



# Lesson learned and challenge to regulate occupational exposures for industrial workers and related industries in THAILAND

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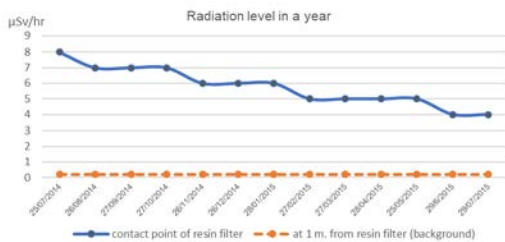
## 1. Background and Goal of the present work

In THAILAND, radioactive material and radiation activities are widely used. This paper shows the lesson learned and challenge concerned radiation exposures in industrial fields. The minimum requirements for licensee during operation of gamma irradiation facility or radiographic testing were radiological monitoring system, safety or interlock system, operation and emergency procedures, radiological protection, individual dose record for workers and radiological inspection report not incommensurate to protect the workers from occupational exposures. Furthermore, the by-product from steel mill plant such as slag and red dust are issues to consider in THAILAND. Because of radioactive contamination in scrap material bring to furnace then contaminated radiation in system and by product. The huge red dust which contaminated radiation have to manage and into the Technologically Enhanced Naturally Occurring Radioactive Material. The implementation of measures and soft power have been establishing to regulate continuously perform. The incidents from gamma irradiation facility, radiographic testing operation and contamination of the by-product from steel mill plants are presented. Whatever all of incidents are challenges related with radiation protection to people and environment.

## 2. The incidents related with occupational exposures in industries

### 2.1. Gamma irradiation facility

In early 2014, the gamma irradiation facility attempted to modify the sources rack for special test. In procedures immersed the spotlight for lighting in water pool but a little electrical arcing between the spotlight and the sources rack was happened. The special test was canceled. In the middle of the year, Radiological contamination at resin tank in water treatment system have been found by high radiation level from Radiation Safety Officer (RSO). The investigation was practice to find the reason and sampling water in the pool to check radiological contamination. The result showed contamination in water treatment system and 3 pencils were damaged. The action plan had establishment and report to regulatory body. After one year from the incident, decontamination in water system by 5 pumps supplementary with resin for circulation both water pool and circulation treatment system were operated. Until 2 months later, the water in system have been treated. As a result of the radiation exposure about 3 months for workers, the individual dose records have been examined. However, all workers do not any individual dose greater than 1 mSv/year.



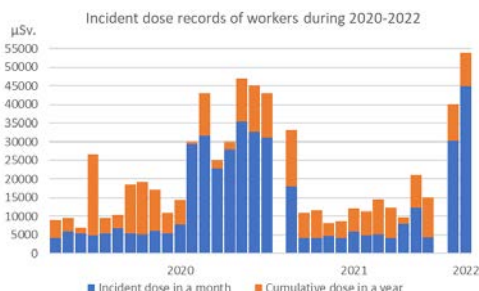
The result of radiation level after incident at water treatment system

### Improvement and measures for regulation in this case to all gamma irradiation facilities:

- Sampling the water in system to check contamination every month at the standard laboratory and report the result to regulatory body are implemented.
- Disallow any special test or modification all system related with radiation risk before regulatory body are approved.
- Every gamma irradiation facility has been Installed the radiological measurement in water treatment system.

### 2.2. Radiographic testing operation

Radiographic testing in industries have been identified highest occupational doses in Thailand. Especially from 2020 to 2022, radiography staff received whole body doses ranging from 1.0 to 53.9 mSv/year. Some worker received whole body dose as a result of an accidental overexposure compared with the 20 mSv/year. The notations from licensee were explanation about defaulted workers or limited operation areas. That means, the effective operational procedures for safety were not always practice on site radiographic testing. In addition, from verification were found unreadiness and neglect in plan and procedure operation both the workers and licensees. There are significant and challenge for regulation in occupational exposures in Thailand.



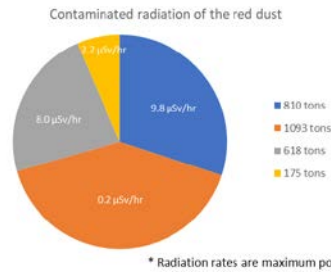
The incident whole body dose records of workers in radiographic testing

### Improvement and measures for regulation in radiographic testing operation:

- Planning and operational procedures are revised and submit to regulators for approval.
- All workers must be training and refreshing about radiation safety every year include rigorous evaluation.
- Encouragements to all workers are using direct-reading personal radiation dosimeter.
- Communication system between regulators and radiation safety officers will be implementing.
- The new technologies such as VDO-call or portable body camera are using for remote regulation.
- Follow-up the role and situation are continuous assessment of workers who received high occupational dose.
- On site an unannounced inspection will be sampling by regulators.

### 2.3. Contamination of the by-product from steel mill plants

One of important industry in Thailand is recycle scrap metal by steel mill plant. In some case by-product from the plants were contaminated radiation. In particular, the red dust out of by-product acquired contamination depending on characteristic and quantity of radioactive materials into production process. It has been being very difficult to decontamination and management especially for the huge quantity. Although amount of radiation exposure in Thailand was low level, it still affected both internal and external radiation exposure to industrial workers. All of contamination in the red dust was Cs-137 and more than 2,600 tons in total. At present, the principles of NORM management are using for contaminated radiation from the red dust. Moreover, all workers do not receive high dose rate from this situation.



Quantity and proportion of Cs-137 contamination in the red dust

### Improvement and measures for protection and management in contamination of the by-product from steel mill plants:

- Protection of radioactive materials into smelting steel process and finding a solution to manage the contaminated radiation from by-product are two steps for arrangement.
- Encouragement installs radiation monitors for detection radioactive materials that mixed in scrap materials.
- Contribution by related sectors have been supporting the research for decontamination or deal with problems.
- Agreement or protocol among stakeholders and responsible authorities are concerned.

## 3. Lesson learned and challenges analysis

All the incidents are mentioned related with occupational exposures by the industrial workers. We have been found the gaps from workers, licensee, regulation and other authorities. Awareness in risks from radiological activity and safety culture for workers and licensee are reinforcing and improving. Any testing or modifying and procedures concerned radiation safety will be approved by regulatory body. Cooperation will have operated among responsible authorities to all-encompassing processes. The oversight and obscure safety guides must be fixed and applicable operation according contexts and situations. Not only enhancement of safety regulation and strict investigation are required but also realizing dangerous from radiation by operators. Meanwhile, licensee and workers will be contest to meet requirements. In addition, criteria for national dose constraints and medical examination records should be established. However, if consideration all incidents, that can be prevent by the effective of regulation and appropriate practice. Correspondingly, the unity and commensurable standards of responsible authorities or workers will have achieved safety objective and sustainable development.

## 4. Conclusions and Acknowledgements

Lesson learned and challenge concerned with occupational exposure for industrial workers in Thailand are presented. This is roughly explained the incident events and measures to improve safety regulation. The workers in industries involving high occasion to receive radiation dose by operation. For this reason, the dynamic regulation and guidelines will be developing to support for safety from occupational exposures in radiological application.