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The Manga “Oishinbo” Controversy: Radiation and Nose Bleeding in the Wake of 3.11 「美味しんぼ」論争　3. 11以降の放射線と鼻血

Eiichiro Ochiai

“Oishinbo” is the title of a series of manga (comic), meaning “Gourmet Craze”, created and written by Kariya Tetsu. It has been continuously published since 1983 in a comic magazine “Big Comic Spirits” published by Shogakukan (Tokyo), and enjoyed great popularity in Japan. The series, mainly centered on gourmet food, has been re-published in more than 100 books, and in the past caused controversies regarding its criticisms of food and food regulations.

Oishinbo volume 102

An episode titled “The Truth about Fukushima (series 604)”, with episode 22/23 published on May 12, 2014. It depicted a conversation about “Nose Bleeding” among the comic's protagonist Yamaoka Shiro, a scientist and the former mayor of Futaba-machi a town adjacent to the Fukushima Dai-ichi Nuclear Power Plant, which had severe accidents on the occasion of the Great East Japan Disaster when a powerful earthquake (magnitude 9) combined with the

huge Tsunami on March 11 of 2011 (the 3.11 incident). A portion of a key scene of the comic is shown below. The controversy, centered on the issue of the main character suffering nose bleed after a visit to the plant, and another character modeled on the former Futaba Mayor, warning people against living in the prefecture. After the Fukushima prefectural government issued a protest against the manga for inflaming fears about the safety of the prefecture's fish, the publisher announced that the popular series would take a break following a final issue on "The Truth about Fukushima" on May 19.

This episode in the comic, centered on nose bleeding in the wake of 3.11, provoked an unusual controversy immediately upon publication, and all printed copies of the comic were rumored to have sold out quickly. Essentially there are two views. One is "denial of the fact" that many people have experienced nose bleeding after the Fukushima incident, with the assertion that nose bleeding cannot be caused by the radiation emitted from Fukushima Dai-ichi. The other view is that it is reasonable that the nose bleeding observed among the people of Fukushima prefecture and surrounding areas including Tokyo could be caused by radiation, as suggested in the comic.

Courtesy of Shogakukan (Tokyo)

(The conversation goes like this (top to bottom, right to left): "I think the reason that so many people in Fukushima are suffering from nose bleeding and serious fatigue…" "It is due to exposure to radiation." "Concerned mothers in Osaka investigated 1000 persons living near the incinerating facility dealing with the debris brought from the affected areas." "They found problems with the eyes and respiratory system, though I would not say that all are due to radiation.")

The fact is that no scientifically definitive proof has been found for the cause-effect relationship in the case of nose bleeding. No serious studies have been conducted on this issue. The question is then whether the scientific arguments "against" causality are more reasonable than the arguments "for" causality or the reverse. If the former (against) is reasonable, and is very likely based on the best

human knowledge available, it would suggest that it is not necessary to worry about the entire issue of radiation effects on living organisms at current levels. On the hand, if the latter (for) is more reasonable and conforms to the best human knowledge, there would be need to worry about radiation effects, and action would be required to reduce such danger to the minimum.

The Political Aspect

The denial has two aspects: one is political, the other scientific. The political powers, including the current mayor of Futaba-machi, the minister of the environment and even the prime minister, strongly criticized the episode, saying that the contents do not hold up to scrutiny. They deny categorically the facts depicted in the comic. The intention seems to be to suppress any suggestion of a causal relationship between nose bleeding and the radiation emitted as a result of the disaster and any criticism of the government and the nuclear industry. People, including locals, have been keenly aware of government intentions in strongly reacting to this trivial incident. After all, it was simply a description of certain incidents observed by the author and associates and presented in a comic. Why did the government go to such lengths to suppress mention of nose bleeding? The incident suggests the desperation of the government and the industry to suppress the facts concerning the danger of radiation.

The local governments of Fukushima prefecture and local communities expressed concern, coining the term “damage caused by rumors”. This suggests that to express something that cannot be verified may adversely affect those for which the concern is expressed. In this case, the idea was to suggest that people (Japanese citizens) may receive a false impression that radiation is still significant in Fukushima, and might become afraid of approaching the area, buying products made in the area, *etc.*, despite the fact that the radiation level has already been reduced significantly, as the local governments and the Japanese government insist. However, it is to be recognized that the damages caused by radiation are indeed more serious than rumors such as these. But what is the true situation concerning radiation? Unfortunately, precise, accurate and detailed data are non-existent or have been hidden from public scrutiny. Besides, a more significant issue is the question of how low a level of radiation should cause us to worry. Is there a threshold? This is a scientific issue, so we now turn to the scientific aspects of the controversy, which are the main focus of this article.

The Facts about Nose Bleeding and Other Symptoms

There have been a number of reports of unusual nose bleeding after the Fukushima Dai-ichi accident. These have been made mostly by individuals who have had nose bleeding themselves or have observed their children’s experience of unusual nose bleeding. Some prominent persons, such as a medical doctor who appeared in the comic, have reported observations of nose bleeding. Nose bleeding has also been reported in connection with the Chernobyl incident (1986). Dr. Hida Shuntaro, a medical doctor and a survivor of Hiroshima Atomic Bomb, has witnessed many examples of radiation-related illnesses, including nose bleeding and unusual fatigue syndrome after the Hiroshima bombing. Fatigue is another symptom discussed in the comic. One of the more recent reports can be seen here,[1] in which several citizens from Fukushima prefecture describe in detail their experiences of ill-health including nose bleeding.

It is true that there are many causes for nose bleeding. This fact may have influenced some people to belittle the possible causality between nose bleeding and radiation. Whether this is the case or not, no official detailed data

on nose bleeding has been collected in any of these situations (Hiroshima/Nagasaki, Chernobyl and others), let alone the Fukushima case. This is a fact, and the deniers use this fact as a ground for their claim that no widespread nose bleeding incidence has been observed, and that such a description even in a comic is demagogic.

A few relatively large data sets have, however, been collected. One on the Chernobyl incident was collected by a group led by Hirokawa Ryuichi.[2] Over the years 1993-96 he collected data from 25,564 persons who were evacuated from the immediate vicinity of Chernobyl. The following results were obtained from 2127 persons who evacuated from Chernobyl city 8-9 days after the accident.

(a) Ill-health effects experienced one week after the accident:

headache: 64.5 %; nausea: 41.5 %; sore throat: 42.5 %; pain on the skin: 7.1 %; nose bleeding: 21.6 %; fainting: 9.7 %; unusually strong fatigue: 61.7 %; state like being drunk 22.1 %; other ill effects: 13.4 %

(b) Current health conditions:

healthy: 2.7 %; headache: 74.6 %; sore throat 35.6 %; anemia: 14.2 %; dizziness: 50.2 %; nose bleeding: 19.6 %; fatigue: 74.9 %; susceptible to cold: 59.0 %; pain in limbs and bones: 64.0 %; eye sight problem (cataract): 30.5 %; abnormalities in thyroid glands: 37.8 %; tumors: 3.8 %; leukemia: 0.7 %; congenital abnormalities: 0.1 %; others 20.0 %.

A team from Kumamoto Gakuen University led by Nakachi Shigeharu[3] in Nov. 2012 investigated nose bleeding and other illness among the people living in Futaba-machi adjacent to Fukushima dai-ichi and Marumori-machi 60 km north west north of Fukushima dai-ichi, and compared the data to those for people living in Kinomoto-cho in Shiga prefecture 600 km west of Fukushima dai-ichi. The odds ratio of nose bleeding among the people living in Futaba- and Marumori-machi were 3.5 and 3.8, respectively. This indicates that nose bleeding incidence was significantly higher (by 3 to 4 times) in towns close to Fukushima Dai-ichi compared to that in a place far from it. Other symptoms including headache, dizziness, nausea and fatigue were also high among people living in Futaba-machi.

Thyroid gland abnormalities including cancer have been systematically investigated for children (under 18) in Fukushima prefecture, and this is the only data the government seems willing to accept and make public. Over the last three years since the Fukushima Dai-ichi accident, 90 children have been found to have thyroid cancer or to be strongly suspected of having contracted cancer among about 370,000 children tested.[4] This amounts to about 24/100,000. This rate is abnormally high for thyroid cancer in children, the normal rate being less than 1/100,000. The government is of the opinion that these cancers have nothing to do with radiation from the Fukushima Dai-ichi accident. We will set aside the arguments for this contention here.

Radiation Level, and the Distinction between "External" and "Internal" Exposure

The scientific aspect of the controversy is about whether nose bleeding can be caused by radiation at the current level found in Fukushima prefecture. Confronted with the reality of nose bleeding, some scientists on the denier side argue that nose bleeding is impossible at the current radiation level.

How low is the radiation level in Fukushima? This question cannot be answered immediately. First of all, what is the radiation level and how is it measured? Radiation comes from a variety of sources, and consists of several different kinds. The important ones are a, b and g-radiation, and they behave differently. Radiation level is usually defined in terms of Bq

(per kg), but often converted to Sv (or Gy), which represents exposure dose of the radiation. How is Sv defined? Exposure dose of who? How is Sv determined, and how meaningful is the Sv value thus determined? Radiation comes from radioactive material, such as U (uranium)-238, Pu (plutonium)-239, Cs (cesium)-137, Sr (strontium)-90, I (iodine)-131 and K (potassium)-40. [See note 1 at the end of this article for Bq, Gy/Sv]

Radioactive materials come out from sources. One source is natural, i.e., rocks and others that contain naturally occurring radioactive material (U-238, K-40 and a few others). An artificial source is the atomic bomb, which releases an enormous amount of radioactive material upon explosion. Another artificial source is nuclear power facilities. They release radioactive material even under normal operating conditions and they are allowed by law to release a certain amount per year. They would release various amounts of radioactive material in the case of an accident, depending on the severity of the accident. In what forms and how does the radioactive material spread out from a nuclear facility? These have not been studied sufficiently as yet.

How widely and in what locations have radioactive materials spread? There have been some answers to these questions. A number of organizations as well as individuals have measured radiation in various locations. The distribution of the so-called spatial dose rate is often expressed in Sv/hr, and Bq (/kg) values of soil, water, or food samples. The Bq value can be measured quantitatively, but how can exposure dose to radiation be measured in a significant manner? Besides, how is "exposure" defined? One other method of finding distribution is to conduct a simulation based on the amount of radiation released, the atmospheric condition (rain, wind, its direction/speed, *etc*.), geographical conditions and others. One recent simulation result shows how radioactive Cs and I were distributed and deposited across the entire earth; this result is expressed in terms of Bq/m^2.[5] It shows that more than 40 kBq/m^2 has been deposited over the area about 300 km from Fukushima Dai-ichi; this includes Tokyo. It spread eastward, and is believed to have circled the entire northern hemisphere[5].

We need to set aside these fundamental questions, because it is not our purpose here and no definitive answers can be given. It should be pointed out that low level radiation Sv/hr is such a vague concept and cannot represent the real exposure situation at the individual level. The only meaningful thing is, perhaps, to use it to compare radiation levels between two locations. Here as well, nothing can be said about exposure to an individual in a single location (community), as the distribution of radioactive material spread from an accident site is not even, and indeed it is quite spotty.[6]

The Japanese government authorities claim that the current level of exposure in Fukushima is well below 20 mSv/y, which, they say, is not serious, in the sense discussed below. We will leave the issue of radiation level as given here. Under such a condition, is it possible for people to get nose bleeding? A couple of arguments for the "NO" answer will be discussed below.

However, one more fundamental issue needs to be mentioned before we turn to the main subject, the cause of nose bleeding. That is the issue of "external" *v*s "internal" exposure. Radiation including

a, b, g

x-ray and ultraviolet light derives from various sources. Sources are substances containing radioactive isotopes mentioned earlier, x-ray instruments and the sun, which emits a number of radioactive particles as well as ultraviolet light (and visible light as well). When the source is external to a body, radiation enters a body through the skin. a and b would not penetrate much into the body, because of their

nature, but g and neutron can penetrate deep into the body, and usually come out of the other side of the body. This is termed “external exposure”. a and b are not significant in damaging the body when coming from outside, because they are typically stopped by clothing.

A radioactive source may enter a body by various means. It can be breathed in through nose or mouth, or can enter as radioactively contaminated food or drink. When such a source settles in certain tissues or organs, it irradiates the immediate surrounding tissues. This is “internal exposure”. Common sense indicates that “internal” exposure is more serious than “external exposure”, but the authorities including the initial commission that studied the Hiroshima/Nagasaki atomic bomb victims and ICRP (International commission for radiological protection) have not recognized “internal” exposure. As a result, most of the arguments pertaining to the health effects of radiation do not distinguish “external” and “internal”, or ignore “internal” effects. This is critical in assessing radiation effects on living organisms. The nose bleeding controversy occurred in this atmosphere.

“NO, it is Not Caused by Radiation” - Mistaken Reasoning

Now we will try to see how reasonable or unreasonable the “NO” answers are. Three representative “NO” answers will be discussed.

(a) The first argument goes like this: “nose bleeding can only be induced by damage to platelets produced in bone marrow. Damage to platelets can be brought about only by severe destruction of the bone marrow. Destruction would occur only at a high exposure dose, something like more than 2 Sv. Therefore, the current level of exposure, i.e., less than 20 mSv, would definitely not cause nose bleeding."[7]

This argument is based entirely on the idea of external exposure, atomic bomb effect data, and experimental results of x-ray irradiation on animals. The official atomic bomb effect data are about the effect of g-ray and neutrons from the explosion of the atomic bombs; that is, the external exposure only. They dealt with high dose levels such as several hundred Sv down to about 250 mSv, and did not recognize any effect below that level. X-ray effects on animals are also external exposure, and have shown that damage to the bone marrow and associated blood producing system may occur at 1-10 Sv (not below it).[8] Besides, platelets are not to cause bleeding, but to repair the damaged blood vessel so as to stop bleeding. Hence this argument is also based on a mistaken notion about platelets.

Besides, this argument entirely ignores a possibility that a minute radioactive particle may get into the nose through breathing and stick to the surface of the capillary vessel in the nose. The radioactive particle emits a, b or g rays (depending on the radioactive isotopes contained therein) in the surroundings and may destroy the membrane of the blood vessel. In this situation, a and b as well as g can cause damage to the tissue. How large this damaging effect is on the capillary membrane is yet to be studied, but it is likely possible.[9] However, to prove it scientifically may not be easy.

(b) Another “NO” answer depends on the notion that the damage causing nose bleeding is due to active oxygen produced as a result of radiation from the radioactive particle stuck to the surface of the capillary;[9] this is the mechanism for nose bleeding suggested in the comic. The argument[10] goes something like this: “There is a very effective means to detoxify active oxygen in the body. The body detoxifies an enormous amount of active oxygen every moment. An estimate of active oxygen production due to the radioactive particle stuck in the capillary site in the nose is way below the level of active oxygen that is effectively reduced by the detoxifying mechanism. Therefore, in order to overcome

the detoxifying effect to cause nose bleeding would require a very high radiation level, hence the current low level radiation would not be able to cause nose bleeding." The argument includes certain quantitative calculations which themselves may be reasonable, though the assumptions are wrong.

However, a fundamental mistake would make this argument meaningless. That is the issue: what is "active oxygen". In this argument,[10] the author does not specify it; likely he is not aware that so-called "active oxygen" is a collective name for several chemical entities. The term means several oxygen-containing entities that are more reactive than oxygen itself. It includes "singlet-state" oxygen [see note 2 below], hydrogen peroxide, superoxide (free radical), hydroxyl free radical and various hydroperoxides. The author has in mind "superoxide" and likely hydrogen peroxide as the major entities that are detoxified regularly in physiology. This is true, because the organisms are prepared to deal with them, as these entities are produced regularly without the effect of radiation. The enzymes superoxide dismutase and catalase are present in cells to detoxify them. However, the major entity produced from radiation of water is hydroxyl free radical, and no defensive enzyme is known against it. There are a few chemicals that may reduce the very strong reactive character of hydroxyl free radical, but they are not meant for this purpose only. Anyway, the basis for the argument of denial is flawed, and hence its conclusion that the current low level would not cause nose bleeding is questionable.

(c) "Stress caused by fear of radiation effect rather than radiation itself is the cause." This idea was first expressed by the Soviet government right after the Chernobyl incident. In order to absolve themselves of responsibility for the consequences of the disaster, particularly the ill health effects on people, they invented this excuse. That is, "don't worry" and "worry is more harmful". The same excuse has been mentioned in regard to the Oishinbo controversy.[11] This opinion is difficult to debunk but also difficult to prove. To prove it scientifically it would be necessary to start with defining "stress, what kind of stress, its causes, its seriousness etc" and then see how it affects people's health, and determine causality. It is almost impossible to assess this correlation scientifically but it is also impossible to deny it. Mental and spiritual status of a person would certainly affect his/her physical conditions. This is true. Therefore, we have to say that it is possible, but the question is: Are all nose bleeding incidences caused by "stress" alone?

Most of the flat denial arguments are baseless, in terms of the detailed nature of the radiation effect that may cause nose bleeding. Yet, the so-called authorities are making many baseless arguments, which may convince ordinary citizens simply because they are known to be "authorities".

"Yes, it could be Caused by Radiation" - some Scientific Reasoning

The argument for the causal relationship between nose bleeding and low-level radiation is based on a reasonable assumption that minute floating radioactive particles might enter a nose and stick on the surface of the capillaries. Minute particles could emit a, b and/or g (depending on the radioisotopes contained in them), irradiate and damage the membrane of the capillary directly; alternatively, hydroxyl free radicals produced by that radiation may cause damage there.[9, 12] This could lead to nose bleeding. There is again not enough data to verify this hypothesis. This is how internal exposure would damage the tissues upon settling in certain localities in a body.[9] Radiation particles (a, b and/or g) would interact with cells, cell membranes, molecular species such as DNA, proteins, lipids, water, etc., and damage and destroy them. This reaction is inevitable, and no mechanism exists to defend against such an action of radiation.

The only thing the biological system can do is try to repair damages from radiation or somehow nullify the damage. Yes, indeed quite a few mechanisms exist to repair damage to DNA, but none exists for damages on other molecules, proteins, lipids, etc.[9]

Final Comments

Neither "YES" nor "NO" answers as discussed above have been verified rigorously. Those whose tendency is to tolerate radiation tend to accept the "NO" answer, and those whose inclination is to abolish nuclear power tend to accept the "YES" answer. However, many people are confused about this issue, and even those who oppose nuclear power may accept the "NO" answer. The issue should not be a political one, but should be settled scientifically. Unfortunately no science on the effects of radiation on living organisms has yet been developed sufficiently to give an unequivocal answer.

Then, what should we do? Should we wait without doing anything until the issue is resolved scientifically? Or should we act to reduce the danger of radiation, assuming the *possibility* that the "YES" answer turns out to be correct? The Japanese government takes the first option, and suggests that people should bring any complaint about the health effects to a judicial system in which the plaintiffs have a responsibility to prove their case. This seems to be their intention from the very beginning as suggested, for example in.[13] In order to reduce the chance that the plaintiffs could gather enough data to support their case, it seems, government agencies are suppressing data-collection and publication concerning serious health effects.

The majority of Japanese people oppose continued use of nuclear power as their energy source, and call for decommissioning all nuclear facilities, many of which are located on top of dangerous active faults. Those facilities are vulnerable to earthquake and other disasters. Yet, the electric power companies are trying to reopen many of the nuclear power reactors that have been closed since 3.11. In order to do so, they seek to suppress dissenting opinion, even from affected people, and convince the Japanese people that the level of radiation caused by the Fukushima Dai-ichi accident is safe for human health, implying that it will be safe even if another disaster should occur. That is why this controversy has taken place, including intervention by government officials. And certain scientific authorities are assisting the government in this regard.

Now then what is left to those concerned with health effects of radiation and other issues associated with the nuclear power industry in order to counter pressure by the authorities? One way is to try to understand the nature of radiation and its possible effects on living organisms, and to decide one's own attitude toward radiation. This search for truth and the most appropriate action during the crisis is expressed in the most recent issue of another comic titled "Sobamon" published by the same publisher.[14] It is also the intention of this writer's recent publication.[9]

In addressing the problem of radiation, it is worth noting that, currently (as of June, 2014), none of 50 nuclear power reactors in operative conditions is operating, and yet Japan is facing no electric power shortage. This fact suggests that the electricity producing capacity in Japan is sufficient without nuclear power. It has been argued, however, that the trade deficit has increased because Japan has to import more petroleum and natural gas, as a result of shutdown of nuclear powers. Yet the main reason for the trade deficit is not increased imports of energy sources, but lowering the exchange rate of Japanese "yen".[15] Moreover, nuclear power reactors are inefficient in using nuclear energy. They convert only about one third of the energy produced by the reactor into electricity, and the remaining two thirds of heat is released into the environment. The

nuclear power plant is a direct environmental heater, though it does not produce greenhouse gas in the electricity producing process. In other words, nuclear power is not particularly green.

Notes

Note 1 on Bq and Sv(Gy): A radioactive material may contain several substances including radioactive ones that emit radiation. A radioactive nuclide disintegrates spontaneously (at a set speed, related to half-life), and emits radiation in the process. This process is called "disintegration" or "decay". The number of disintegrations that takes place per second is measured in "Bq (Becquerel). Important radioactive substances include a, b particles, and g-rays. g-ray is an electromagnetic wave but behaves like a particle when it interacts with atoms and molecules, and hence is regarded as a particle, photon. Bq can be regarded as the number of radioactive particles emitted from a sample per second in most cases, though there are exceptions. Bq is proportional to the number of radioactive nuclides. (Bq represents the number of radioactive nuclides.)

Radiation impacts on a material; this exposure dose from the point of view of the impacted material is defined in terms of Gy (gray), energy of radiation absorbed by the material; Gy = J/kg (energy J/kg of the material). It has been found that different radiation particles, though with the same energy, would have different impacts on living organisms. Thus a unit Sv (sievert) has been devised, which represents an effective dose, and Sv = Q x Gy. Q-value is set to be 20 for a, and 1 for b and g. Mentioning just the definition of these terms would not be sufficient to tell the significance and problems associated with them. However, no further details about them can be given here, as to do so requires lengthy explanation.

Note 2: singlet/triplet state: Oxygen molecule O_2 can be in different (electronic) states. O_2 molecule has two electrons not involved in binding O-to-O. How these two electrons correlate with each other determines whether the state is either a "singlet" or "triplet". In this case, the triplet state is more stable than the singlet. This implies that the singlet oxygen is more reactive than the triplet oxygen, which is the normal state of the O_2 molecule.

Eiichiro Ochiai was born in Japan, and educated up to the PhD in Japan. He taught and conducted research in chemistry at college/universities in Japan, USA, Canada and Sweden. Publications include "Bioinorganic Chemistry, an Introduction" (Allyn and Bacon, 1977), "Bioinorganic Chemistry, a Survey" (Elsevier, 2008), "Chemicals for Life and Living" (Springer Verlag, 2011), and "A Sustainable Human Civilization Beyond 'Occupy' Movements" (Kindle, 2011).

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Sources

Most of the source cited are in Japanese, and were not published in the form of articles or reviews in scientific journals. This fact reflects the current research situation concerning health effects of radiation due to the Fukushima Dai-ichi accident, in particular regarding nose bleeding.

[1] http://www.ourplanet-tv.org/?q=node%2F1785) (in Japanese): Fukushima mothers and teachers voice their experience (regarding nose bleeding and others) and protest against the prevailing denial attitude of the authorities.

[2] http://www.tanpoposya.net/main/index.php?id=1990 (in Japanese): The organization "Tanpoposha" has been active in collecting and publishing information and data about the Fukushima Dai-ichi disaster and subsequent developments.

[3] http://repo.lib.hosei.ac.jp/bitstream/10114/8738/1/661nakachi.pdf

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[11] Anzai, I., (in Japanese): commentary published in the last issue of "Oishinbo" (episode 24, p391, May 17, 2014)

[12] Nishio, M., "About Nose Bleeding Controversy": https://dl.dropboxusercontent.com/u/23151586/20140523_nishio.pdf (in Japanese): Dr. Nishio is a respected medical doctor specializing in cancer radiation therapy.

[13] http://kasai-chappuis.net/IraqNewsJapan/CircleA.htm#CircleA20110714

[14] http://img1.shogakukan.co.jp/eximages/comic-soon/sobamon/cmsn-sobamon-ep134.pdf

[15] For example: http://nucleus.asablo.jp/blog/2014/02/04/7212254 argues in detail how the quantity of natural gas and petroleum imports to Japan has changed, and how the trade deficit has changed. It is shown that the amount of oil and gas has not increased significantly but the trade deficit increased significantly for two reasons. One is the exchange rate of Japanese yen, and the second is that the LNG (liquefied natural gas) price has been raised by producers for export to Japan only. This is based on a

report in Mainichi Newspaper (Feb. 2, 2014).