Analysis of the Activities of the Website “Question and Answer about Radiation in Daily Life” after the Accident at the Fukushima Daiichi Nuclear Power Plant and Some Lessons Learned from It: To Pass on This Experience to the Future

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After the accident at the Fukushima Daiichi Nuclear Power Plant, artificial radionuclides such as radioactive cesium and iodine were released into the environment. It caused great anxiety not only in the vicinity of the Fukushima Daiichi Nuclear Power Plant but also in other regions of the world. Some members of the Japan Health Physics Society (JHPS), a leading academic society in Japan in the field of radiation protection, volunteered to establish a website called “Question and Answer (Q&A) about radiation in daily life” shortly after the accident to help reduce the residents’ anxiety about the health effects of radiation. In August 2011, “Committee for Q&A about radiation in daily life” was established in JHPS, making the website-related activities a responsibility of JHPS. The Q&A website continued to respond to the questions from the general public with expertise and sincerity until February 2013 when the Committee members decided to end the activities because the number of questions received had gradually decreased with the passage of time. This paper aims to introduce the following: the activities of the Q&A website during the two years (2011–2013), the stance chosen for the activities, the information related to the website activities and the analysis of Twitter data. Building on the experience and the knowledge obtained from the activities, it also discusses issues and experiences that can be utilized in the initial response to emergencies for radiation protection experts as well as those in other fields.

Keywords: Fukushima Daiichi Nuclear Power Plant Accident, Radiation, Risk Communication, Website, Analysis of Twitter data, Committee of the Q&A Website

Introduction

Due to the accident at the Fukushima Daiichi Nuclear Power Plant of the Tokyo Electric Power Company Holdings Inc. (TEPCO), caused by the massive tsunami that followed the Great East Japan Earthquake of March 11, 2011, most members of the Japan Health Physics Society (JHPS) were called to respond to the emergency as radiation protection experts. Because the members were heavily involved in their professional duties, it became difficult for the JHPS to make its presence felt as a leading society of
experts on radiation protection. The JHPS was rarely mentioned in the government’s publicity materials, nor did the media reports refer to the JHPS [1].

JHPS members were aware from the beginning that the JHPS had to be prepared to respond if it received any external inquiries. The first step was the formation of a volunteer team called “Volunteers of the JHPS,” in which 13 JHPS members formed the team on March 16, with an approval from the Board of Directors. The total number of the team members eventually grew to 22. However, the team understood that it was a tentative structure before the JHPS could resume its normal function before the accident.

On March 18, we, the team members, received a request from the Ministry of Education, Culture, Sports, Science and Technology of Japan, asking the JHPS to collaborate on setting up a helpline. Thanks to Dr. Oumi, a former Director of the Kinki University. On March 23, two “health counseling hotlines” were opened at the university. JHPS members from the Kansai region mainly worked together in running the hotline [1]. This hotline became the start on which the JHPS built the “Question and Answer about radiation in daily life” activity, which is described below.

On March 20, a JHPS director contacted us that there was a plan to create a website to answer questions from the public and asked if we could cooperate. The experience of running a hotline made us aware that further efforts were required, and we responded.

Thus, we launched the “Question and Answer about radiation in daily life” [2] website (hereinafter, Q&A website) on March 25 and began answering questions from the public [3]. The website posted answers to approximately 750 questions in the first 4 months.

On August 24, “Steering Committee of the Q&A website” (hereinafter, Committee) was formally established as one of JHPS’s committees. Since August 2011, we had reported our experiences and the results of the analysis of the Q&A website (including the number of questions received and the characteristics of the questioners) at JHPS symposiums, conferences, and international meetings [4–6].

This paper reviews the activities of the Q&A website from the time of the accident until its closure in February 2013, and summarizes the lessons learned, including those that have already been published. In addition, this paper is the translation of a previously published one [7] written in Japanese in order to widely disseminate experiences gained from this activity both domestically and internationally.

Stance and Background of the Radiation Q&A for Daily Life Website

1. Stance

We decided on the stance in the Q&A website based on three principles in consideration of the public’s deep distrust for the central government, the municipal authorities, and the electric operators at the time. First, we will say “there is no need to worry about the risk from radiation” in the following terms, depending on circumstances and the available information. Second, we will provide answers based on scientific findings and our expertise, recognizing the importance of gaining trust from the public and reducing their concerns. Third, we will need to be accountable for our answers as a team of experts (it is directly related to our credibility as professionals on radiation protection).

In the specific work process, we took care to ensure the following attitudes: (1) answering all questions, (2) address any all questions with care, (3) remain objective, and (4) maintain the dignity of the JHPS. Furthermore, in order to ensure the objectivity of the answers, we presented the data as quantitatively as possible by showing mathematical formulas and calculation processes, as well as citing the sources of the data and figures used (dose conversion coefficients, etc.). In addition, we focused on responding to the questions instead of using the website as a platform for our opinion.

The contents of the questions started to change after about a month after the website’s launch, including an increase in the number of questions regarding the risk of health effects from radiation. In responding to those questions, we made sure to address the following points: (1) There is no “zero risk,” (2) uncertainty is unavoidable, and (3) consider and calculate the representative population risk as a basis of the answer (as it was not possible to evaluate the risk of a certain individual in a specific circumstance).

The Q&A website was our attempt to provide interactive communication on radiation, but it would still appear as one-way from the viewpoint of the citizens who did not send the questions. To address this problem, we utilized the social networking service (SNS) Twitter. Twitter users can post short messages (tweets) of up to 140 characters, and other Twitter users can “Reply,” “Retweet,” and “Like” them. The term “Retweet” refers to the act of re-distributing a tweet, whereas “Like” refers to a positive reaction to a tweet. The JHPS creat-
ed a Twitter account for Q&A [8] and tweeted all Q&A web-
site updates to promote our activities, to invite Twitter users
to our website, and to possibly generate exchanges on Twitter.

2. Procedure for Responding to the Q&A website

The details of the establishment of this website will be re-
ferred to in the articles such as “Activities in the early stage
after the occurrence of the accident,” [1, 3, 9]. This paper will
provide a summary of the development after the launch.

As explained earlier, the JHPS volunteer team initially draft-
ed the answers to the questions. Out of the 22 team members,
16 members were involved in writing the answers before the
activities were transferred to the Committee on July 20, 2011.
Six members of them were retirees and the rest of them worked
full-time in universities or research institutes (As mentioned
in the Introduction section, JHPS members working for cor-
porations or authorities were busy in their professional ca-
pacity, thus researchers played a central role in developing
the answers for the Q&A website).

The names of the people coordinating the Q&A website
were published, but we chose not to disclose the name of the
individual who wrote the specific answer to spare him/her
from extra burden of responding to additional inquiries
amid the already busy work schedule (Also, we set up a sys-
tem so that the Committee as a group was responsible for
the answer from the Committee).

An answer was prepared through the following process.

After receiving a question, it was sent to a team member who
wrote and sent the initial draft to the coordinator. The coor-
dinator would review the draft and ask for any addition, revi-
sion, etc. as necessary. The coordinators took care to correct
obvious errors and looked for deviations from the viewpoints
of JHPS but respected the works of the fellow members. After
reflecting these comments and making necessary revision,
the writers of the original draft posted the final answer on the
website.

As explained above, the Q&A Committee was officially es-
established in the the JHPS in August 2011. Thereafter, risk com-
munication activities involving radiation to the public became
JHPS’s responsibility, until the website’s closing in February
2013. The Committee had approximately 50 members. Young-
er members of JHPS played key roles with approximately
40 members from the JHPS Young Researchers’ Association
and the Students’ Association. They were supported by about
ten senior experts who played advisory roles. The young re-
searchers drafted the answers and the advisors reviewed and
commented the draft. A diagram describing the workflow is
shown in Fig. 1 [10].

Actual Situation of Q&A

1. The Questioners

The questions sent from the public in the first month or so
after the launch clearly showed how the questioners refused
to accept ambiguous explanations such as “Not dangerous, but not entirely safe.” This was a direct reaction to the government’s overuse of the phrase, “There would be no immediate threat.” Therefore, we adopted a principle to explain that “zero risk” was impossible in our answers and aimed to provide an estimate of the health risk using available data at the time.

After a few months, we started to see some changes in the people’s attitude, judging from the tweets in response to our Q&A. It could be summarized as an answer vouching for safety is actually suspicious, and an honest answer pointing out the true risk is more trustworthy and thus welcome. The change may reflect the fact that more information on the accident and the situation in Fukushima became available over time via the internet and the mass media. It is understandable how the public struggled with the many and often conflicting information. And it is natural for people to be skeptical when even authorities and experts appeared to disagree with each other. To address this issue, we introduced and emphasized the view of the International Commission on Radiological Protection (ICRP) about the probabilistic effects of radiation below 100 mSv in our answers, as it is the consensus of leading experts. Specifically, we assessed the radiation dose in the particular circumstance that the question referred to, and if it was below 100 mSv, stated that “(scientific findings to this date show that) there is no need to worry if the dose does not exceed several tens of mSv.”

In retrospect, our response may have been confusing for those without knowledge of radiation. However, in the early days of the accident, when there was no foreseeable future and the situation was urgent, we believed it was more important to secure a minimum standard of living while utilizing scientific knowledge to avoid the health effects of radiation to the extent possible. This meant we tried to alleviate the anxiety of those who sent us questions by providing them answers based on scientific findings. It should be noted that in the initial days after the accident, radiation measurement data was significantly limited. Thus, we had to estimate exposure doses using extreme assumptions, such as calculating the dose assuming a person stayed outdoors 24 hours being exposed to the highest dose rate measured on the day. We knew the result would grossly overestimate the exposure, but we chose this method to show that if the calculated dose did not exceed several tens of mSv, the actual exposure would have been significantly smaller. We used the expression “several tens of mSv,” which was independently established by the JHPS members, taking into consideration both the risk of radiation (the health effects of 100 mSv or less are not well understood scientifically, and they are much lower risk than the risk of cancer caused due to lifestyle factors) and the risk of other social damage.

Reflecting the situation, our answers became increasingly careful, polite, and lengthy. This tendency became more pronounced after the Ministry of Education issued the “Tentative Concept for Determining the Use of School Buildings and Grounds in Fukushima Prefecture (3.8 μSv/h),” and the government’s plan to reduce the dose with a long-term goal of 1 mSv/yr was widely shared [11].

It should be noted that these reference levels are only guidelines for the effective implementation of radiation protection measures; they do not indicate exposure dose limits or the line between safety and danger.

2. Situation of the Respondents

The 16 members of the volunteer JHPS team came from a diverse range of fields, including radiation protection, radiation control, the environment, and biology. We posted more than a dozen questions with answers on the website each day, and sometimes even more. Because the members were radiation protection researchers and engineers with sufficient knowledge and experience, the team could respond to questions slightly beyond their specialties, but we also took care to match the team member with the knowledge/expertise required to provide an appropriate response.

There were questions that were directly related to our daily lives as well as questions that experts would not have thought of, and we were frequently stumped as to how to respond to them. In hindsight, the need to provide answers quickly led to some hastily written responses. The coordinators’ role as gatekeepers was also limited by time-constraint, and there were cases where the answers did not directly address the concerns raised by the question.

3. The Number of Questions and the Characteristics of Questioners

Our website allowed the person sending questions to enter their attributes including gender, age, occupation, and place of residence. After compiling the data, it was estimated that women made up the majority, according to the gender place of residence. After compiling the data, it was estimated that women made up the majority, according to the gender place of residence.
did not provide their occupation information, we had no way of knowing if they were homemakers or working mothers. As for the background and expertise, as well as their level of knowledge on radiation, we could only assume these information based on the content of the question.

Fig. 2 shows the number of questions received in the early stages of the response (from the launch until July 2011) for each 10-day period. The graph shows that the Q&A website was closed from April 26 to May 5 because of Golden week holiday period, early May. We also closed it from May 26 to June 5 and June 16 to June 25 in order to handle a large number of questions. After the website reopened, we received about double the number of questions and struggled to post timely answers.

Fig. 3 shows the number of questions received between June 6 and July 1, 2011. We recognized that people from Tokyo, Chiba, and Fukushima sent in high number of questions. It is understandable that the residents of Fukushima took a keen interest, but the residents of the Tokyo capital region—Tokyo, Kanagawa, Chiba, and Saitama—sent many questions as well.

After the Committee was established, the demand was strong, and there was a week when we received approximately 100 questions. However, the number of questions decreased over time. In February 2013, we decided to terminate the website as few questions came in. Throughout the website, housewives with children were most likely to send questions. The data shows their keen interest in the health effects on their children. As previously stated, the information such as gender, age, and place of residence was self-reported, and the results of the analysis described here only allow us to draw a rough picture.

4. Characteristics of the Questions
The Q&A website received a wide range of questions, including simple questions, opinions, criticism of the answers posted, distrust of the government and experts. Some sought advice on life. We analyzed 246 questions posted from June 6 to July 1, 2011, in the initial days of the website, to count the frequency of the keywords being used. Table 1 shows the keywords (The Committee developed a set of keywords. The member who maintained the website assigned appropriate keywords for the individual Q&A.) that appeared in the questions, in order of frequency (The total is 276, because some questions used more than one keywords). The result can be used to understand the issues the public was most concerned about at the time. Our analysis shows that the top concerns were children’s health and food, followed by contamination and decontamination.

Whenever there was a major government announcement (e.g., a policy on exposures in a school environment or data on dose) or a significant change in the situation (e.g., the appearance of hot spots), we received multiple questions with similar concerns. As a result, listing the frequency of the keywords appearing in chronological order allowed us to reconstruct what the public was interested in at a specific point in time.

5. Analysis and Discussion of the Questions
The questions revealed that the public had the following concerns:
- Radiation and radioactivity are unfamiliar and cause
Table 1. Keywords Used in the Questions on our Q&A Website, in Order of Frequency

| Frequency | Keywords                                                                 |
|-----------|--------------------------------------------------------------------------|
| 39        | Children                                                                 |
| 25        | Harmful health effects, anxiety                                          |
| 16        | Water and food                                                           |
| 14        | Indoor & outdoor decontamination                                         |
| 12        | How to calculate radiation dose (method)                                 |
| 9         | Swimming pool, school playground                                         |
| 8         | Rain, laundry, hotspot, choices in daily life                           |
| 7         | Dose outdoors, internal exposure                                         |
| 6         | Cesium, ventilation                                                      |
| 5         | Breathing, space around one's house, buildings                           |
| 4         | Strontium, self-measurement, Chernobyl                                   |
| 3         | Airplane, natural background radiation, pregnancy, exposure from injury, marine contamination, radiation dose, rainwater gutter |
| 2         | Pets, farm products, radioactive material, mode of exposure, survey, measuring device, system for testing, dose inside a building, vegetable garden, criticism of the website, frustration towards the government, accuracy of the information, need to wear masks |
| 1         | Beta rays, cosmic rays, basic knowledge of radiation, parks, incidence of cancer, data on exposure, state of contamination in the region, contaminated building wall, contamination indoors, car contamination, laundry contamination, cleaning, heavy metal contamination, calf from a contaminated animal, false testing of decontamination, polluted sludge, sea-bathing, being wet from muddy water, relationship with altitude, radiation from buildings, reliability of the regulation values, 3.8 μSv, 1 mSv, 100 mSv, evacuation, setting fire on dead grass, ash from incinerators, next explosion, school lunch |

anxiety. ("Radiation/radioactivity is dangerous, period.")
- Any contamination is scary and should be avoided. ("I want decontamination but don’t know how it can be done.")
- There are many values, but what do they mean? (”I don’t know what to do with those numbers.”)
- There is a lot of information, and it is hard to determine which one should be trusted.
- Someone who says “it is safe” should not be trusted, those who say “it is dangerous” should be trusted.
- The government, TEPCO, and the experts are all conspiring together, and they should not be trusted.

We can see from the above that education on radiation has not reached the general public and the mechanism of how radiation affects health is difficult to be understood. Also, it is hard to grasp how the risk of radiation is represented, either as a product of radiation weighting factor and absorbed dose or as a product of tissue weighting factor and equivalent dose. In particular, understanding the health effects of low-dose radiation was a huge challenge, as the mechanism is still being debated among experts. If one wants to be scientifically accurate, one cannot determine there is no effect from even a small dose. The expression the experts use for probabilistic effects is difficult and can be misleading for the public, which caused anxiety and led to a suspicion that the experts are conspiring to underplay or hide the real risk. It is natural for the public to have many unanswered questions in such circumstance, and the questions actually sent to our website may be a tip of the iceberg.

On the other hand, those who sent questions showed positive responses to the answers posted on the website. This demonstrates how the interactive communication (i.e., the public could send further question/comment if they were not satisfied with the answer) through the Q&A website contributed to reducing anxiety and distrust from the lack of, or, inappropriately presented information. This was not instantaneous but happened over time through our effort to continue answering all questions. Kinoshita pointed out that the bidirectional nature of information ensures credibility [12], and although earning trust was not our initial objective, our activities seemed to have contributed to this aspect.

Response on Twitter

1. Compilation of Responses on Twitter

Tsubokura et al. [13] analyzed and summarized the Twitter information related to the accident and radiation in about six months after the Fukushima Daiichi Nuclear Power Plant accident. We also referenced the result in examining the response from the public who did not send questions, using the twitterers’ responses to our website, as mentioned in our stance. In this section, we look at the contents of the Q&A that caused high engagement by counting the number of "Reply," "Retweet," and "Like" to the tweets of the Q&A account. The scatter plot matrix of the number of “Reply,” “Retweet,” and “Like” is shown in Fig. 4. The results of Pearson product-moment correlation coefficient [14] for each response are shown in Table 2. Here, one point in the scatter-plot of the number of "Retweet" and "Like" in Fig. 4 was confirmed to have an outstandingly large value, so we excluded this value and calculated the correlation coefficient. Table 2 shows the results of calculating the correlation coefficient by Pearson product-moment correlation coefficient with this value. Regardless of the existence of the data, the correlation coefficient is approximately 0.70, which means that there is a
correlation between “Retweet” and “Like.”

Table 2 shows that there is a strong correlation between “Retweet” and “Like,” followed by a loose correlation between “Reply” and “Retweet.” Table 2 shows that there is a strong correlation between retweet and like, and a loose correlation between reply and retweet. In addition, Fig. 5 shows that the number of “Retweets” and “Likes” was small during the period immediately after the accident, and the number of responses increased more than one year after the accident.

Table 2 shows that there is a positive correlation among the three types of responses. Therefore, the total number of “Reply,” “Retweet,” and “Like” is defined as the “score,” and the tweets with the largest response are extracted using the score. Table 3 shows the contents of Q&A with a score of 31

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Table 2. Pearson Correlation Coefficient (r) among “Reply,” “Retweet,” and “Like” without outlier or including outlier

|               | Without outlier | Including outlier |
|---------------|-----------------|-------------------|
| **Reply**     |                 |                   |
| Retweet       | 0.39            | 0.40              |
| **Like**      | 0.26            | 0.68              |
| Retweet       | 0.68            | 0.76              |

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Fig. 4. Matrix of scatter plots regarding “Reply,” “Retweet,” and “Like.”
or higher for the entire period. In addition, Table 4 shows the Q&A with a score of 12 or higher during the first year of the activity, when there were few responses on Twitter.

Tables 3 and 4 show that our Q&A-related tweet that received the most “Retweet” and “Like” were those where the questioner expressed his/her lack of knowledge and anxiety. The website received many questions asking for our views on the problem (shown in Tables 3 and 4) are reflection of this situation). The website also received comments and complaints; although not in such large numbers compared to the questions (shown in Tables 3 and 4), these received relatively a large number of “Retweet” and “Like.”

2. Analysis and Discussion

Shown from the questioner’s anxiety based on the keywords used in the question (Table 1), these keywords represented topics which the questioners wanted to know about. Exposure related keywords appeared most often (8 out of 61 in Table 1), such as “exposure-related,” “exposure effects,” and “internal exposure,” in order of the frequency of use. In the questions, people wanted to learn about the reference values of radioactive materials in food in Japan, internal exposure through breathing, and health effects of exposure to low doses of radiation such as 1 mSv and 100 mSv.

The second most sought-after topic was food-related (7 out of 61 in Table 1), linked to keywords, such as “safety,” “standards,” and “radioactivity in food.” Specifically, they wanted to know about the new regulation values for radioactive materials in food and the amount that can be eaten in a day, the concentration and amounts of radioactive materials in food, and the safety of food.

Keywords related to children appeared the same number
The website should forcefully warn the risk of washing on removing radioactive materials, such as for vegetables.

Effectiveness of washing on removing radioactive materials, such as for vegetables.

Table 3. Inquiries with Highest Twitter Engagement (Score ≥ 31)

| Date (YYMMDD) | Question no. | Reply | Retweet | Like | Score | Summary of question |
|---------------|--------------|-------|---------|------|-------|---------------------|
| 12.12.08      | 1,765        | 2     | 60      | 41   | 103   | The website’s opinion on children’s thyroid problems |
| 13.04.19      | 1,822        | 0     | 40      | 29   | 69    | New regulation standard for food and the amount of food consumed per day |
| 13.06.13      | 1,838        | 1     | 29      | 17   | 47    | Radioactive materials in food |
| 13.06.19      | 1,855        | 1     | 23      | 23   | 46    | The actual status of the children’s radiation exposure level |
| 13.06.21      | 1,869        | 0     | 27      | 18   | 45    | Concern about the children’s future health |
| 12.05.21      | 1,534        | 4     | 24      | 15   | 43    | The website should forcefully warn the risk |
| 12.01.17      | 1,272        | 2     | 20      | 20   | 42    | The website should not say something is safe if the effect of radiation is not clear |
| 13.04.21      | 1,823        | 0     | 17      | 24   | 41    | Regulation values for radioactive materials in food |
| 13.06.13      | 1,846        | 0     | 31      | 10   | 41    | Humans being exposed to radiation through pets |
| 13.04.21      | 1,828        | 0     | 24      | 15   | 39    | Safety standards in Japan for internal exposure |
| 13.06.19      | 1,853        | 0     | 20      | 19   | 39    | Internal exposure from inhalation |
| 13.06.19      | 1,857        | 0     | 19      | 18   | 37    | About food safety |
| 13.06.15      | 1,813        | 0     | 19      | 15   | 34    | Concern for radioactive cesium intake through contaminated soil in the areas bordering Fukushima Prefecture |
| 12.10.03      | 1,701        | 1     | 21      | 11   | 33    | Polonium in tobacco |
| 13.06.15      | 1,837        | 1     | 17      | 14   | 32    | Radiation controlled area |
| 13.06.13      | 1,844        | 0     | 20      | 12   | 32    | Difference of lower detection limit, detection limit, and minimum value measurable; becquerel (Bq) amount in food; and screening level |
| 13.06.19      | 1,841        | 0     | 14      | 17   | 31    | Radioactive contamination of the internal organs of beef |
| 13.06.15      | 1,842        | 0     | 20      | 11   | 31    | The website’s opinion on the thyroid disease in Chernobyl reported in NHK’s TV program |

NHK, Nippon Hoso Kyokai (Japan Broadcasting Corporation).

Table 4. Inquiries with High Twitter Engagement (Total Response ≥ 12 and < 30)

| Date (YYMMDD) | Question no. | Reply | Retweet | Like | Score | Summary of question |
|---------------|--------------|-------|---------|------|-------|---------------------|
| 12.03.13      | 1,450        | 0     | 23      | 7    | 30    | Children’s internal exposure |
| 12.02.02      | 1,396        | 0     | 13      | 14   | 27    | How cesium and potassium affect human bodies differently |
| 11.09.12      | 811          | 0     | 10      | 10   | 20    | How to think about these different views: “There is no effect on health from radiation dose lower than 100 mSv” and “Radiation higher than 1 mSv is dangerous.” |
| 11.11.09      | 941          | 0     | 11      | 9    | 20    | Internal exposure from inhaling radioactive materials that fell on the ground and refloated in the air |
| 12.02.14      | 1,426        | 1     | 13      | 6    | 20    | A radioactivity measuring device showed high value in front of the refrigerator |
| 11.10.10      | 1,053        | 1     | 10      | 6    | 20    | The website’s opinion on the view stated by an expert on his blog |
| 12.02.28      | 1,440        | 0     | 9       | 8    | 17    | Concern for using mushrooms and seafood in weaning food for babies |
| 11.09.28      | 859          | 0     | 9       | 7    | 16    | Whether plutonium and strontium were scattered by wind in Kanto region |
| 11.06.16      | 548          | 0     | 7       | 8    | 15    | Whether the answers on the website stand the test of time 10 years later |
| 11.12.19      | 1,132        | 0     | 10      | 5    | 15    | Radiation exposure at 1 mSv and 100 mSv |
| 11.12.25      | 1,149        | 0     | 9       | 6    | 15    | Health effects from low dose radiation exposure |
| 12.03.13      | 1,467        | 0     | 12      | 2    | 14    | Health effects from radioactivity polluted flower pollen |
| 12.04.10      | 1,517        | 0     | 5       | 8    | 13    | Reliability and standing of academic papers |
| 11.03.29      | 65           | 0     | 8       | 4    | 12    | Effectiveness of washing on removing radioactive materials, such as for vegetables |
| 11.08.24      | 759          | 0     | 7       | 5    | 12    | How to convert Bq/kg to Bq/m³ |
| 12.04.13      | 1,453        | 0     | 5       | 7    | 12    | The meaning of “lower limit of quantitation” |

of times (7 out of 61). The questioners wanted to learn the actual situation of their children’s exposure to radiation, and what will happen to them in the future.

Some questions were related to expertise in radiation protection, such as “What is a ‘radiation controlled area’?” “The difference between the lower limit of detection, detection limit, and measurement limit, and the number of becquerels in food,” “I want to know the screening level,” “I want to know how to convert Bq/kg to Bq/m³,” and “What is the lower limit of quantification?”

Questions asking for the opinions of websites included: “I would like to know the website’s opinion on thyroid abnor-
malities in children,” “What do you think of the opinion on thyroid disease after Chernobyl in the TV program of NHK (Nippon Hosokai Kyokai), the Japanese public broadcasting company?,” “I would like to know your opinion on the contents of a blog written by an expert,” “I would like to know the credibility and position of a certain academic paper,” and “I would like to know your opinion on the articles by Dr. Christopher Busby and Professor Yury Bandazhevsky.”

Other questions not related to radiation, but classified as comments and complaints on the Q&A website included “The dangers should be communicated in full” (score = 43; Reply = 4, Retweet = 24, Like = 15), “We should not say that something is safe if the effects are not clear” (score = 42; Reply = 2, Retweet = 20, Like = 20), and “Is this a confident answer that will not be a problem even if it is seen after 10 years from now” (score = 15; Retweet = 7, Like = 8).

The above analysis indicates that the following principles/practices of our activities were welcomed: (1) the format of answering questions from the general public worked well, (2) in the initial stage, it was effective to reply that something (asked by the questioner) was safe, as long as it was supported by science, (3) the speed of answering a question was important, even at the cost of some accuracy, and (4) we should explain as clearly as possible, trying to understand and respect the questioner’s point of view (specifically, include full details without abbreviating explanations, and show numerical values and calculation formulas to show our answers were backed by science). In fact, we believe the above were received quite favorably. We adopted these principles/practices from the start, and the fact that they received a positive reaction shows our initial stance was not wrong.

After the initial stage, we stopped emphasizing that it was considered safe as long as the dose did not exceed several tens of mSv. Instead, we focused on providing accurate information based on actual measured data and scientific findings, so that the questioner may make the best decision reflecting his/her lifestyle choice and risk perception. Our answers started to reflect this tendency as our colleagues agreed on the need for a change. However, there was no noticeable response on Twitter regarding the change.

The issues for the future will be discussed later, but it should be stressed that our Q&A is an excellent archive of actual post-nuclear accident communication, showing what kind of topic/information was sought at each moment in time. Thus, it serves as a good source of information for someone providing information to the public after a future accident. At the same time, the questions, answers, and tweets show how the people’s interests/attitudes changed over time and can provide hints for post-crisis communication in general.

It should be added that analyzing Twitter activities was difficult. For example, what is the difference between “Retweets” and “Likes”? Or how should we interpret the large number of tweets in response to our tweet; whether the tweet reflected sympathy for the questioner, interest in the answers, or both?

### Issues Raised through These Activities

There are four main issues that we learned through these activities. The following explains the issues and our responses at the time. The first was whether to disclose the name of our team member who wrote the answer. As mentioned above, we initially posted the answers on our website without specifying the names. In response to this, we received a request to disclose the names. An other person pointed out that the lack of disclosure led to the lack of credibility. For that, most members felt their names should be disclosed, and we planned to make a change to include the name of the respondent in due course. However, by disclosing the name, there was a concern that the respondent may receive unexpected emails related to the Q&A that would interfere with their regular work (In fact, some members suffered from such phenomenon indirectly). Therefore, around the mid-point of the activity, the coordinators decided to disclose only the names and affiliations of the coordinators. In the book published at a later date [15], the names and affiliations of all members involved in this activity are listed.

The second issue was the organizational framework to carry out the activity. The initial team was tentatively made up of JHPS volunteers. Needless to say, shifting the role to a formal committee established in the JHPS was desirable. The team carried out the activity for about four months, and after a one-month break, the Committee was established mainly by the board of directors of the JHPS. As a result, the number of members who wrote the draft answer increased significantly. The members of the temporary team who had experience in writing answers took on the role of supervising them. Although this reduced the workload per member to write the draft answer, the sudden increase in the number of respondents caused considerable inconsistency in writing-style. The diversity was not bad per second, but different times it took for different members to draft an answer and the time required to ensure a certain level of consistency as a website.
often led to delay in posting an answer. In order to solve these problems, we created a manual outlining the role of each assignment (drafting, reviewing, correcting, etc.), the workflow, and our stance in answering the questions. The manual reduced the variance in the time it took to write an answer and the content itself. The Committee members shared the following recognition in developing answers, building on the experience of the volunteer team.

(1) Answer all questions sent to the website carefully. (Even if similar questions have been answered in the past, develop an answer.)

(2) State objective facts in the answer. (Provide numerical values by calculating the exposure and compare them with reliable sources.)

(3) The respondent’s opinion may be stated without forcing a conclusion. (Do not be too pushy.)

(4) Leave the final decision to the questioner. (Our stance is to provide information for the questioner to make his/her decision.)

The third issue was when to terminate the activity. We recognized the importance of continuing this activity, and many people wanted us to do so, too. However, it was pro-bono activity of the JHPS members alongside their profession. As many members were participating, we needed to have a common understanding on our activity, and we had to set a goal and decide the timing of closure. In the end, the Committee was disbanded about one and a half years after its establishment. We believe that it was an appropriate timing to conclude the activities since very few questions came in by then (at most, few questions per week).

The fourth issue was the publication of a book. Six months after the launch of the Q&A website, some of the early respondents suggested that we should publish the book as a record of our activities. Although there were some problems such as the pros and cons of a Q&A website, mismatches between questions and answers, and errors in some of the answers, we felt that the good and bad aspects should be left as they were, so that the entire exchange could be used as primary data for a later use. Fortunately, we were able to obtain support from the publisher. We extracted 80 representative questions from a total of 1,870 questions posted on the website, examined the contents of the answers, and corrected errors in the contents before publishing the book [15]. In addition, all the questions and answers on the website were archived in the National Diet Library as a web archive [4].

Future Direction

Severe accidents such as the accident at the Fukushima Daiichi Nuclear Power Plant should never happen again. However, given the nature of humanity, it is impossible to say such accident will never happen, and one can only strive to reduce the possibility of such accident from happening. Thus, it is extremely important to be prepared for a major scale disaster (not limited to nuclear accidents), including countermeasures in the initial stage.

As described earlier, our activities running the Q&A website earned the following positive feedback from the public:

(1) The format we chose, answering questions from the public,

(2) That we answered all the questions received,

(3) That we replied “it is safe” when appropriate in the initial days,

(4) That we answered the questions swiftly (even at the cost of some accuracy),

(5) That we aimed to produce an intelligible answer for the questioner,

(6) That the explanations were detailed (without abbreviation),

(7) That our answers were based on scientific grounds, as evident from the values and calculations in the answer.

We believe that the public understood our stance, that is, we strove to see from the questioner’s viewpoint in developing the answer (to the extent possible), to allow the questioner to make the final decision instead of forcing our view, and our sincerity reflected in the answer (for example, explaining the thought/decision process of the respondent in arriving at the advice). This stance was developed through the trial and error repeated in preparing the answers to the questions, and it reflects the changes from the initial days.

In developing the answers, there were several mistakes that should have been avoided, and our response left room for an improvement [2]. We also received negative comments and criticism on our stance for the Q&A website activities, our decision to use ICRP’s views as the basis of our answers, and that our answers did not significantly diverge from those of the government. We accepted these as constructive comments to be used for further improvement.

It should be noted that the communication through Q&A website, although intended as interactive communication, had its limitation. As it was not a face-to-face communication, it is difficult to confirm if our answers reached the ques-
tioner as intended. Based on this experience, we need to construct a better system to overcome this weakness if we were to build a similar Q&A website in response to a future accident (for example, as part of the JHPS’s website). More specifically, a feedback system within the Q&A website, as well as utilizing some social media platforms to receive opinions from the general public (who did not visit our website). For the record, there was a case where a person who sent a question actually called the JHPS secretariat to say that he was satisfied with the contents of the answer.

In this paper, we look back on the activities of the Q&A website and summarize our stance and the actual response situation, the experiences and issues gained from those activities, and the results of analysis through Twitter. Should there be a similar nuclear accident in future, the lessons and experiences from the Q&A website will be helpful not only for radiation protection experts but also for experts in other fields, especially in the initial response to emergencies.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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