Proposal and field practice of a method for promoting CMC hiyarihatto activity

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Abstract: A kind of hiyarihatto activity where workers report incidents on their works and discuss them, has been introduced to industrial fields to cultivate safety attitude of participants. However, Computer Mediated Communication (CMC) hiyarihatto activity is not always active. The purposes of this study are to propose a method for promoting CMC hiyarihatto activity and to practice the proposed method. The proposed method consists of following two methods. (1) Introduction of active participants who are requested to activate hiyarihatto activity and are hidden facilitators. (2) Introduction of Root Cause Analysis(RCA) form as a new way of reporting incident case to database for promoting thinking about incidents. The proposed method was practiced where 6 groups of 6 active participants and 30 normal participants who were working in nuclear power plants. The results showed that (a) Some groups were activated under the control of the active participants and their topics were about new knowledge of incidents, (b) Participants could submit incidents using RCA form without big problems, however it needs much time, and (c) The proposed method was practicable in actual work environment on condition of periods without regular facility inspections. However, "discuss new knowledge" should be added to the action guidelines and RCA form should be changed to easier way.

Keyword: safety attitude, hiyarihatto, Computer Mediated Communication (CMC), Root Cause Analysis(RCA), facilitation

1 Introduction

Safety attitude of workers in nuclear power plants affects their behavior in prevention of incidents and accidents or ensuring safety in their daily work[1]. Therefore, cultivation of workers' safety attitude is one of the priorities in nuclear power plants. A kind of hiyarihatto activity where workers report incidents on their works and discuss them has been widely introduced to industrial fields to cultivate safety attitude of participants.

Common hiyarihatto activity is conducted in Face to Face (FtF) environment. However, it is difficult to conduct such FtF hiyarihatto activity in organization of nuclear power plants because workers of these plants are geographically distributed and always busy. Therefore, asynchronous and distributed Computer Mediated Communication (CMC) is a suitable environment for hiyarihatto activity.

Existing CMC hiyarihatto activities however are not always active. For example, a CMC system of hiyarihatto activity with incident database and electronic Bulletin Board System (BBS) was operated in a Japanese power company. Nevertheless, few participants post messages to the BBS in this system, and the activity was stagnated.

The purposes of this study are to propose a method for promoting CMC hiyarihatto activity and to practice the proposed method in an actual nuclear power plant organization.

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2 Proposal of a Method for Promoting CMC Hiyarihatto Activity

2.1 Problems in existing methods

2.1.1 Problems of facilitator in hiyarihatto activity

An existing method of hiyarihatto activity employs a facilitator to organize discussion about incidents[2]. His important role is to encourage participant to join the discussion. He gives instruction of speaking or presents guidelines of what to speak to other participants[2][3] to fulfill his role.

Nevertheless, the system in the power company mentioned in chapter 1 has no facilitator or no alternative way to promote participants' speaking. It is supposed that this is one cause of stagnation of hiyarihatto activity.

However, introduction of facilitators into CMC hiyarihatto activity as a countermeasure against this cause does not have always advantage. This is because participants tend to rely on facilitator and they don't participate in the discussion spontaneously, and discussion about incidents is superficial and have no meanings then safety attitude will be not cultivated.

2.1.2 Problems in discussion process of hiyarihatto activity

As well as encouraging of participants' speaking, there is another consideration. If discussion in a hiyarihatto activity cannot contribute cultivation of safety attitude, it has no meaning even if the activity is activated. This is a fundamental requirement of hiyarihatto activity.

According to Shigemori M., it is important for participants to follow three step discussion as analyzing and discussing (1) events which happened in incidents, (2) factors which cause these events and (3) measures to these factors in order to cultivate their safety attitudes[2]. This is because such analysis and discussion promote (a) sharing knowledge and measures of the incidents, and (b) understandings and sensitivity, which contribute fostering their safety attitude.

Therefore, in order to encourage participants to analyze and discuss the above, a facilitator presents an incident case as a topic, and directs all of them to discuss it in one room. Nevertheless, this discussion process is inadequate for asynchronous CMC, because it consumes much time and only a few cases can be discussed even if many incident cases are currently stored in database.

On the other hand, in case of the system in the power company mentioned in chapter 1, users can freely choose incident cases and discuss them without any controls by a facilitator. In this way, multiple cases can be topics of discussion concurrently and users can discuss them spontaneously. However, they may not follow the three step discussion.

2.2 An outline of CMC hiyarihatto activity

Before describing the details of our proposal as a solution of the mentioned problems, the procedure of CMC hiyarihatto activity is roughly explained in this section.

First, participants use "Hiyarihatto sharing system" as CMC environment, which has been developed by the authors. It provides functions of BBS and incident database. The number of participants in a group should be about five, and all of them are kept anonymous not to hesitate about submitting incident cases which they have experienced. They are expected the following two actions in the activity.

(1) Submitting incident cases to the database as many as they want at anytime.
(2) Reviewing incident cases and discuss these cases in BBS.

They can submit the cases which they just heard from others. When a new incident case is submitted, a thread of BBS is automatically generated for discussion about it. They can freely discuss multiple cases of incident concurrently in multiple threads in BBS.

2.3 Introduction of an active participant

The proposed method introduces an "active participant" into each group of hiyarihatto activity in order to promote participants' posting of messages in BBS. Active participant is a special participant who is requested to follow action guidelines shown in table 1 for promoting the activity.

Table 1 Action guidelines for active participants

・Submit an incident case as the beginning of the group

・Use various functions of the system

・Post a message to bulletin board as the beginning of the group

・Ask other participants' messages

・Post positive messages such as compliment

・Agree to messages or incident cases

・Refer to contents of incident cases or messages

・Reply messages if there are no reply

Active participants' roles will be played by persons in charge of safety in power companies. Roles of them have following three characteristics compared with facilitators' roles.

(i)Since existence of an active participant is hidden from normal participants (participants who are not an active participant), they will not rely on him/her regarding him/her as a special participant. Instead, an active participant cannot use authority or power which is based on the fact that he/she is a special participant.

(ii)An active participant doesn't use authority or power but conformity to induce normal participants to posting messages. A social psychological study said that humans tend to conform others whose behaviors are consistently active[4]. Consequently, an active participant should behave actively in order to draw normal participants' conformity. This is expected to contribute (1) direct increase of normal participants' posting messages because they will conform to active participant's activeness, and (2) controlling contents of messages which can contribute further increase of messages. Because conformity is felt as spontaneous behaviors by the one who conforms, active participants therefore don't disturb spontaneity.

(iii)An active participant increases messages which give normal participants positive impressions then they can build a good social relationship in the activity. This is because such a social relationship is an important elements for promotion of discussion according to some studies (e.g. GARRISON[5] or BALES[6]) and it will promote their spontaneous participation. On the other hand, he/she doesn't mention concrete procedures of discussion such as

"discuss causes of incident next to situations of that". This is because discussion in the proposed method doesn't have very strict procedure so that participants can freely discuss.

Explanations of each action guideline showed in table 1 are as follows. "Submit an incident case in the first place of the group" and "use various functions of the system" are presented so as to present how to use functions of the hiyarihatto sharing system to normal participants.

"Post a message to bulletin board in the first place of the group" is presented because conformity tends to occur on uncertain condition that people don't know what to do[7]. "Ask other participants' messages" is presented in order to promote normal participants posting messages directly.

Following four guidelines give positive impressions about the activity to normal participants. "Post positive messages such as compliment" and "agree to messages or incident cases" directly give positive impressions. "Refer to contents of incident cases or messages" is presented so that the one who posted messages can feel that these are surely read by others. "Reply messages if there are no reply" is presented because humans generally want a return which is equal to a cost they spent something[7].

2.4 Root Cause Analysis form

The proposed method uses Root Cause Analysis (RCA) form as a submitting form of incident cases. RCA is an analysis method which realizes root causes of accident cases for taking measures against these[7]. Some RCA methods give a graphic representation of an accident case, which is consists of a timeline of each events in the accident, factors (causes) tree of these events, and measures of these factors[9][10].

Now, if such graphic representation is adopted as a submitting form of incident/accident cases to database, someone who uses this form naturally analyze cases. Consequently, discussion about incident cases after submitting them with RCA form will have the same effect to three step discussion mentioned in 2.1.2. In other words, three step discussion[2] provides analysis and discussion of incident cases at the same time, but the proposed method provides discussion of these after analysis of these.

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There are some software or methods which support a graphic representation of an accident case in RCA (e.g. HINT-HFC[11]). Nevertheless, these aim detailed and strict analysis which is original objective of RCA, and users need some training to master these. Hiyarihatto activity requires more easy way of analysis, and there are no methods which have sufficient easiness. Therefore, the proposed method uses simplified graphic representation of incident cases. **Fig. 1** shows RCA form of hiyarihatto sharing system. This simplified version of RCA form omits complex procedures of original RCA, such as distinction between concurrent events or detailed categorization of factors. It has one simple event timeline, and factor and measure tree.

If this RCA method is introduced, participants will certainly analyze incident cases. However, whether or not discussion about analyzed cases can promote sharing knowledge as mentioned in 2.1.2 should be confirmed.
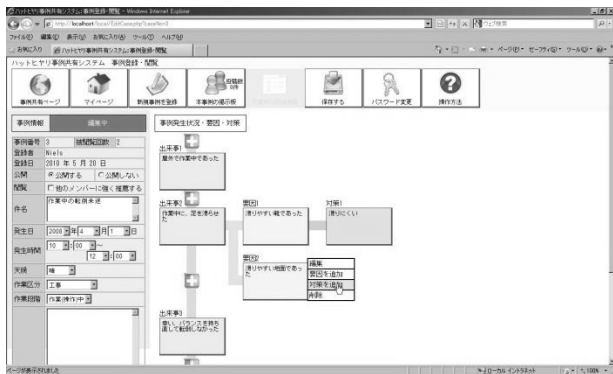

Fig. 1 RCA incident case form.

3 Field practice of the proposed method

3.1 Purposes of the practice

As a step toward broad practical applications of the proposed method, a field practice of it was conducted in an actual nuclear power plant organization. The purposes of the practice are as follows.

(1) To confirm that normal participants who work in actual nuclear power plants can join the activity even if they has a lot of business in their daily work.
(2) To confirm that normal participants can share knowledge through discussion in the proposed method.

(3) To confirm that active participants can take intended actions by a presentation of the action guidelines shown in table 1 in 2.3.
(4) To confirm promotion of posting messages of normal participants, which is caused by active participants' actions.
(5) To propose revised version of the proposed method if it is not sufficient based on results of the practice.

3.2 Method of the practice

The proposed method had been practiced for 25 days from January 13 2009 to February 6. Participants of the practice were total 36 people who are divided into six groups, and each group consists of five normal participants and one active participant.

All normal participants are male workers who are responsible persons of maintenance work in three sites of nuclear power plants. When groups of participants were constructed, each group has preferably equal number of workers of each site and their professions are the same in a group. Their company allowed them to join the practice in office hours using Personal Computer via the Internet. They were requested to participate in the practice as evaluation of the system and (1) to login the system two times a day, (2) to submit over five incident cases in the practice and (3) to discuss in BBS. Before the beginning of the practice, 23 incident cases were prepared as topics of discussion in incident database of the system in advance.

Active participants are five researchers of human factors and a veteran worker of normal participants' company, and all of them are male. They were trained how to use the hiyarihatto sharing system. They were requested to follow the action guidelines shown in table 1.

Before and after the period of the practice, questionnaire surveys were conducted in order to find information about individual factors that affects participants' behaviors in the practice and other information which is related to the purpose of the practice. Pre practice questionnaire asked participants' age, periods of current work, experiences of using BBS and experiences of joining hiyarihatto activity. Post practice questionnaire asked their impressions to the activity, the system and others' behaviors. In

addition, a personality questionnaire with five points scale was conducted[12][13].

3.3 Results and discussions

3.3.1 An overview of results and individual factors

The pre practice questionnaire got 30 valid responses of normal participants and the post practice questionnaire got 26 valid responses. The log of the system realized that participants showed wide variety of participation patterns.

To show their diverse participation pattern in an understandable way, all participants were classified based on the number of login to the system, visiting BBS, posting messages in BBS and submitting incident cases to the database, and **Table 2** shows the results of classification.

Table 2 Average number (standard deviation) of each type participants' login, visiting BBS, posting messages and submitting cases

	Login	Visit BBS	Post messages	Submit cases	#
Dropout	7.0(7.3)	0.3(0.5)	0.0(0.0)	1.9(2.2)	8
ROM	13.6(7.8)	8.9(4.8)	0.3(0.5)	3.1(2.0)	9
Average	22.4(8.7)	39.3(17.3)	5.8(4.1)	4.4(1.2)	9
Spontaneous	60.5(13.2)	163.8(44.8)	28.5(15.4)	11.5(5.4)	4
Active participant	11.7(5.3)	50.5(22.9)	13.8(4.4)	0.3(0.8)	6
Total	19.2(17.6)	38.7(51.9)	11.5(11.5)	3.6(3.8)	36

#: Number of each type participants.

The classification process are as follows.

(1) Normal participants who posted up to one message and visited BBS <u>up to</u> one time were interpreted as "dropout".
(2) Normal participants who posted up to one messages and visited BBS <u>over</u> one time were interpreted as "Read Only Member (ROM)".
(3) Normal participants who posted over one message were named as "Average participants" except for four participants who are very active.
(4) Very active normal participants, such as visiting BBS over 100 times, were named as "spontaneous participants".

Next, before analysis of the results for the purposes of the practice from (1) to (5), effects of individual factors were analyzed with ANalysis Of VARiance (ANOVA) and multiple linear regression analysis. Dependent variables were the number of login, visiting BBS, posting messages and submitting cases. Independent variables for ANOVA were a site where he belongs(site) and a group that he belongs(group). Independent variables for multiple linear regression analysis were age, periods of current work, experiences of using BBS, experiences of joining hiyarihatto activity and answers to the personality questionnaire. As a result, effects of individual factors were not significant (p>0.05) except for effects of site and group (p<0.05).

3.3.2 Can normal participants join the activity?

Total 13 participants who were classified as "average participants" and "spontaneous participants" submitted about or over five incident cases which were requested, and posted some messages to BBS. In particular, four "spontaneous participants" showed stronger aggressiveness than active participants did. Consequently, they could join the activity sufficiently. However, whether or not they can join the activity in the same way after the practice should be confirmed.

Next, total 17 participants were "dropouts" and "ROMs". "ROM" is not a problem for themselves because they can read others' messages in BBS, and they would get some knowledge and cultivate safety attitude. Nevertheless, the number of "ROMs" is desired to decrease if possible from the viewpoint of continue of discussion. On the other hand, existence of "dropout" is a problem if their absence from the activity is constant state in their daily work.

Table 3 shows answers of a question which asked whether or not each type participants wanted to continue the activity in the post practice questionnaire. According to Table 3, 23 normal participants somehow wanted to continue the activity. In particular, five "average participants" and "spontaneous participants" answered "I want to continue" or "If the system is improved, I want to continue". These results suggest that a number of normal participants can continue to participate with some improvement of the proposed method.

Table 3 Whether or not each type participants want to continue the activity

Answer*	Dropout	ROM	Normal	Spontaneous	Total
I want to continue.	0	0	2	1	3

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If the system is improved, I want to continue.	0	1	1	1	3
If conditions are met, I want to continue.	0	1	2	1	4
I want to continue as a ROM.	3	5	4	1	13
I don't want to continue	2	1	0	0	3
Valid answer total	6	8	9	4	26

*: Answers are originally Japanese.

Concrete proposals of improvements that were described by normal participants who conditionally wanted to continue, were "more easy method for submitting cases", "submitting cases without any quota", "posting messages only, not submitting cases". Since all of them intended to lighten workload of submitting cases, this is an assignment for drawing continuous participation of them.

Next, table 3 shows that the most common answer was "I want to continue as a ROM", and three "ROMs" and "dropouts" answered "I don't want to continue." Because "dropouts" and "ROMs" are desired to decrease, the reason of their answers were analyzed in order to get clues as to decrease them. In the post practice questionnaire, the reason of fewness of messages was asked, and five "dropouts" and six "ROMs" gave us valid responses. As a result, five "dropouts" and five "ROMs" choose "I was busy" as a reason. In addition, nine answers of another free-answer question in the post practice questionnaire stated their lack of time to join the activity, which is caused by busyness of daily work. Consequently, a part of normal participants could not sufficiently join the activity because of lack of time.

However, four normal participants answered interest comments. Major point of them is that "generally, we are busy in regular facility inspection periods of nuclear power plants, but we will join the activity in other periods." In particular, two "ROMs" of them said that the period of the practice and regular facility inspection periods were overlapped. They belong to site B where regular facility inspection was conducted to day 8 of the practice in fact. On the other hand, a "spontaneous participant" who belongs to site A where regular facility inspections were not conducted in the period of practice, said that he could join

actively becauseregular facility inspections were not conducted.

There is another fact. In site C, a regular facility inspection was conducted from day 24 in the practice, and normal participants who belong to site didn't post any messages after day 18 even if other site participants posted to day 23. This can be because preparation of the regular facility inspection affected behaviors in the practice. In addition, all "dropouts" belong to site B and site C except for one "dropout".

These facts suggest that the main reason why some participants were "dropouts" and "ROMs" was regular facility inspections. However, common site of nuclear power plant has a few months without regular facility inspections. To conclude, normal participants who work in actual nuclear power plants will be able to join the activity on condition of periods without regular facility inspections.

3.3.3 Can participants share knowledge?
Messages that provided any knowledge were counted in order to confirm knowledge about incident cases were shared in the activity. In doing so, "originally existing knowledge (existing knowledge)" such as an established work procedure or a common countermeasure against accidents, and "knowledge which is obtained in the practice (new knowledge)" such as an idea of counter measure or a new interpretation of an incident case, were distinguished. This is because this distinction will realize each a difference of contents of groups' discussion. Details about this will be described in 3.3.5 and 3.4.

The procedure of counting is as follows. First, the first author and other two graduate school students individually counted these messages. Its concordance rate was 69%. Next, all messages which results of first counting were not coincident, were discussed to reach an agreement by all of them. The results of the counting are shown in **table 4**.

Table 4 shows that all participants except for "ROMs" and "dropouts" posted messages which provide knowledge. In individual level, all participants except for "ROMs", "dropouts" and one "average participant" posted one or more messages which provide knowledge. Consequently, the results suggest that participants can share knowledge through the

proposed method if they post any massages in the activity.

Group	Existing knowledge	New knowledge	Message total
Dropout	0.0(0.0)	0.0(0.0)	0.0(0.0)
ROM	0.2(0.4)	0.1(0.3)	0.3(0.5)
Average	4.9(3.7)	1.8(1.9)	5.8(4.1)
Spontaneous	14.8(3.6)	19.0(7.0)	28.5(15.4)
Active participant	5.3(2.6)	9.5(4.8)	13.8(4.4)
Total	6.6(5.3)	7.9(7.9)	11.5(11.5)

3.3.4 Can active participants take intended action?

Table 5 shows whether or not active participants could post a message or submit a case in the first place of his group. According to table 5, only an active participant of group 3 submits any cases of incident to database. This may be because the action guidelines are mainly about posting messages, and explanation of active participants emphasizes their roles in BBS, not submitting cases.

Table 5 Whether or not active participants could post a message or submit a case in the first place of his group

	Message*1	Case*2
Group 1	3rd	×
Group 2	2nd	×
Group 3	1st	○
Group 4	1st	×
Group 5	23rd	×
Group 6	1st	×

*1:Rank of posting the first message for him in each group

*2:○submitted a case in the first place、×submitted no case

In addition, the active participant of group 3 only belongs to the normal participants' company, and he had strong motivation and interest in the activity. In our interpretation, this is because he only inputted incident cases.

Next, only active participants of group 3, 4 and 6 could post a message in the first place. In addition, first postings of them in group 1 and 2 were not so late. However, the active participant of group 5 completely fell behind in posting messages. According to him, this is because he lowered his guard when other participants submitted cases and posted messages at the beginning of the practice. In

fact, normal participants of group 5 behaved actively the beginning of the practice without the active participant. Such normal participants' behaviors would remove a motivation to activate the group from him.

Next, **table 6** shows a summary of counting messages which correspond to action guidelines of active participants. This counting followed the same procedure of the counting of messages which provide knowledge mentioned in 3.3.3. Since one message can contain multiple contents or no contents, summations do not coincident to total number of posting. The concordance rate of the first counting was 91.2%. Targeted action guidelines were "ask other participants' messages (message request)", "Post positive messages such as compliment (positive messages)", and "agree to messages or incident case (agreement). "Reply messages if there are no replies (reply)" was counted according to use of a reply function of the hiyarihatto sharing system. "Refer to contents of incident cases or messages" was removed from the counting because all messages basically mentioned contents of incident.

Table 6 Summary of messages of active participants and normal participants which are related to active participant's action guidelines

Group		Message request	Reply	Positive Message	Agreement	Message total
1	AP	6	2	1	1	13
	NP	3	5	0	0	9
2	AP	3	5	6	2	19
	NP	0	19	11	11	30
3	AP	9	5	3	3	14
	NP	18	38	6	14	95
4	AP	5	1	0	0	15
	NP	2	1	0	0	3
5	AP	7	11	7	3	16
	NP	3	13	2	2	32
6	AP	2	0	1	0	6
	NP	0	0	0	0	0

*1 NP : Normal Participant

*2 AP : Active Participant

Table 6 shows that active participants posted about the same number of messages except for group 5. However, contents of these were different. "Reply" was not so often posted in group 1, 4, and 6. This may be because normal participants posted few messages that are target of "reply" in these groups. "Message request" was posted in all groups except for group 2. Active participants of group 1, 4 and 6 posted few

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"positive messages" and "agreements" compared to them of group of 2, 3 and 5.

Presentation of the same action guidelines caused such different behaviors of active participants. There are some supposable reasons. First, individual factors, their ability, knowledge, and in particular motivation mentioned above would be different. Second, other participants' messages would affect. However, ambiguity of presentation of these should be considered at first, because ambiguous presentation will strengthen effects of individual factors and other participants. Before this practice, contents of the action guidelines were clearly presented to them. However, they were not so strongly requested to follow these, such as "follow all of the action guidelines without any exception." This may be because of differences of active participants' behaviors. To conclude, not all active participants could take intended action because of their motivation or ambiguous presentation of action guidelines.

3.3.5 Can active participants promote posting messages?

In this section, effects of active participants' behavior s on normal participants' behaviors will be analyzed. First, whether or not normal participants increased their posting messages with conformity is analyzed. **Table 7** shows that the number of participants who was influenced by other's pace of posting messages. According to table 6, group 2, 3 and 5 were relatively active groups which normal participants posted many messages, and group 1, 4 and 6 were not active groups. Table 7 shows that normal participants who was influenced by others and increased pace existed only in active groups. In addition, a normal participant, who followed other's pace and belong to activated group, increased his pace according to an answer of the post practice questionnaire. On the other hand, another answer of the post practice questionnaire shows that the one, who followed other's pace and belongs to not activated group, decreased his pace.

These results show that message posting of six normal participants mentioned above promoted by someone who posted actively.

Table 7 The number of participants of each group who was influenced by other's pace of posting messages

Group	Be influenced and decreased pace	Did not change pace	Be influenced and followed other's pace	Be influenced and Increased pace	Total answer
1	0	4	0	0	4
2	0	3	1	1	5
3	0	2	0	2	4
4	0	3	2	0	5
5	0	1	1	2	4
6	0	3	1	0	4
Total	0	16	5	5	26

Nevertheless, not all results support effectiveness of conformity. A cross tabulation table of the number of participants by participants' type, site and group is shown in **table 8**. This table shows that activated groups even have "ROMs" and "dropouts", and suggests that they did not conform to others. Nevertheless, almost all "ROMs" and "dropouts" belong to site B or site C where regular facility inspections were conducted. This result suggests that an effect of regular facility inspections is stronger than that of conformity.

Table 8 Cross tabulation table of the number of participants by participants' type, site and group

Participant type	Site	Active groups	Not active groups	Total
ROM & Dropout	Site A	1	4	5
	Site B & C	4	8	12
Average & Spontaneous	Site A	4	2	6
	Site B & C	6	1	7
	total	15	15	30

Next, whether or not conformity to active participants could control contents of normal participants' messages is analyzed. Table 6 in 3.3.4 shows normal participants of group 5 posted only two messages that contain "positive message" and "agreement". On the other hand, normal participants of group 2 and 3 posted relatively many "positive messages" and "agreements". These results indicate that active participants of group 2, 3 and 5 similarly posted many "positive messages" and "agreements", but only active participant of group 5 could not post in the first place as shown in table 5, then only he could not promote conformity of other participants. In addition, both normal participants and active participants in

group 2 posted few "message requests". This would be also because of conformity.

Such concordance of behaviors of active participants between that of normal participants in group 2 and 3, and discordance of these in groups 5 were also seen in ways of sharing knowledge. **Table 9** shows the number of messages which mentioned existing knowledge and new knowledge of active participants and normal participants in each group. Both of them in group 2 and 3 posted both "existing knowledge" and "new knowledge". On the other hand, in group 5, active participant posted "new knowledge" and normal participant posted "existing knowledge". These results suggest that conformity to active participants could control contents of normal participants'

Table 9 The number of messages which mentioned existing knowledge and new knowledge of active participants and normal participants

Group		Existing knowledge	New knowledge	Messages total
1	AP	3	7	13
	NP	6	3	9
2	AP	7	18	19
	NP	21	24	30
3	AP	6	9	14
	NP	45	61	95
4	AP	9	11	15
	NP	2	1	3
5	AP	1	10	16
	NP	26	4	32
6	AP	6	2	6
	NP	0	0	0

*1 NP : Normal Participants total

*2 AP : Active Participant

At last, whether or not control of contents of messages and intended action of active participants can promote normal participant' posting of messages is analyzed. In table 6 in 3.3.4, active participants of active groups posted three or more "positive messages" and "agreement" On the other hand, those of not active groups posted one or less "positive messages" and "agreement". This suggests that "positive messages" and "agreement" affected promotion of posting messages.

Table 10 shows impressions of normal participants toward the activity. As described in 2.3., "positive messages" and "agreement" intend to give normal participants positive impressions. In fact, Table 10 shows that normal participants of activated groups had a relatively positive impression. However, note that another interpretation is possible. They would originally have positive impressions, and then posted many messages.

Table 10 Impressions of normal participants toward the activity

Group	Very interested	Interested	Neutral	Not interested	Not interested at all	Total
1	0	0	4	0	0	4
2	0	2	3	0	0	5
3	2	1	1	0	0	4
4	0	1	3	0	1	5
5	0	2	2	0	0	4
6	0	0	3	1	0	4
Total	2	6	16	1	1	26

Next, **table 11** shows comparison of replied rate between "message request" and not "message request". Table 11 shows that "message request" got more reply, except for group 2 and 6 where few "message request" were posted. This result suggests "message request" can promote posting messages.

Table 11 Comparison of Replied rate between "message request" and other messages

Group		Replied	total
1	Message request	3(33.3%)	9
	Other	4(30.8%)	13
2	Message request	1(33.3%)	3
	Other	18(39.1%)	46
3	Message request	14(51.9%)	27
	Other	11(13.4%)	82
4	Message request	1(14.3%)	7
	Other	0(0.0%)	11
5	Message request	6(60.0%)	10
	Other	10(26.3%)	38
6	Message request	0(0.0%)	2
	Other	0(0.0%)	4
	Total	68	252

To conclude, if active participants can take intended action and regular facility inspections are not conducted, active participants' action can promote posting messages of normal participants in some way.

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3.4 Proposal of improvements of the method

In this section, improvements of the method will be proposed based on the results. First, normal participants could submit incidents using RCA form without big problems, discussion in 3.3.2 however pointed out that workload of submitting incident cases would be better off being lightened. So, more simplified RCA form which contains just three textbox for events, factor, and measures is proposed.

Second, 3.3.2 also pointed out that participants cannot take time to join the activity in regular facility inspection periods. Consequently, we propose that number of normal participants should increase twofold or more by participation of workers of many sites, many companies. The reason is that overlap of regular facility inspection periods will often occur if one group consists of only five participants who belong to three sites.

From the discussion in 3.3.4, when action guidelines are presented to active participants, it has to be more strongly requested.

Lastly, a new action guide line is proposed. **Table 12** shows the number of messages that contain both a type of knowledge and contents which correspond to the action guideline of active participants. This table suggests that "new knowledge" has stronger relation to "message request", "positive message" and "agreement" than "existing knowledge".

Table 12 The number of messages which contain both a type of knowledge and contents related to action guideline of active participants.

	Message request	Reply	Positive Message	Agreement	Message total
New knowledge	31	54	28	24	154
Existing knowledge	14	49	9	18	134
total	58	101	37	36	258

This is supposed that "new message" tends to be followed by thank to others who submitted a case as a source of new knowledge, and also tends to be followed by request of opinion to new knowledge which is often a subjective impression. Therefore, "discuss new knowledge" should be added to the action guidelines.

4 Summary

In this study, the method for promoting hiyarihatto activity was proposed and practiced in an actual nuclear power plant organization. The results realized that

(1) Normal participants who work in actual nuclear power plants can join the activity on condition of periods without regular facility inspections.
(2) Participants can share knowledge through the proposed method except for "dropout".
(3) Not all active participants could take intended action because of their motivation or ambiguous presentation of action guidelines.
(4) If active participants can take intended action and regular facility inspections are not conducted, active participants' action can promote posting messages of normal participants in some way.

In addition, some improvements of the method were proposed based on the results as mentioned in 3.4.

However, this study has a limitation. The period of practice was not so long that if the activity continue some month or some year, other problems will possibly occur in the propose method. This is a future task.

Acknowledgement

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