The Development of Risk Informed Screening System (RISS) for Operating Experience Program to Balance out the Quality and the Number of Reports

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1. Introduction

Nuclear Energy has positioned reliable and low cost energy in Korea since 1978 thereby, as of 2019, 24 Nuclear Power Plants are currently in operation. With its technical complexity and man-machine interface, nuclear industry experiences some number of events in their daily operation. Many previous researches have presented that the repetition of small events could be an important precursor to the big event like Davis-Besse in US. In this regard, many nuclear organizations have set up the Operating Experience (hereinafter OE) Programs to reflect the lessons learned effectively from the other station or facility as driven by IAEA or WANO. Accordingly, a screening process was designed to balance out the organization's limited resources practically. But, the screening process has remained unchanged for decades in a subjective manner with some checklist items. A new screening system using grading is modeled in this study in consideration of risk information to make the result of screening more reliable to the end users.

2. Modeling of Grading

2.1. Current Operating Experience Program

All internal or external event reports are collected in nuclear organizations to enhance their equipment or to improve their work practices (Fig. 1).

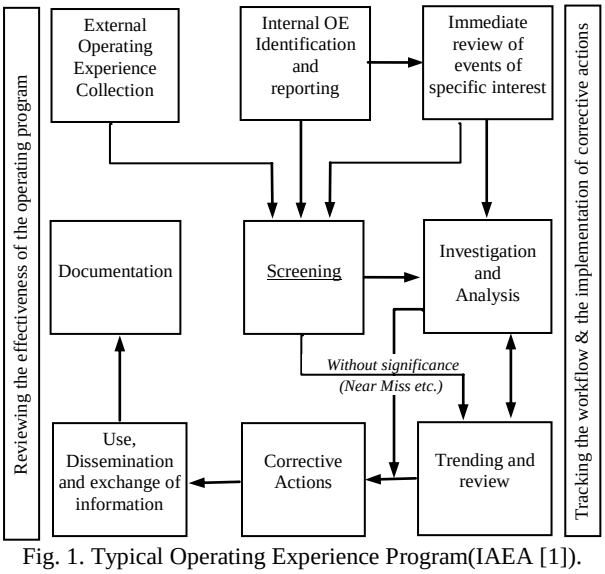


Fig. 1. Typical Operating Experience Program(IAEA [1]).

The screening process is an indispensable step to use OEs effectively within limited resources. Therefore, each organization has a similar screening process including criteria of urgency level, significance or applicability to the organization etc. (Table I)

Table I: OE Screening Criteria(7 items from IAEA[1])

(a) Whether immediate actions are necessary in response to significant external operating experience
(b) Whether there are generic implications that may apply to the installation
(c) Whether there is similar equipment at the installation
(d) The possibility of the occurrence of a similar event at the installation
(e) Whether reported corrective actions are applicable to the installation
(f) Whether similar environmental conditions exist
(g) Whether similar management expectations, personnel behaviors, practices or processes (i.e. organizational factors) have been observed in the organization

This screening process has worked well for decades to meet the needs of the organization. The process was simple to use by small number of OE staff. However, the involvement of station OE coordinators was limited and the quality of screened OE was frequently challenged. The comments of screening meeting were mainly “No specific insight” or “insufficient information to dissemination” etc.

This top-down screening approach by Central OE Review Committee sometimes was not good enough to communicate closely to the OE end users why it is important or worthwhile to review. And it could miss an opportunity to enhance report quality by sharing review focus with station OE coordinators. The OE report should maintain the consistency in their quality as much as possible, otherwise the report could be considered as less important by the end users in the station. [2]

If this practice continues or report continues to be overproduced, the end users, especially new comers, could regard the organizational learning from experience as a time-consuming or miscellaneous work that interrupts their daily operation & maintenance. For this reason, the quality and the number of OEs should be balanced at some level together on a reasonable basis.

2.2. Modeling of Grading System with Risk Information

The nuclear organizations have prepared a Corrective Action Program (CAP) which supports issue identification, collection and corrective actions. It

grades the events from Level 1 to 4 in consideration of its "Risk" and "Uncertainty" upon evaluation by the station Corrective Action Review Board. This Risk Informed Screening System (RISS) is designed to make best use of this existing CAP levels, which contains risk information evaluated, in the station as a trustworthy input.

Firstly, the OE coordinators at station grade the OE report from 1 to 4, correspond to the CAP level respectively and if the coordinators find the potential risk elements in the event, they could plus 2 points moreover, in order to highlight the risk (Table II & III). Effective risk management starts from proper identification of risks.[3] By highlighting the potential risk elements at the 1st step of screening, the risk in OE could be surely recognized and communicated to the appropriate station personnel in the other station.

Table II: RISS Grading Table for two-steps screening

CAP Level	OE Coordinator at Station		OE Committee	Total
	point	Plus point		
2	2~4	2	2~4	4~10
3	1~3		2~4	3~9
4	1~2		1~3	2~7

Second, a Central OE Review Committee grades the OE report with its importance from 1 to 4 respectively. In this stage, the committee member could verify the first stage screening and, if any, could ask the station OE coordinators of the technical background or supplementary information to improve the quality of report. After that if the total point scored more or equal to 7, then the OE report is decided to be disseminated to the other station.

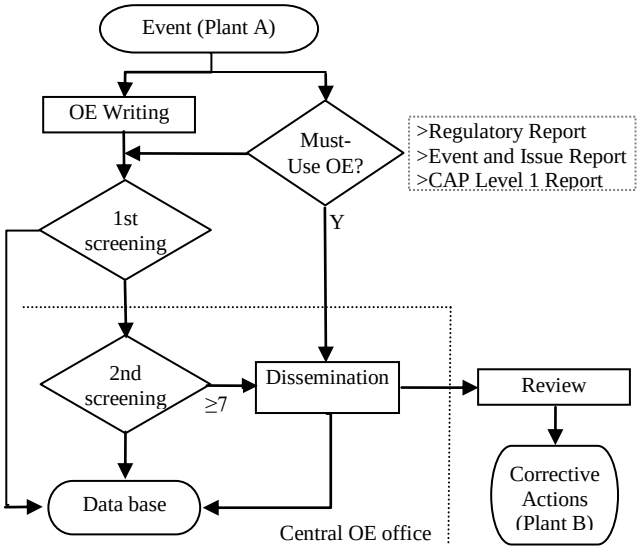


Fig. 2. The flow chart of modeled RISS [4]

Then, the end users in the other station could see the result of committee deliberation including several tags such as a graded score of importance, potential risk elements identified or committee discussions why it was upgraded or downgraded. As an illustration of screening and dissemination, the modeled process is shown as a flow chart in Fig. 2.

3. Model Validation

3.1. Validation of Applicability in the field

200 out of 531 OE reports written in 2018 (except for Must-Use OEs) were selected for the RISS validation. The meeting minutes of 2018 "Central OE Review Committee" was used as a reference record for crosscheck. Based on the results of the RISS verification, 56 OEs (28%) were received more or equal to 7 points, which means dissemination. It showed the rate of dissemination is fallen from 72 (36%) from 2018 record. And the number of cases re-classified as dissemination was increased by 21 and the number of cases re-classified as non-dissemination was decreased by 5. In addition, in the group of the re-classified as a dissemination, 14 OEs were found to have some kinds of potential risk elements. (Fig. 3, 4)

Point	No.
10	3
9	8
8	13
7	32
6	37
5	55
4	41
3	11
2	0
1	0
Sum	200

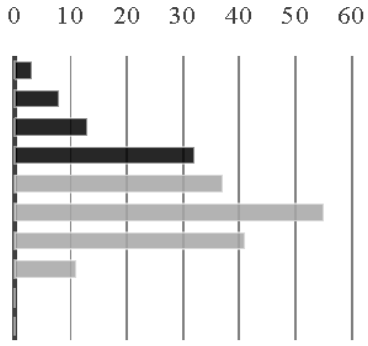
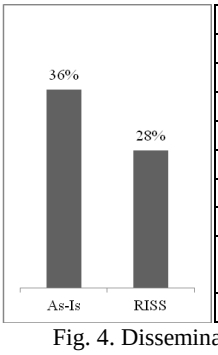


Fig. 3. Result of RISS validation.



Simple experiences to DB	7
Insufficient cause analysis	6
Frequent events to DB	2
Information already recognized	1
Other stations in service	1
Sharing in peer group	1
Self-study information	1
Program improvement proposal	1
Not applicable for the other station	1
Total	21

Fig. 4. Dissemination rate change and the reasons of re-classification for non-dissemination.

Among the potential risks identified, "New workers, vendors, suppliers, manufacturers" elements were highlighted 4 times (Table III). This risks identified convey important implications to the OE end users including station managers in charge. It will be a useful

OE report to the personnel who carries out the corrective actions.

Table III: 14 potential risk elements identified [3]

Category	Contents for plus points	Identified (times)
Field Risk	New types of Design, Equipment, Project	v
	First kind of Test, Maintenance, Operation	
	Test, Maintenance, Operation after long time	vv
	Complex design change compare to Original	v
	New workers, vendors, suppliers, manufacturers	vvvv
	Infrequent natural disaster (Tsunami, Flooding etc.)	v
Safety Culture	Lack of questioning attitude	vv
	Perform though there was uncertainty	v
	Recognized by employees but no actions	v
Others	Need for Organization-wide standard update	v
	Industrial safety	
	Radioactive safety	

3.2. Balancing out the quality & the number of reports

To maximize the effectiveness of use of operating experience, the appropriate strategy for balancing of the quality and the number of reports should be established in the each nuclear organization. For the nuclear power plant, Industry experience for last two decades showed that 9 to 12 operating experience reports per station, where about 350 employees work, have been accepted as a best practice in consideration of limited resources to maintain station's management focus on daily operation.

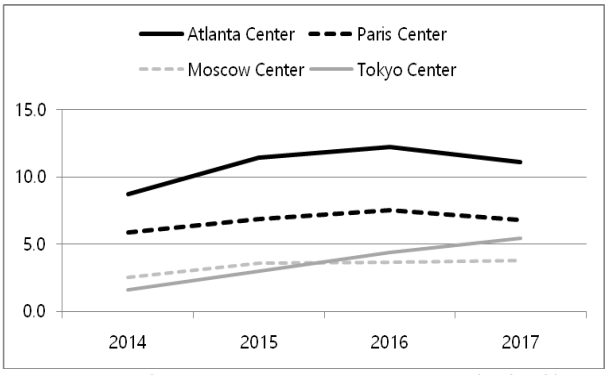


Fig. 5. OE Reporting practice per station (WANO)

From the expanded application of this RISS to full 810 OE reports in 2018, the number of reports classified to dissemination is estimated for about 230 (9.6 reports per station). This estimation shows that a RISS model fits for the industry best practice and could be a useful tool for not only managing quality of reports but also controlling of the number of OE reports to balance out the station resources.

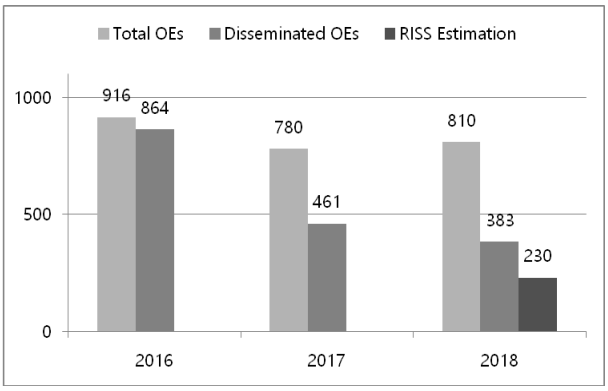


Fig. 6. Estimated number of reports for dissemination

4. Conclusions

In reality, organization's resource is limited and needs to focus on their main business, but, as all knows, nuclear safety is utmost important aspect to achieve in operation of nuclear power plant. From this study, a Risk Informed Screening System (RISS) is found to be a useful tool in screening of important operating experiences systematically. This model is useful enabling station OE coordinators of active involvement in the operating experience feedback program. The potential risk elements could be also highlighted easily with tags attached for the OE end users in the other station in order to incorporate timely and appropriate measure against the attribute of the event. By securing this kind of robust or reliable operating experience program, the nuclear organizations could reduce the recurrence of the events and enhance nuclear safety culture.

REFERENCES

[1] IAEA, "Operating Experience Feedback for Nuclear Installations", SSG-50, 2018
[2] WANO, "Guidelines for Operating Experience at Nuclear Power Plants", GL2003-01, 2003
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[4] KHNP, "Management and use of Operating experience", STP-2038, 2018