2015 ISOE International ALARA Symposium Rio de Janeiro, Brazil, 26-28 May, 2015

Analysis on Occupational Exposure of Radiation Workers in Korea based on KISOE Database

26 May, 2015

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2. Brief Introduction of KISOE

KISOE Database Establishment and Operation of KISOE

- Korea Information System on Occupational Exposure (KISOE) in KINS
- Developed in 2002 ~ 2004 & Operated since 2005
- Collect Exposure Doses and Evaluation of Trends in Occupational Radiation Exposure to Assess Radiation Protection Programs (RPP) in Korea



This Presentation Analysis for 10 years based on KISOE database

• In this presentation, analyses on occupational exposure in Korea are summarized for 10 years from 2004 to 2013.

Korea Institute of Nuclear Safety

3. Radiation Workers in Korea (2004~2013)

- **Radiation workers works** for Licensees that are classified into 10 types.
- Top3 Nuclear energy
- Top3 **Non-Destructive Testing (NDT)**
- Top3 **General industry**
 - Education institute
 - Medical use
 - Research institute
 - **R.I.** Production and distribution
 - Public institute
 - Military activity
 - Others

Number of **Radiation Workers**

Padiation Workers (person) Has increased about annually until 2012. However, in 2013, remained steady.



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4. Annual Average Dose (2004 ~ 2013)

• Top 3 (2013) : NDT >> Nuclear ≒ Medical

- The Highest average dose is in NDT.
 - 2~4 times higher than the Total Averaged dose.
 - Increased VERY HIGH in 2012 & 2013 in NDT.
 - Paradoxically, good signal for the settlement of thorough RPP

• Trends between Nuclear Energy and Medical Use are similar.

• Nuclear energy & Medical use are Around the Total Averaged dose.

Temporal Trends on Annual Average Dose (mSv/yr)



4.1 Detailed Annual Average Dose (2008~2013)

Higher than 1 mSv/yr during (2008 ~ 2013)

- Nuclear Energy : below 1 mSv/y, but not CANDU in 2009 ~ 2010
 - (2009 ~ 2010) CANDU Rx. Pressure pipes replacement in Wolsong Unit 1.
 - (Feb. 2015) License Renewal of Wolsong Unit 1 was decided.
- Nuclear Medicine : the highest dose in Medical Use area.
 - NDT : the highest dose in Industrial Use area
- RI. Production : the 2nd highest dose in Industrial Use area



4.2 Trends on NDT by using Moving Average

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- Annual Average Dose for NDT (Radiographic Testing)
 - increased very high (2012~2013)
 - Additional analyses by using Moving Averages which are useful to identify overall trends without interruption of data fluctuations.
 - Moving average trends of monthly doses
 - In the end of 2011, trends began to increase until Mid-2013.
 - However, since Mid-2013, trends began to decrease.
 - Numbers of monthly NDT workers began to increase in the end of 2011 until 2013.

4.3 Effects of thorough Compliances of RPP

Over-exposure and Death of 3 NDT workers (Mid 2011 ~ 2012)

• The accidents were REPORTED by the public broadcastings and many NDT Workers began to be REALLY aware of radiation risks.

Strong enforcements to enhance RPP of NDT by regulatory body

 Thorough compliances of Radiation protection programs (RPP), Improvement of RT room where NDT activities are done

Increasing and Decreasing of Doses

- Began to increase high, as RPP began to be applied thoroughly.
- Began to decrease slightly, as RPP were settled down and safety facilities such as RT rooms were enhanced.





5. Trends on Collective Dose (2004 ~ 2013)

- Top 3 (2013) (NDT > Nuclear Energy > Medical Use) constitute the most part of collective dose (about ~97%).
 - Many Workers are in these licensees (17%, 35% & 11%, respectively).
 - Annual average doses (3.77, 0.79 & 0.73 mSv/yr, respectively) are Higher than other types of licensees.



Collective doses of other types of licensees are very small (below 10%) due to the low annual average doses (<0.4mSv), although workers are not a few (~40%).

5.1 Detailed Collective Dose (2008 ~ 2013)

• Top 3 (NDT > PWR > Nuclear Medicine) collective doses in 2013

- NDT workers are FEWER than PWR, but average dose 4 TIMES HIGHER.
- Workers in Nuclear medicine receive a rather high level of average dose.

• Collective dose in PWR decreased till 2010 but increased since 2011

- Due to an increase of workers in new PWRs that began operation.
- Due to an increase of job tasks after Fukushima accident



6. Overall Analysis on radiation protection program

• Numbers of licensees & radiation workers have increased.

- Collective doses have been kept at the same level until 2011.
- Average doses have continuously gradually decreased until 2011.

• In 2012 & 2013, doses increased very high due to NDT

- By the strong enforcements and thorough RPP, trends seem to begin to decrease slightly since Mid-2013 in NDT areas.
- These trends imply the continuous improvement of radiation protection programs (RPP) in Korea.



7. Conclusion

- Analyses on Occupational Exposure of Radiation Workers in Republic of Korea were performed.
 - By using KISOE database that collects dose records of radiation workers in various fields in Republic of Korea.
- Based on the analyses for (2004~2013), it is implied that radiation protection programs have been continuously improved in Korea.
 - Number of radiation workers has increased about 5% annually.
 - Nonetheless, annual average dose has continuously gradually decreased and annual collective doses been kept at the same level.
 - In 2012 & 2013, by strong application of RPP in NDT areas, moving average analyses indicate a good signal for the settlement of the thorough radiation safety management in NDT areas.

• It is necessary to continue to improve KISOE system,

- By collecting more detailed data about jobs of radiation workers.
- By developing more useful method for data analysis.

Thank You.

