip fault movement dominates among the fault movement in the MTL fault zone. However, the Long-term Evaluation of the MTL Fault Zone (Second Edition) states, as described in the Findings, the MTL fault zone is mainly composed of right-lateral strike-slip faults, but with vertical slips, which are reverse faults at the easternmost edge of the fault zone, but are regarded as mainly normal faults dipping to the northern side at the westernmost edge of the fault zone close to the Iyo-nada Sea. In light of the fact that the fault in the Iyo-nada Sea is potentially a fault that contains the normal fault component, it should be said that there is no denying that the possibility that the MTL itself as a geological boundary is a strike-slip fault containing the normal fault component.

#### (B) Gravity anomaly survey results

The appellants assert that the possibility that the MTL as a geological boundary is an active fault can be directly proved from the gravity anomaly survey results based on Professor q4's view that the gravity anomaly survey shows that a half-graben has been

formed along the MTL (geological boundary) closest to the NPP premises (i.e., this geological boundary is a fault) because there is a steep gradient zone of gravity anomaly along the geological boundary.

In this regard, although it is certain that there is not enough evidence to demolish Professor q4's finding that the steep gradient zone of gravity anomaly indicates that substances with different densities exist next to each other, there is no dispute in the fact that there exists the MTL as a geological boundary in the north coast of the Sadamisaki closest to the NPP premises, and, in light of the aforementioned finding, it is also considered that the steep gradient zone of gravity anomaly only indicates the geological boundary; therefore, it is difficult to say that the steep gradient zone of gravity anomaly directly proves the existence of an active fault. Hence, the aforementioned assertion of the appellants cannot be accepted.

(C) Active faults on both edges

The appellants assert that, based on Professor q4's view that it can be reasonably assumed that the MTL as a geological boundary from Beppu Bay through the Iyo-nada Sea is commonsensically an active fault as a whole because there is the Shimonada-Nagahama coast active fault zone in the eastern area of the place close to the NPP premises on the MTL, and, on the opposite side (Kyushu side), an active fault called Saganoseki fault is specified also by the Headquarters for Earthquake Research Promotion, the MTL within easy reach of the NPP premises is also an active fault because of the existence of the aforementioned active faults in the west and east.

Nevertheless, considering that Professor q4 himself testifies, "It cannot be simply assumed or recognized in a way that as both edges are active faults, so is the middle" (Witness q4 [p.52]), and that, according to the Prima Facie Material (Plaintiff 885 [p. 15]),

it appears that the MTL fault zone, located from 5 to 8 km offshore of the NPP premises, is connected to the Shimonada-Nagahama active fault, it cannot be immediately said that, the MTL (geological boundary) within easy reach of the NPP premises is also an active fault only because there is a place where the MTL as a geological boundary accords with the active fault in the west and east of the NPP.

However, as described in the paragraph (A) above, in light of the geological structure of the Iyo-nada Sea area close to the NPP premises, there is no denying that the MTL itself as a geological boundary in the same area is likely to be a strike-slip fault that contains the normal fault component. Also, the fact that there is a place where the MTL as a geological boundary accords with the active fault in the west and east areas close to the NPP can be a circumstance that supports the aforementioned possibility.

(D) According to the above, it should be said that there is no denying that the MTL itself as a geological boundary within easy reach of the NPP premises may be a strike-slip fault that contains the normal fault component.

E. On the other hand, the adverse party asserts that, in case of strike-slip fault, it has been revealed, from experiment results (Defendant 432), that, because the fact that a moderate-dip-angle earthquake source fault causes a high angle active fault in the shallow part thereof, no active fault will be generated in the north coast of the Sadamisaki Peninsula that is the extension of a moderate angle earthquake source fault.

Then, considering the above, according to the results of experiments by the staff of Shikoku Electric Power Company, Incorporated, and other research groups (Findings (C)i), the MTL active fault system in the Iyo-nada Sea area is an oblique-slip fault with the right-lateral strike-slip component and the normal fault component, and, in particular, has consistency with the experiment results in the case where the fault dip angle in the batholith is gentle and the strike-slip component dominates. Also, according to the

aforementioned experiment results, if the fault dip angle in the batholith is gentle and the strike-slip component dominates, the MTL fault zone, two shear surfaces indicating the en echelon array (i.e., a type of array specific to the right-lateral strike-slip fault) will be generated in the area immediately above the fault, and a depression will grow in the area immediately above the fault sandwiched between such surfaces, in which case there is no denying that the geometry of such terrain is similar to that of the MTL fault zone located about 8 km offshore of the NPP premises. However, the aforementioned experiment results point out that shear surfaces will be generated in the area immediately above the fault, which does not clearly specify that no active fault will be generated in the location that corresponds to the extensions of a moderate angle earthquake source fault. The aforementioned experiment results also point out the right-lateral strike-slip fault movement has been dominant in the eastern Iyo-nada Sea area since early times while it is considered that the normal fault movement is also identified in the central-western Iyo-nada Sea area. Hence, there is no denying that, in the area close to the NPP premises located in the central-western Iyo-nada Sea area, the MTL fault zone contains an appreciable extent of the normal fault component. Then, it should be said that, based on the aforementioned experiment results, it cannot be determined that no active fault will be generated in the north coast of the Sadamisaki Peninsula that corresponds to the extensions of a moderate angle earthquake source fault.

F. As described in paragraph D above, there is no denying that, in the area close to the NPP premises, the MTL itself as a geological boundary may be a strike-slip fault that contains the normal fault component. Although it is difficult to accurately measure the distance from the surface fault to the NPP premises under the assumption that the MTL itself as a geological boundary is a fault, according to the Prima Facie Material (Defendant 126 [p. 10], Defendant 442 [p. 13]), it is found that the distance is within 2 km at most from the NPP premises. Then, the NPP premises will be within 2 km from the earthquake fault area of the subsurface ground in the MTL. Hence, with respect to the Reactor Facilities, it was necessary to perform the seismic ground motion evaluation for “the case where the earthquake source is extremely close to the premises” in accordance with the provisions of Appendix 2 of the Interpretation of the Ordinance on the Standards for Installation Permission, and the description in the Earthquake Guide, as described in paragraph A above. However, the adverse party has not carried out the seismic ground motion evaluation for “the case where the earthquake source is extremely close to the premises.”

Then, it must be said that there was certain error and omission in the course of the NRA’s determination because, despite the possibility of falling under “the case where the earthquake source is extremely close to the premises,” the adverse party determined that there is no active fault in the north coast of the Sadamisaki Peninsula without sufficient survey on the existence of an active fault therein and made respective applications for the permission for change in the installation of the Reactor, and for the approvals for the construction plan for the Reactor and for the change in the safety regulations for the Reactor, and because the NRA then determined that there is no problem with such applications.

Hence, as described above, despite the fact that it is found that there is some unreasonableness in the NRA’s determination that the Reactor Facilities conform to the New Regulatory Requirements, the adverse party must make an assertion and a prima facie showing based on substantial evidence and materials that there is no specific risk that the appellants suffer serious damage to their lives, bodies and livelihood foundations from radiation exposure due to the release of radioactive substances into the surrounding environment arising from the operation, etc., of the Reactor Facilities.

However, the adverse party has not made any assertion or prima facie showing on this point since it has no specific figures concerning the seismic ground motion evaluation for “the case where the earthquake source is extremely close to the premises” without performing any survey other than the aforementioned acoustic survey by the adverse party and others; therefore, it cannot be said that the adverse party has fulfilled the responsibility for making the aforementioned assertion and prima facie showing. Hence, it is found that there is a specific risk of interference with the appellants’ lives, bodies, etc., due to the operation of the Reactor. [Underlined by the editor.]

In this regard, the adverse party asserts that the natural period of important safety equipment in the Reactor Facility is approximately 0.1 seconds or less or at most less than 0.3 seconds, and the short-period seismic ground motion is unlikely to occur in the shallow ground, the impact of which will be slight on the earthquake safety of the Reactor Facilities. It is certain that, according to the Prima Facie Material (Defendant 299), it is found that the natural period of important safety equipment in the Reactor Facilities is approximately 0.1 seconds or less or at most less than 0.3 seconds; however,

according to the Prima Facie Material (Defendant 296), it cannot necessarily be said that the short-period seismic ground motion is unlikely to occur in the shallow ground. In other words, the Seismic Ground Motion Evaluation in the Very Near Field of the Earthquake Source (Figure 7 of Defendant 296 [p. 6]), as described in Appendix Figure 6, suggests that, rather on the short-period side, the distance to the fault has large impacts on the seismic ground motion evaluation (in this regard, although the adverse party asserts that they cannot be compared because the seismic ground motion level in a shorter period less than 0.5 seconds, judging from the Figure, it is difficult to say that the short-period seismic ground motion is unlikely to occur in the shallow ground). Also, the Prima Facie Material the adverse party uses as the evidence for its assertion (Defendant 298 and 435) only assumes that the influence is limited to the long-period component, or that, in the case of the occurrence of a large-scale crustquake in which a surface earthquake fault will emerge, a long-period seismic ground motion is highly likely to be generated in the very near field of the fault. It cannot be said that either finding clearly states that the short-period seismic ground motion is unlikely to occur in the shallow ground. Hence, the aforementioned assertion by the adverse party cannot be accepted.

Then, it should be said that, with respect to the petition of the appellants, a prima facie showing has been made on the right to be preserved related to the evaluation of risk of the evaluation of the MTL.

#### (5) Ground of the NPP premises

A. The appellants make an assertion concerning the ground of the NPP premises as the issue concerning the location of the MTL. In other words, the appellants assert that it is considered that the NPP is located in the MTL’s damage zone, and the bedrock under the NPP premises is fragile, and therefore, if the MTL fault becomes active, there will be risk of deep-seated landslide in the bedrock constituting the ground of the NPP premises.

In this regard, according to the Prima Facie Material (Defendant 13 [pp. 6-3-8 through 6-3-19, pp. 73-82, pp. 112-123]), it is found that: based on the geological map of the area around the NPP premises, the adverse party has confirmed that the geological structure of the land surrounding the NPP premises is stable, that, based on the results of the surveys conducted in the NPP premises (e.g., surface geological survey, surface elastic wave survey, boring survey, test pit survey, deep boring survey, and groundwater level survey), the ground of the NPP premises mainly consists of basic schist of Sambagawa metamorphic rocks, and, basic schist in the NPP premises has schistosity

but is generally less detachable, in massive form, and firm, that the ground of the NPP premises is almost horizontal, in massive form, firm and stable, and consists of continuous bodies of crystalline schist mainly containing firm and dense pelitic schist at a depth of about 50 m to at least about 2,000 m, that almost all faults found in the NPP premises are small (less than 10 cm) and has no continuity down to the deep underground, that the foundation of the Reactor Facilities has bearing capacity, safety against slippage, and resistance to deformation, thereby it can be said that such foundation has the soil bearing capacity even under the earthquake force caused by the standard ground motion, and that it is found that the slopes surrounding the Reactor also have safety against slippage, and stability even under the earthquake force caused by the standard ground motion; that the adverse party determined that the facilities subject to the design standards for the Reactor and the ground under the facilities used to address a serious accident, etc., conform to Articles 3 and 38 of the Ordinance on the Standards for Installation Permission; and that the NRA recognized such determination is justifiable.

B. In response to this, the appellants assert as described in paragraph A above on the grounds of the comment of Associate Professor q3 that, with respect to the mafic schist displayed by the adverse party at the Ikata Visitors House, the surface is not a fresh rupture surface but found with manganese staining, and the upper surface is a shiny slickenside, and of the statement of the expert evidence by Expert Witness q5 adopted by the Matsuyama District Court that handled the first instance case judged by Ikata Supreme Court (Plaintiff 890, "Evidence q5").

However, the comment of Associate Professor q3 (Plaintiff 1035, 1056, and Defendant 480) does not prove the bases of his/her comment that the surface of the mafic schist displayed at the Ikata Visitors House is not fresh rupture surface but found with manganese staining, and its upper surface is a shiny slickenside surface, and we have found no adequate materials that suffice for the facts to be acknowledged.

Also, Evidence q5 states that, because the ground of the premises of the Reactor Facilities consists of the Sambagawa crystalline schist which significantly develops schistosity, and because the crystalline schist is cut off by a joint or fault, many places on which are fractured into large and small lenticular bodies by the low angle slip surface,

it cannot be said that such ground has the so-called monolithic rock character, and that, because it is likely that quite a few of the aforementioned faults were generated in association with the MTL movement, the premises ground is not firm but rather weak. It is clear that photographs were attached to Evidence q5 according to its description; however, there is no photograph attached to the Prima Facie Material (Plaintiff 890), and it is therefore unclear which parts of the NPP premises were photographed. Also, the comments in Evidence q5 remain descriptions of overall impressions, rather than determinations based on measured figures, stating that, because the "lenticular bodies," "reach from several tens of centimeters to a few meters or occasionally over," and small lenticular bodies, even in their appearance, "give a clear impression" of being fractured, and even large lenticular bodies are "fractured into many small lenticular bodies, which is not the determination made based on measured figures. Furthermore, the comment states that "many fracture zones are small (i.e., the width of 40 cm or less)" and "the fracture zone of the largest scale reaches about 70 cm and the width of fault gouge reaches a few centimeters," but does not clarify whether the aforementioned fault reaches the deep underground. Hence, because it is difficult to accept that such size of fracture zone has influence on the soil bearing capacity, and because the aforementioned largest fracture zone seems to have existed in the foundation of Unit 2

reactor (Plaintiff 890 [p.43]), it cannot be accepted that such fracture zone was discovered around the foundation of the Reactor Facilities.

In addition, in light of the fact that Evidence q5 was prepared in 1976 (Plaintiff 890), it is difficult to accept that the accuracy of the various findings and research results at that time are sufficient in light of the current level of science and technology, and it is also difficult to consider that the adverse party's ground survey, and safety evaluation of surrounding slopes, are inferior to the survey and findings on which Evidence q5 was based.

According to the above, the credibility of the ground evaluation by the adverse party described in paragraph A above cannot be undermined by the comment of Assistant Professor q3, and Evidence q5. Hence, the appellants' assertion concerning the ground of the NPP premises cannot be accepted.

(6) According to the above, the right to be preserved is acknowledged on the basis of consideration in paragraph (4) above, without considering the remaining points. However, in light of the course of the proceedings, we will next consider safety against volcanic events (Issue 4).

### 3. Safety against effects of volcanic events

#### (1) Findings

Other than the correction made below, the findings remain the same as described in Section VI.4(1) in the column entitled "Reasons" in the Original Decision, which are therefore cited as follows:

A. The word "324," shall be added immediately after "Defendant" in line 23 of page 249 of the Original Decision.

B. A new line shall be started immediately after the end of line 21 of page 250 of the Original Decision, and the following words shall be added:

"- The Aso-2 eruption about 140,000 years ago (50 km<sup>3</sup> or more)".

C. Line 1 of page 251 of the Original Decision shall be deleted.

D. The word "Maeno" in line 2 of page 251 of the Original Decision shall be replaced with "previous".

E. The text that begins with "this Nagaoka (1988)" in line 5 and ends at the end of line 8 of page 252 of the Original Decision shall be replaced with the following: "The adverse party determined, as described below, that the current Aso volcano has continued small eruptions of various types and is in a stage equivalent to the post-caldera eruption stage in the eruption phases in the aforementioned finding. However, in caldera eruptions, a plinian eruption often precedes a large pyroclastic flow eruption but it is suggested that a pyroclastic flow eruption may occur without being accompanied by a plinian eruption (Defendant 372 and 373).".

F. The words "366 and 376" in line 14 of page 252 of the Original Decision shall be replaced with "365, 366, 372 and 376".

G. The word "376," shall be added immediately after "373," in line 8 of page 253 of the Original Decision.

H. The text that begins with "... of magma chamber" in lines 2 through 3 of page 255 and ends at the end of line 5 of the Original Decision shall be replaced with the following: "If the wall rock is heated by the formation of a magma chamber, the plastic deformation strength may become smaller than the brittle fracture strength; therefore, it is considered that the stress concentration may be relieved by the flow deformation of the country rock (the surrounding whole rock) before the formation of an open crack due to intensified pressure. In this case, it is pointed out that the country rock will be significantly deformed, thereby causing significant deformation on the ground surface according to the expansion of the magma chamber.".

I. The words “(i.e., the method to make a long-term eruption forecast by making a line graph with a horizontal axis representing time and a vertical axis representing eruptive volume {Defendant 366}.)” shall be added immediately after “Step Diagram” in line 21 of page 255 of the Original Decision.

J. The words “administrative agencies, and” in line 16 of page 259 of the Original Decision shall be replaced with “administrative agencies and”.

K. The words “(the “Basic Concept”)” shall be added immediately after “the Basic Concept” in line 5 of page 260 of the Original Decision.

L. A new line shall be started immediately after the end of line 11 of page 261 of the Original Decision, and the following text shall be added:

“d. The NRA revised the Concept of New Regulatory Requirements for Commercial Power Reactors (the “Concept of New Regulatory Requirements”) on December 19, 2018. The Concept of New Regulatory Requirements states that huge eruptions shall be included in the Disasters in Article 43-3-6, paragraph (1), item (iv) of the Act on Control of Nuclear Reactors, etc., that huge eruptions shall be taken into consideration to the extent necessary for scientific and technical determination, upon stating that, based on the concept similar to paragraph b above, the risk of huge eruptions can be regarded at a socially acceptable level unless the probability of occurrence of a huge eruption is shown with reasonable grounds, and that it can be determined that “the probability of a huge eruption is small enough” at least during the operation period if it can be confirmed that the current status of volcanic activity is not in a state of imminent huge eruption based on sufficient volcanological surveys in light of the current volcanological findings, and if it cannot be said that there are scientifically reasonable and specific basis that a huge eruption will occur during the operation period (Defendant 450 [pp. 346-349]).”.

M. The words “once in” shall be added immediately before “20,000-30,000 years” in line 7 of page 268 of the Original Decision.

N. The word “[p. 15]” in line 14 of page 270 of the Original Decision shall be replaced with “[p. 6, pp. 9-10, p. 13, p. 15]”.

O. The words “the current eruptive activity at Aso volcano” in line 15 of page 270 of the Original Decision shall be replaced with the following:

“Turning our eyes to the eruptive magma volume since the eruption in which pumice was erupted to Kusasenrigahama 30,000 years ago, the volume of mafic magma was 2.3 km<sup>3</sup>, but that of felsic magma remained only 0.2 km<sup>3</sup> and the frequency of eruption thereof is also very low. With respect to the petrological characteristics of volcanic material, the strontium isotopic compositions in Aso 2 through Aso 4 are relatively homogeneous, but those in Aso 4 and later are inhomogeneous. According to the above, it seems that, while there was one magma chamber (i.e., a huge magma chamber) in Aso 2 through Aso 4, there were multiple magma chambers in Aso 4 and later (i.e., no huge magma chamber).

Also, it seems that since the 1930s the crust has sunk, and magma chambers have deflated.

Moreover, if there is a huge felsic magma chamber, the mafic magma supplied from the deep part must be unable to erupt from the central caldera by being trapped by felsic magma; however, in Aso caldera mafic magma has been mainly erupted in its center.

As seen above, the current eruptive activity at Aso volcano”.

P. The words “such a precursor in the current Aso volcano” in line 19 of page 271 of the Original Decision shall be replaced with the following:

“In light of the fact that, based on the relationship between the Kumamoto Earthquake in 2016 and Aso caldera, it is indicated that there is no huge magma chamber that may cause any caldera eruption in the deep part of Aso caldera, and no effusive eruption has

occurred in the past few hundred years, in the current Aso volcano, a precursor that corresponds to any of aforementioned models”.

Q. Line 20 of page 272 of the Original Decision shall be replaced with the following:

“With respect to a future eruption of Aso-4-type, it is difficult to illustrate the numerical probability of occurrence, but, in my opinion, by using the best available scientific knowledge, it is possible to determine whether the occurrence of such an eruption should be considered for the assessment of the soundness and safety of the NPP. In other words,”.

R. The words “because the magma chamber about 6 km underground, etc., have been detected” in lines 12 through 13 of page 273 of the Original Decision shall be replaced with “despite the fact that several small magma chambers, etc., have been detected”.

(2) Location evaluation

A. In accordance with the Volcano Guide, the adverse party selected, out of 42 Quaternary volcanoes within a 160-kilometer radius of the geographical area, the volcanoes that may have impact on the Reactor Facilities (i.e., Mount Tsurumi, Mount Yufu, the Kuju Mountains, Aso volcano and Abu Volcanoes as Holocene active volcanoes; and Himejima Island and Takahira volcanoes as volcanoes that were not active in Holocene times but their probabilities of volcanic events in the future cannot be denied), and the NRA determined the assessment thereof as reasonable (the outline of the facts 8(3)A). Also, it is not found that the process of the above selection (in particular, the selection of Aso volcano) and the NRA’s determination has no problems.

B. Individual assessment of each volcano above (subject volcanoes for review)

(A) As described in the outline of the facts (8(2)B), with respect to the individual assessment above, the Volcano Guide requires to [1] comprehensively assess the probability of volcanic activity of the subject volcanoes for review during the operation period of the nuclear power plant based on the results of the surveys above and the results of bibliographic survey, geological survey, topographic survey and volcanological survey performed in the course of the selection of volcanoes under paragraph A above, and, as a result, if it cannot be said that such probability is sufficiently low, [2] further estimate the eruption scale, and assess whether the probability of any beyond-design-basis volcanic event in eruption scale reaching the nuclear power plant is sufficiently low,

thereby determining whether the installation of a nuclear power plant is reasonable, based on the understanding of the current status of volcanic activity and the history of volcanic activity as well as on geophysical survey (analysis on underground mechanics, etc., concerning the scale and location of magma chambers, and concerning magma supply systems) and geochemical survey (analysis on volcanic material, etc.), if required.

In light of the above, the Volcano Guide must be understood to assume that it is possible to determine whether the probability that the subject volcanoes for review become active during the operation period of the nuclear power plant is sufficiently low, by conducting geophysical survey and volcanological survey, if required, in addition to the results of analyses of the past volcanic activities by bibliographic survey, geological survey, topographic survey and volcanological survey, and also determine the scale of volcanic activities (eruption scale) if it cannot be said that the probability of the subject volcanoes becoming active is sufficiently low, that is, that it is possible to predict the time and scale of eruptions, at least with the time required for the suspension of operation of nuclear power reactors and the transfer of nuclear fuel materials out of the premises.

On the other hand, the adverse party asserts that, with respect to the probability of future volcanic activity cannot be denied, the Volcano Guide requires to assess “whether the possibility that a beyond-design-basis volcanic event causes an impact

during the operation period of the nuclear power plant is sufficiently low”, but does not assume the predictability, well in advance, of the time and degree of eruptions of the subject volcanoes for review. However, it can only be said that it is difficult to imagine that the adverse party can assess “whether the possibility that a beyond-design-basis volcanic event causes an impact during the operation period of the nuclear power plant is sufficiently low” in spite of unpredictability of time and degree of eruptions of the subject volcanoes for review; therefore, the aforementioned assertion by the adverse party cannot be accepted.

(B) Then, we will consider in the following whether such a prediction described in paragraph (A) above is possible in light of the current level of science and technology. There are some experts who point out that it can at least be said that the probability of the occurrence of a huge eruption of Aso volcano during the operation period of the nuclear power plant is substantially low (e.g., clearly saying that Aso volcano is not in a condition to cause a huge eruption in the next few hundred years) (the findings in Section VI.4(1) in the column entitled “Reasons” in the Original Decision corrected and cited as described in paragraph (1) above (the “Findings” in this paragraph) C(E), C(G) and C(H)). However, the majority opinion in the review by a volcano review team is that it is difficult to predict normal eruptions, that it is also difficult to predict the time and scale of a huge eruption, and that it is at least difficult to do so by ensuring the lead time sufficient for the transfer, etc., of fuels (i.e., the time-scale of the order of a few years or a decade), which is also stated to that effect in the Basic Concept on Monitoring of Volcanic Activity for Huge Eruptions in connection with Nuclear Power Facility that is a summary of the opinions of experts brought on board (Findings B). Professor Fujii who was brought on to the volcano review team presented a view that it is hard even to discuss the probability of the occurrence of an eruption over several tens of years and it must be impossible even to judge whether the probability of being affected by a caldera eruption during the operation period of a nuclear power plant is high or low. In the light of the fact that there are experts who express opinions to the same effect as above (Findings C(A), (B), (D)), the majority of views are that it is difficult to exactly predict the time and scale of an eruption with the current level of science and technology, that no method of mid to long-term prediction for huge eruptions (with VEI6 or more) has been established, and that it is difficult to exactly predict the probability of eruption of the subject volcanoes for review during the operation period of a nuclear power plant, or predict the time and scale thereof. Hence, it must be said that, in determining whether to grant the permission for the installation, etc., of a nuclear power plant, a review must be carried out on the basis of such views from conservative viewpoints.

Hence, it must be said that the part of the provisions concerning individual assessment in the Volcano Guide assuming the aforementioned predictability is unreasonable. Then, [1] because it cannot be said that the probability of the volcanic activity of the subject volcanoes for review during the operation period of the nuclear power plant is sufficiently low, [2] it will be necessary to move on to the assessment of a beyond-design-basis volcanic event is conducted. However, because the eruption scale cannot be assumed, it will be necessary to determine whether the reachability of a beyond-design-basis volcanic event to the NPP premises is sufficiently low, assuming the largest-ever eruption of the subject volcanoes for review.

(C) The concept of the assessment of the probability of huge eruptions stated in the Basic Concept and the Concept of New Regulatory Requirements

In response to the above, the adverse party asserts that, if it can be confirmed that the current status of volcanic activity is not in a state of imminent huge eruption, and unless it can be said that there are scientifically reasonable and specific bases that a huge eruption will occur during the operation period in light of the fact that the risk of a huge

eruption is a socially acceptable level, it can be evaluated that the probability of a huge eruption is sufficiently low during the operation period, and employs the Basic Concept by the Secretariat of the NRA and the Concept of the New Regulatory Requirements revised on December 19, 2018 by the NRA.

However, the Volcano Guide has no statement dividing huge eruptions and other ones,

and rather states that, if the area of influence cannot be determined in the assessment of beyond-design-basis volcanic events, such area of influence shall be the domestically longest recorded reaching distance of beyond-design-basis volcanic events, which certainly assesses the area affected by a huge eruption. Moreover, as described in paragraph (B) above, at the current level of science and technology, it is difficult to assess that the probability of a huge eruption is sufficiently low during the operation period. Nevertheless, according to the assertion above, if it is confirmed that the current status of volcanic activity is not in a state of imminent huge eruption, and unless there is any scientifically reasonable and specific basis that a huge eruption will occur during the operation period (according to the aforementioned scientific finding, it is difficult to predict in advance the time and scale of eruptions, and it is not easy to assume a case in which there is any specific basis for the occurrence of a huge eruption during the operation period), it is deemed that the probability of a huge eruption is sufficiently low during the operation period, which must be said to have deviated from the assessment of the probability of volcanic activity based on the results of various scientific surveys assumed in the Volcano Guide. Even in the application for the permission for change in the installation of the Reactor which was made to resume its operation, and in the NRA's review and disposition (permission, etc.) in response to such application, there seems to be no indication that the eruption of Aso 4 was dealt with differently from normal eruptions on the grounds that it was a huge eruption. Hence, the aforementioned assertion by the adverse party cannot be accepted. (However, as a result of our review based on the above, even in the case where the location of the NPP is determined to be inappropriate, there may be a case where, in light of the conventional wisdom, it is not reasonable to determine that the location is inappropriate only on the grounds of the assumed eruption scale. This point will be considered in paragraph (E) below).

(D) According to the review above, even in the Case, it will have to be determined whether the reachability of a beyond-design-basis volcanic event to the NPP premises is sufficiently low, assuming the largest-ever eruption of the subject volcanoes for review.

Then, the aforementioned determination will have to be made for Aso volcano, assuming the largest-ever eruption thereof, i.e., the Aso-4 eruption.

In this regard, the adverse party assessed, as described in the outline of the facts (8(3)A), that the sediment of pyroclastic density current resulting from the Aso-4 eruption has not reached to the NPP premises.

However, as described in the Findings C(C) above, considering the fact that the Aso-4 pyroclastic flow sediment thickly remains also in Akiyoshidai in Yamaguchi Prefecture about 150 km away from the eruption center, it is a common-sense decision to see that the pyroclastic flow reached within a radius of about 150 km from the eruption center, Professor Machida expresses his views: that it can be said that the NPP premises are included in the scope where the Aso-4 pyroclastic flow reached as it is only about 130 km from Aso caldera to the NPP premises; that waters are not an obstacle to the pyroclastic flow because the friction on the sea surface is lower; and that it cannot be said that the pyroclastic flow did not reach the area surrounding Ikata even if there is no pyroclastic flow sediment therein because it is difficult for tephra to remain on the

Sadamisaki Peninsula because of its being a part of a steep-sided mountain range and because the Peninsula has the terrain in which even the accumulated tephra will easily be eroded by sea waters, wind and rain. Also, the Japan Association for Quaternary Research (1987) and Machida and Arai (2011) indicate the possibility that the pyroclastic density current of the Aso-4 eruption reached the Sadamisaki Peninsula on which the NPP premises is located, which is also admitted by the adverse party. In light of these facts, it must be said that a beyond-design-basis volcanic event at Aso volcano may affect the NPP premises.

On the other hand, the adverse party asserts that the Aso-4 pyroclastic flow has not reached the NPP premises on the grounds that: [1] Dr. Brittain expresses his views that, although the pyroclastic flow ceases to exist when the pyroclastic density current contacts the seawater, the reason that the Aso-4 pyroclastic density current sediment was identified in Yamaguchi Prefecture was because there was no water in the Suo-nada Sea area at the time of the Aso-4 eruption and such area was accessible by land from Aso volcano, in which case the situation is different from that in the area surrounding the Sadamisaki Peninsula where there also existed the sea area at that time, and therefore it cannot be considered that the Aso-4 pyroclastic density current reached the NPP premises (Defendant 423); and [2] Professor Hasegawa Shuichi (Faculty of Engineering of Kagawa University) and Part-time Lecturer Makoto Yanagida (Komazawa University) (“Professor Hasegawa, etc.”) expressed their views, as the reasons the pyroclastic flow sediment from the Aso-4 eruption has been identified in Yamaguchi Prefecture but not in the Sadamisaki Peninsula, [A] that the Aso-4 pyroclastic density current was distributed unevenly rather than spread concentrically, and [B] that the pyroclastic density current from Aso volcano to the east went into the Ono Mountains and Sadamisaki Peninsula, most of which flew into the south (Usuki City), and only a small portion of which flew into the north where the NPP is (Oita City), and [C] that, as with Dr. Brittain’s opinion, it is likely that the pyroclastic flow sediment generated from the Aso-4 eruption did not reach Shikoku (Defendant 419) because Shikoku is across the sea from Aso volcano while Kyushu and Yamaguchi are accessible by land from Aso volcano. However, although the views in [1] and [2][C] above contradict with those of Professor Machida, it cannot be determined that either view is correct, and it is difficult to deny [2][A] in general terms. Nevertheless, they do not positively support that the Aso-4 pyroclastic flow did not reach the Sadamisaki Peninsula. On the other hand, [2][B] is a finding based on the comparison between the volume of pyroclastic flow sediments in areas near Aso volcano, and it is therefore difficult to deny its reasonableness; however, in light of the fact that the Aso-4 pyroclastic flow sediment was identified in Yamaguchi Prefecture also located to the north of the Ono Mountains and Saganoseki Peninsula, it must be said that [2][b] does not support the fact that the Aso-4 pyroclastic flow did not reach the Sadamisaki Peninsula.

According to the above, even considering the aforementioned assertion of the adverse party, it should be said that it cannot be denied that a beyond-design-basis volcanic event at Aso volcano may reach the NPP premises.

Then, it will be impossible to say that the possibility that a beyond-design-basis volcanic event causes an impact during the operation of the nuclear power plant is sufficiently low for the Reactor; therefore, according to the Volcano Guide, the location thereof will be considered to be inappropriate.

(E) According to the above, it will be considered that the adverse party was not able to make prima facie showing that there is no unreasonableness in the NRA’s determination that the Reactor Facilities conform to the New Regulatory Requirements.

However, unlike lawsuits in which the very issue will be whether the disposition made by the NRA is reasonable, the issue in the Case is specific risk in connection with an injunction claim based on the personal rights. Hence, as described in paragraph 1(3)B above, there is no denying that, a specific risk is required to be determined based on the conventional wisdom concerning the allowable degree of risk.

Then, the review with respect to this point is as follows:

a. In Japan, the volcanic eruption itself is not an uncommon natural phenomenon; the larger the scale of an eruption, the less the frequency. In particular, catastrophic eruptions equivalent to VEI 7 and above occur only about once every 10,000 years in the entire Japanese archipelago (Findings C(A), C(B) and C(D); in addition, there are also findings that it occurs about once every 20,000-30,000 years in the entire Kyushu region, and about once every 60,000 years for the Aso volcano), which are significantly less-frequent small natural phenomena. Also, a large amount of pyroclastic flow from a catastrophic eruption causes serious and material disasters over a large area. For instance, it is said that, if at this point of time a catastrophic eruption in Aso caldera (such as the Aso-4 eruption) occurs, the areas to the north of central Kyushu will be directly hit by the pyroclastic flow and almost completely destroyed, as well as causing more than 10 million deaths, the entire Japanese archipelago including Hokkaido to be covered with more than 15-cm-thick or more volcanic ash, a spate of house collapses, lifeline outages and inability of food production, and that it will be necessary for those who barely survived to evacuate or migrate overseas from the Japanese archipelago covered with volcanic ash (Findings A(B)a). Then, it must be said that, if a catastrophic eruption occurs, the surrounding residents will suffer serious damage to their lives, bodies and livelihood foundations without regard to whether such eruption causes an accident involving the release of radioactive substances from a nuclear power plant into the surrounding environment. Nevertheless, it cannot be found that there are laws, regulations or disaster-prevention measures assuming the above are implemented in any field other than nuclear regulations.

It must be said that the conventional wisdom (i.e., socially accepted idea in Japanese society) relating to risks in the case of a catastrophic eruption differs from that relating to any other natural phenomena, and that such risks are accepted to a considerable degree, and that it is against the conventional wisdom to determine that the location of the nuclear power plant facilities is inappropriate only for the reason that there is no denying that the pyroclastic flow generated from a catastrophic eruption may reach the nuclear power plant facilities. Nevertheless, as mentioned above, there is a finding that it is expected that some short-term precursor phenomenon will occur prior to a huge eruption, and it can never be said that granting of permission for the installation, etc., of a nuclear power plant conforms to the conventional wisdom even in the case where such phenomenon is found. It is understood that, if the existence of short-term precursor phenomenon of a catastrophic eruption is shown with reasonable evidence, the location will be determined to be inappropriate in accordance with the principle, and it is impossible to deny the specific risks of infringement of the personal rights of the surrounding residents. [Underlined by the Editor.]

b. On the other hand, the appellants assert that [1] even with the low frequency of catastrophic eruptions, and in light of their extensive damage, it is unreasonable, and against international standards, not to take into consideration any catastrophic eruption, [2] the consistency with other external events (i.e., faults, tornadoes and aircraft accidents) in connection with nuclear regulations should be taken into consideration, and [3] the lack of public concern about catastrophic eruptions should not be the basis, and many volcanologists point out the necessity of national measures against huge eruptions.

Then, considering the above, with respect to [1], as described above, the larger the scale of a volcanic eruption, the less the frequency; however, the frequency (risk) of occurrence of a largest scale natural phenomenon never becomes zero. Hence, it cannot be denied that it must be determined whether such risk is acceptable, and if accepted, to what degree such risk is acceptable, based on the conventional wisdom, and the determination method as such is not denied only because the damage is extensive. The appellants assert that, based on the expert opinion related to the preparation of q6 (Plaintiff 1013, the “Expert Opinion q6”), it is necessary to be confirmed that the probability of a beyond-design-basis volcanic event reaching the premises does not exceed  $10^{-7}$  per year (i.e., once every 10 million years). However, the Expert Opinion q6 states that, because the probability needs to go below the core damage frequency (CDF) and the large early release frequency (LERF,  $10^{-5}$  per year),  $10^{-7}$  per year is considered to be a reasonable level (Plaintiff 1013 [p. 6]). However, considering the way of expression as such, it cannot be said that such level is established as an international standard. Nevertheless, although the Expert Opinion q6 points out that the occurrence frequency of once every 10 million years is in many cases used as the threshold of whether a certain hazard can be a significant risk for the nuclear power plant in question, it cannot be said that the level above is used as an international standard, in light of the statement of Expert Opinion q6 that the level above has not been used because, for example, with respect to earthquake hazard, there is a realistic difficulty to establish the design standards as such (Plaintiff 1013 [p. 22]). Hence, the appellants’ assertion described in [1] above cannot be accepted.

Next, considering [2] (i.e., consistency with other external events) above, according to the Findings, Chairperson q7 expressed his view at the NRA that, although records of earthquake observation are made almost on a daily basis, what is needed is a discussion that takes into consideration the characteristics of huge eruptions as a hazard which humans have never experienced since the beginning of recorded history, and that the discussion involving the comparison with other hazards is fraught with danger, and other members had no objections to this point (Findings B(C)c). Also, Dr. Brittain, a lead author of the IAEA Safety Guide, also presented his view that it is difficult to calculate exact figures with respect to the probability of an Aso-4-type eruption, and that a numerical calculation method used to assess an earthquake hazard cannot be used for calculating the numerical event probability of future caldera eruptions such as those like Aso-4-type eruptions, which corresponds to the Chairperson q7’s view above (Findings C(I)). In the light of these findings above, it is not found that it is necessary to use the thresholds for the occurrence frequency of volcanic eruptions which are the same as those of other hazards (e.g., earthquakes); therefore, the aforementioned assertion [2] by the appellants cannot be accepted either.

On the other hand, with respect to [3] (i.e., public concern, etc.) above, as described in the Findings, it is found that Professors Ishihara and Fujii made a proposal at the commission under the Cabinet Office that a caldera eruptions is very critical (Findings B(A)d), and that the volcano review team presented the Basic Concept that intends to promote surveys and research in order for the government to take national measures that take into consideration the probability of a huge eruption (Findings B(B)). There is no denying that the conventional wisdom about the risk of a catastrophic eruption may change through the promotion of legal and administrative measures (e.g., disaster-prevention measures) assuming catastrophic eruptions and through efforts among the public assuming catastrophic eruptions. However, it is, at least at this time, difficult to find

that the conventional wisdom to recognize catastrophic eruptions as hazards equivalent to earthquakes, etc., has been formed; therefore, the appellants' assertion [3] above cannot be accepted either.

c. According to the above, it should be said that it is against the conventional wisdom to determine that the location of the nuclear power plant facilities is inappropriate and there are no specific risks only for the reason that there is no denying that the pyroclastic flow generated from a catastrophic eruption may reach the nuclear power plant facilities. Hence, it cannot be determined that the location of the Reactor is also inappropriate, because of the determination described in paragraph (D) above that there is no denying that the Aso-4 pyroclastic flow may reach the Reactor Facilities.

Nevertheless, as mentioned above, if the existence of short-term precursor phenomenon of a catastrophic eruption is shown with reasonable evidence, the location will be determined to be inappropriate in accordance with the principle, and the specific risk will not be able to be denied. However, even based on the prima facie materials and the entire import of court hearing, it cannot be found that there is reasonable evidence supporting the existence of a short-term precursor phenomenon of a catastrophic eruption in Aso volcano. In addition, Mr. Sudo expresses his view that, because Mr. Abe's doctoral thesis detected that there is a huge-scale low-velocity zone of 500 km<sup>3</sup> under the magma chamber of the southern Kusasenri, in which case such low-velocity zone is a magma chamber, it can never be denied that such chamber may cause a VEI-7-eruption in the near future (Findings C(D)). However, Mr. Abe who stated a finding that provides a basis for the aforementioned Mr. Sudo's view states that, although there may be magma of at least a few dozen cubic kilometers in such low-velocity zone, there is neither a heat source in some part of the zone nor a trend that another magma chamber is being formed (Findings C(F)). Even excluding such point, it is difficult to say that the above findings alone provide reasonable evidence that shows the existence of a short-term precursor phenomenon of a catastrophic eruption.

(F) As described above, with respect to Aso volcano, the location of the Reactor will normally be determined to be inappropriate based on the determination whether the reachability of a beyond-design-basis volcanic event to the NPP premises is sufficiently low, normally with an assumption of the Aso-4 eruption that is the largest-ever eruption, and on the conclusion that there is no denying that a beyond-design-basis volcanic event at Aso volcano may reach the NPP premises. However, it will be against the conventional wisdom and not be allowed to acknowledge a specific risk, by determining the location to be inappropriate, on the grounds that there is no denying that the pyroclastic flow generated from the Aso-4 eruption (VEI 7) equivalent to a catastrophic eruption may reach the NPP facilities.

Then, in this case, a review should be made of the probability that a beyond-design-basis volcanic event at Aso volcano may reach the NPP premises, again assuming the eruption of the scale equivalent to the Aso-4 eruption at Aso volcano. In other words, the reachability of a beyond-design-basis volcanic event at Aso volcano should normally be reviewed on the assumption that it cannot be said that the probability of occurrence of an eruption of a scale equivalent to the Aso-4 eruption is low. Hence, if such assumption is against the conventional wisdom, it is natural to conduct the location evaluation assuming that it cannot be said that the probability that a VEI 6 eruption equivalent thereto (i.e., an eruption with the eruptive volume of a few dozen cubic kilometers) may occur is sufficiently low.

On the other hand, the adverse party asserts that the location evaluation should be conducted in accordance with the Basic Concept, by limiting "the largest-ever eruption of the subject volcanoes for review" to the largest eruption after the latest huge eruption,

and using the scale of the Aso Kusasenrigahama eruption (eruption volume: about 2 km<sup>3</sup>) that is the past largest scale at “the post-caldera eruption stage” described in Nagaoka (1988). The adverse party points out the following as the reasons for the above:

[1] Aso volcano is in a condition in which it is rather reasonable to understand that there was significant change in its eruptive activity even in a statistical sense because Aso volcano is in the post-caldera eruption stage after the Aso-4 eruption and the mode of its eruptions is different from that in the caldera formation period; [2] although the existence of a large felsic magma chamber underground is necessary for an occurrence of a huge eruption, it is considered, in light of the recent volcanic activities of Aso volcano, that the magma accumulated in the current magma chamber of Aso volcano is mainly basaltic magma that is unlikely to cause huge eruptions; [3] in light also of the difference in the trend of a minor element (i.e., strontium) included in eruptive material that serves as an index showing the differences in the causes of formation of the magma, it is surmised that there is no large magma chamber; and [4] in light of the data of the crustal movement in Aso caldera, etc., the magma chamber of Aso volcano has been diminishing, and it is therefore expected that the future activities of Aso volcano will not be large ones like those in the 1930s, still less the occurrence of a large caldera eruption.

However, [1] above is an assertion based on the so-called eruption stages theory proposed by Nagaoka (1988), and some experts in volcanology, in response, expressed their respective views as follows: Mr. Koyama states that the eruption stages theory is only a hypothesis based on the recognition of patterns in the eruption history (Findings C(B)); Professor Machida states that the cycle of eruption stages described in Nagaoka (1988) is only one of the ideas for organizing (the understanding of) tephra, and that this cannot provide the theoretical basis that enables the prediction of the remaining time until a catastrophic eruption (Finding C(C)); and Mr. Sudo states that the eruption stages are only a working hypothesis for organizing (the understanding of) tephrostratigraphy, which can therefore never be used to predict future eruptions (Findings C(D)). In this way, experts have raised objections to the eruption stages theory with respect to its use for the prediction of volcanic eruptions; therefore, it cannot be said that an assertion is reasonable only because it is based on the eruption stages theory. Also, with respect to [2] through [4] above, certainly there are findings that support the assertion (Findings A(C)b), but the volcano review team expressed its view that it is difficult for the current level of science and technology to exactly infer the scale of a magma chamber, and compiled the Basic Concept to show that it is difficult to exactly predict the time and scale of future eruptions (Findings B(A)d, (B)). In light of these findings, it does not mean that it is enough to take into consideration only the largest scale of eruption after the Aso-4 eruption on the grounds of the aforementioned respective findings, and it must therefore be said that the adverse party’s assertion is not reasonable. Also, in light of the facts that Aso volcano is a volcano that has repeated huge eruptions starting with Aso-4 in the past, and it is difficult for the current level of science and technology to exactly infer the scale of magma chambers, and therefore that it is also difficult to exactly predict the time and scale of eruptions, it should be said that there is no denying that the probability of the occurrence of the largest eruption that stops short of a catastrophic eruption.

Then, we will consider in the following whether the probability of an Aso eruption producing a few dozen cubic kilometers of eruptive material as a beyond-design-basis volcanic event may reach the NPP premises is low. In light of the facts that it is controversial among experts even whether it can be said that the pyroclastic flow sediment from the Aso-4 eruption reached the NPP, and that there is no finding that

proves that the pyroclastic density current from an Aso eruption producing a few dozen cubic kilometers of eruptive material reaches the NPP premises, it is reasonable to recognize that the probability of the pyroclastic density current from the Aso eruption of the aforementioned scale reaching the NPP premises is sufficiently low.

(G) The adverse party determined that, as individual assessments of the subject volcanoes for review, there is no problem with a beyond-design-basis volcanic event other than the pyroclastic density current, and that, also with respect to the pyroclastic density current, there is no need to take into consideration the volcanoes other than Aso volcano in light of the history of their volcanic activities, the offset distances to their respective premises, etc., and the NRA in response evaluated that this adverse party's determination is reasonable, in which in our view there is no unreasonableness.

(H) According to the above, there is some unreasonableness in the Volcano Guide, but the standards of the Volcano Guide can be applied by correcting such unreasonableness. As a result, it can be evaluated that the probability that a beyond-design-basis volcanic event will reach the NPP is sufficiently low, and the NRA's determination with respect to this point is eventually not unreasonable.

### (3) Impact assessment

A. As described in the outline of the facts (8(3)A and 8(3)B), the adverse party, assuming that the probability of the occurrence of a huge eruption of the Aso volcano during the operation period of the Reactor Facilities are sufficiently low, took into consideration the pumice eruption (eruption volume of about 2 km<sup>3</sup>) at Kusasenrigahama as the largest eruption after the Aso-4 eruption as the latest huge eruption, but performed a simulation with a conservative assumption of the eruption volume of Kuju-Pumice 1 of 6.2 km<sup>3</sup> because the effect of Kuju-Pumice 1 about 50,000 years ago was larger due to the closer location of the Kuju Mountains to the NPP premises, thereby assuming that the bed thickness of pyroclastic fall material is 15 cm.

b. However, as reviewed in paragraph (2) above, with respect to the Aso volcano, the eruption producing a few dozens of cubic kilometers of eruptive material equivalent to the Aso-4 eruption should be considered. Then, if the eruption volume is 20-30 km<sup>3</sup>, it will be about 3 to 5 times the eruption volume (6.2 km<sup>3</sup>) of Kuju-Pumice 1 as assumed by the adverse party, and even if it is taken into consideration that the Aso volcano is located further away than the Kuju Mountains from the NPP, the adverse party's assumption of pyroclastic fall material is too small. Hence, it must be said that the assumption of air concentration calculated on the assumption of the above (about 3.1 g/m<sup>3</sup>) is also too small.

In this regard, the adverse party asserts: that a countermeasure construction is completed to address an assumed pyroclastic fall material air concentration of about 3.1 g/m<sup>3</sup>, allowing for a wide margin of safety, by improving the performance of volcanic ash filters of emergency diesel generators; that, even if the emergency diesel generators lose their function, it is possible to cool the nuclear reactor for about 17.1 days with a water source that can supply water to the turbine auxiliary feed water pump even without power source; and that the period for which the Reactor can be cooled down will become longer by further utilizing the water sources that require a power source to supply water and those of Units 1 and 2 of the NPP in addition to those of the Reactor. It is certain that, according to the Prima Facie Material (Defendant 329), it is found that the surface area of the volcanic ash filters installed in the periphery of the intake air silencer of the emergency diesel generators exceeds those necessary to address the pyroclastic fall material air concentration of about 3.1 g/m<sup>3</sup> assumed by the adverse party (securing the surface area of about 6.1 m<sup>2</sup> for the required surface area of 5.9 m<sup>2</sup>). However, if there is no denying that the probability of the occurrence of the largest eruption that stops short of a catastrophic eruption, it is expected that there will be about 3 to 5 times

the volume of eruptive products compared with the pyroclastic fall material air concentration of about 3.1 g/m<sup>3</sup> assumed by the adverse party. Nevertheless, it is not found that the function of the aforementioned filter contains the assumption of such eruptive volume. Also, since the adverse party made respective applications for the permission for change in the installation of the Reactor, and for the approvals for the construction plan for the Reactor and for the change in the safety regulations for the Reactor on the assumption that the pyroclastic fall material air concentration is about 3.1 g/m<sup>3</sup> and that the function of the diesel generator will not be lost, and, in response, the NRA, on the same assumption, permitted or approved the respective applications. Hence, if it can be said that the assumption of the aforementioned pyroclastic fall material air concentration is unreasonable, it should be said that both the aforementioned respective applications made on such assumption and the NRA's determination itself are unreasonable, and the aforementioned determination will not be overturned only because it is possible to cool down the Reactor for a certain period of time in the case where the emergency diesel generators lose their function.

Then, since it should be said that the adverse party's assessment of effects of volcanic events on the nuclear power plant is too small, and that there was a lack of reasonableness in the adverse party's respective applications for the permission for change in the installation of the Reactor, and for the approvals for the construction plan for the Reactor and for the change in the safety regulations for the Reactor made on the assumption of such assessment, it must be said that it was unreasonable for the NRA to make a determination on the assumption that there was no problem with such applications.

Hence, as described above, since it is found that there is unreasonableness in the NRA's determination that the Reactor Facilities conform to the New Regulatory Requirements, it is necessary for the adverse party to make an assertion and a prima facie showing based on substantial evidence and materials that there will be no specific risk that the appellants will suffer serious damage to their lives, bodies and livelihood foundations from radiation exposure due to the release of radioactive substances into the surrounding environment arising from the operation, etc., of the Reactor Facilities; however, it is not found that, even based on the prima facie materials and the entire import of court hearing, the adverse party has made an assertion and a prima facie showing that there is no specific risk in the assessment of the effects of volcanic events on the nuclear power plant. [Underlined by the Editor.]

Then, it should be said that, with respect to the petition filed by the appellants, a prima facie showing has been made on the right to be preserved related to the effects of volcanic events on the nuclear power plant.

#### 4. Necessity or not of preservation and collateral

(1) Since the Reactor is in operation and, as mentioned above, there is a specific risk that the appellants' lives, bodies, etc., suffer direct and serious damage due to its operation, the necessity of preservation is recognized.

On the other hand, the adverse party asserts that, in order to say that their rights need to be preserved in the petition, a prima facie should be made for the occurrence of a huge eruption at a volcano that can affect the NPP that causes an accident involving the release of a large amount of radioactive substances from the Reactor during the period prior to the issuance of the final and binding judgment of the Case. However, the aforementioned assertion does not affect the part of the Court-approved the right to be preserved with respect to the earthquake-caused accident, and, with respect to the assessment of effects of volcanic events, as described the above, it is difficult to exactly predict the time and scale of volcanic eruptions according to the current level of science and technology, and it should be said that, even if the prediction is possible, it can only

be possible about a few days or weeks before at best, and because such an event may occur prior to the issuance of final and binding judgment of the Case, it cannot be said that the necessity of preserving the appellants' rights is denied. Hence, the adverse party's assertions above cannot be accepted.

Nevertheless, the Case involves the provisional disposition procedures in which the procedure for examination of evidence is subject to limitation; therefore, it is reasonable that the period in which the adverse party is ordered to shut down shall be until the rendering of a judgment in the first instance on the merits of the Case.

(2) In the Case, in light of the characteristics of the Case, no collateral shall be provided. 5. Consequently, the Original Decision shall be changed because it differs from the above and is thus not reasonable, and the Court decides as stated in the main text of the judgement.

January 17, 2020

Fourth Division of the Hiroshima High Court

Presiding Judge: MORI Kazutake

Judge: SUZUKI Yusuke

Judge: OKIMOTO Naoki

*[Editor's note: This is the second case at appellate court level to enjoin the operation of a nuclear power plant, after the Fukushima Daiichi Power Plant Accident.]*

*In short, this decision held that: (i) as to volcano risk, as a social recognition matter, generally, the risk of catastrophic eruptions is socially tolerable, however, in case that there is rational basis for such an eruption in a specific context, the eruption is not tolerable for society (ii) in this case, the NRA's process to review the application by the utility company was erroneous, (ii) as to earthquake risk, the NRA's process to review the application by the utility company was erroneous.]*