GOOD PRACTICES Extracted from Peer Reviews

in

FNCA Safety Management Systems (SMS) for Nuclear Facilities Project

Preamble

In the FNCA Safety Management Systems (SMS) for Nuclear Facilities Project, peer reviews on safety management systems for research reactors were held in Indonesia (2010), Malaysia (2011), Korea (2012), Bangladesh (2014), Vietnam (2015), and Thailand (2016).

The objectives of peer review are as follows;

- Friends helping each other with the common goal of improving safety and
- Systematic examination of internal safety systems and their performance

The peer review process aids the host organization by making recommendations for improvements and equally importantly helps the other participants by identifying good practices that can be shared amongst the member countries.

For now, total 117 good practices were found in the peer review, and they were listed as follows. The sections and items are based on peer review tool.

In listing, proper names of organizations were reworded to common name expressing the role of the organization.

The release of these good practices has significance in showing direction of safety management for nuclear facilities. In addition, it is expected that the release contributes to discussion on the way of rational and efficient regulation.

List of the Facilities and Organizations which received FNCA Peer Review

Year	Country	Facility	Organization
2010	Indonesia	RSG-GAS reactor	BATAN
2011	Malaysia	Reactor TRIGA PUSPATI (RTP)	Nuclear Malaysia
2012	Korea	HANARO reactor	KAERI
2014	Bangladesh	・BAEC TRIGA Research Reactor (BTRR) ・3 MV accelerator ・Radio-isotope production facilities ・Co-60 gamma irradiation facilities ・Health Physics and Radioactive Waste Management Unit (HPRWMU) ・Secondary Standard Dosimetry Laboratory (SSDL) ・Whole Body Monitor	BAEC
2015	Vietnam	・DNRR ・Radio-isotope production facilities ・Radioactive Waste Management Section	Dalat Nuclear Research Institute (DNRI)/ VINATOM
2016	Thailand	TRR-1/M1	TINT

1 MANAGEMENT SYSTEM

Items	Good Practices	Country
1.1 Integration	The Reactor Organisation structure helps integration.	Indonesia
	The QA section and ISO 9001 certification is good for integrating all the systems.	Indonesia
	There are Good evidences of Partial Integration such as written instructions and procedures review and approved as part of the quality assurance program including ISO9001 and OHSAS 18001, which are used to assure the safety of operation of the reactor.	Thailand
	The commitment to meet the new ISO 9001:2015 standard is recognised as a good practice.	Thailand
1.2 General	The Reactor has good lines of communication and they work effectively.	Indonesia
	There are good lines of communication with the Regulator Authority that work quickly.	Indonesia
	An emergency exercise on communications has been conducted recently.	Malaysia
	Emergency number (1999) is set. and accidnets can be reported quickly and properly.	Malaysia
	The emergency centre has pre-written lists of actions/calls for each type of emergency.	Malaysia
	The Reactor staff in the Control Room have good authority i.e. are empowered to immediately sound the emergency siren and make site broadcasts. : In case of emergency, individual workers perform their jobs with approved procedure. They announce the emergency information according to the emergency plan implementation procedure.	Korea
	The best way to get the efficient and extended output from a system/equipment by following its manufacturer's instruction during operation. Manufacturers/vendors instructions are properly followed before routine operation of reactor and its associated equipment's during the maintenance. The peer review recognised the established good practice of following manufacturer's instructions as	Bangladesh

Items	Good Practices	Country
	part of routine operation and maintenance of equipment.	
	Planning is the most important thing to implement any work or idea. Center for Research Reactor (CRR) and reactor user group periodically make a 5 year strategic plan and the plan is submitted to the BAEC and relevant Ministry. Monthly and annual activities of CRR routinely sent to the BAEC, Regulatory Authority and Ministry of Science and Technology (MOST). The development and implementation of a 5 year strategic plan for the Reactor Organization along with an annual operation and maintenance plan was recognised as a good practice.	Bangladesh
	The arrangements with external authorities for safety opreration of Research Reactor appear very strong, e.g. quarterly inspections by local fire brigade, priority arrangements with local electricity and water organisations.	Vietnam
	Whenever an abnormal condition happened, the delegation of authority to shut-down the reactor to the lowest level is a sign of a strong safety culture.	Vietnam
1.3 Safety Culture	The Reactor showed very good safety culture by having this peer review.	Indonesia
	Safety culture is in every training course.	Indonesia
	The daily meeting with all operational and safety groups involved is carried out at reactor.	Indonesia
	The regular division meetings and the Internal Safety Review Committees are good practice to enhance safety culture.	Malaysia
	The reviews and walk downs are very good to promote safety culture. : More than 4 times a year, senior staffs check the HANARO and other facilities, and try to find some unsafe situations.	Korea

Items	Good Practices	Country
	The regulatory authority imposed different laws to ensure the safety and security of the reactor. The regulatory authority provides the license to the facility and personnel after proper investigations/examination. Licensed personnel also periodically renew their license from the regulatory authority. CRR and other institutes follow safety documents; organize periodic training and survey on the attitude of safety culture by regulatory authority and manager group to enhance the operational safety of the reactor. The peer review felt that there were a very open culture within the Reactor Organization, the Research Institute and the Regulatory Authority, with strong leadership for safety and a commitment to a strong safety culture.	Bangladesh
1.4 Grading	In approvals by the Safety Review Committee, only relevant members review which is quicker and more effective.	Indonesia
	There is some grading by following the Department of Occupational Safety and Health (DOSH) guidelines of assessing as low, medium and high risks.	Malaysia
	The process of grading the procedures (A, B, C) and then qualifying the workers as A, B, C allowed to perform those tasks is simple to understand and good. : Every procedures has its grade (A: High level skill, B: Medium level skill, C: Low level skill). And every year all workers have to requalify their level.	Korea
	Reactor Management Section advised that Working Instructions will be modified to integrate ISO9001 and OHSAS 18001 requirements by mid-2017. This integration is considered a good practice.	Thailand
1.5 Documentation	The Reactor has ISO 9001:2000 certification already and is seeking ISO 9001:2008 certification.	Indonesia
	The practice where the operators and their supervisors write instructions is good practice.	Malaysia
	The change to the new document format where steps and safety requirements are given in a table format	Malaysia

Items	Good Practices	Country
	makes them easy to read and is good practice.	
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2 MANAGEMENT RESPONSIBILITY

Items	Good practices	Country
2.1 Commitment	Senior people including the Director of Reactor and Deputy Chairman of BATAN visited our FNCA Workshop/Peer Review.	Indonesia
	For several positions of management, the safety responsibilities are included in the terms of reference (job description).	Malaysia
	The interview with the Director each year for all staff is very good in demonstrating commitment : In the Division, the Director has a regular meeting with his employees; 1) There are general meetings where all the division staff are asked to attend, 2) There are personal interviews with the director once a year, the director meets all staff of HANARO, He/She collect the staff's opinions for the safety.	Korea
2.2 Stakeholders	There are good communication channels with the Regulatory Authority.	Indonesia
	The Regulatory Authority staff attend reactor training courses.	Indonesia
	Customers come to the daily meetings at the Reactor.	Indonesia
2.3 Policies	Policy documents are shown prominently.	Malaysia
2.4 Planning	There is a job group meeting before the job (probably similar to a "toolbox meeting').	Indonesia
	There are Internal Safety Review Committees' days which can help inform staff of safety initiatives	Malaysia
2.5 Responsibility and Authority	Several roles have safety responsibilities defined in their terms of reference (job description) e.g. Area Supervisor.	Malaysia
	Responsibilities are given to staff both in the procedures and to the team which is good because it makes the workers understand they are important to safety. : In the technical specification (TS), QA manual (QAM) and SAR, the President of KAERI is responsible for the safe operation of HANARO, and the rights and responsibilities of the authorized	Korea

Items	Good practices	Country
	managers are described in the procedures.	

3 RESOURCE MANAGEMENT

Items	Good Practices	Country
3.1 Human Resources	Operators are drawn from facility staff and have maintenance experience.	Indonesia
	Management are able to evaluate attitudes before operator are engaged.	Indonesia
	There is a coaching system for back up of key personnel.	Indonesia
	Training and qualification requirements are good.	Indonesia
	There is a plan to develop a nuclear engineering course in conjunction with a university.	Malaysia
	There is a well developed formal training course for reactor operators; ・ For reactor operators, trainees are trained for at least 6 months covering Reactor Physics, Reactor Engineering, Radiation Protection, Statutory Bases, Facility Design and Administrative Procedures. ・ For Radiation protection, radiation workers must attend Radiation Protection Course for Workers.	Malaysia
	The definition of competency requirements for each role and the continuous review of compliance with the required competencies is a good practice.	Thailand
	The 2 year refresher training in Radiation Protection for reactor staff is a good practice. The accreditation of the Head of Reactor Management Section as a Radiation Safety Officer is also good in supporting operational radiation protection.	Thailand
3.2 Infrastructure	The emergency exit routes are clearly shown with tiled yellow arrows on the floor.	Malaysia
	The facility has an underwater camera to help with inspections and maintenance.	Malaysia

Items	Good Practices	Country
	The facility has good power backup with diesels and a UPS.	Malaysia
	Having all procedures and drawings available in the Control Room is good. : In the control room, reactor operators easily access the all procedures and drawings (paper copy). Also, all procedures and drawing are stored in the data storage server, so, they can access easily.	Korea
	The system for entering the Reactor Hall that requires a fingerprint (physical security) and TLD (safety) is very good. : All staff who want to enter the reactor hall has to send work application to the reactor manager and has to register their fingerprint. So, only authorized person could enter the reactor hall. And he/she has to have a TLD and EPD (electric pocket dosimeter) for their safety.	Korea
	The policy to allow visitors to enter the Reactor Hall and to go to the pool top area is very open and promotes trust. : Allowed visitors can go to the reactor hall or pool top area with the HANARO staff.	Korea

4 IMPLEMENTATION OF GENERIC PROCESSES

Items	Good Practices	Country
4.1 Developing Processes and Process Management	A knowledge management system (web based) is being introduced with the intention that it eventually includes all documents.	Malaysia
	These processes are mature. : When the staff revise the safety documents and operation procedures, they use the feedback of operation experiences, quality assurance audit and periodic inspection by regulatory body.	Korea
	The use of new technologies such as GoPro cameras to video reactor based tasks and subsequent recording in the knowledge management system is considered a good practice.	Thailand
4.2 Generic Management System Processes 4.2.1 Document Control	All activities are covered in quality system.	Indonesia
	A new format for work instructions with steps and safety requirements in table layout is being introduced.	Malaysia
	There are regular reviews of the documents. : Every 3 year, all procedures are reevaluated. If there are some fault or difference, the document will be revised.	Korea
	The documentation control system such as restrictions on user activities (eg. Read only, editing) was very good and appeared to be very useable.	Thailand
4.2.2 Safety Records	Non	
4.2.3 Communication	The communication processes including meetings are good.	Indonesia
	There is training on communication skills.	Indonesia
	Information e.g. minutes is recorded electronically which makes it very accessible. : If someone want to send the request to the reactor manager, they easily use the e-mail or short message service (SMS).	Korea

Items	Good Practices	Country
	The working staffs are free to present their ideas and raise issues to division/section head in the daily meeting. Weekly meeting is conducted with different divisional/sectional heads with Director, CRR, can present their ideas and raise issues to Director by face-to-face meeting or e-mail/phone. Senior management (DG, AERE and BAEC) instruct the policy to the reactor manager or working staff and share information and feedbacks. Strong communication system is maintained among different divisions/institutes during normal as well as for emergency cases. There was strong evidence of clear and open communication through all levels of the organisation.	Bangladesh
	The Dalat Nuclear Research Institute (Reactor Operating Organization) keeps good communication with working staff, for example, the working staff of the Reactor Operating Organization are free to present their ideas and raise issues to division/section head; the President of Vietnam Atomic Energy Institute (VINATOM) from Hanoi has an annual conference with all staffs of the Reactor Operating Organization in Dalat City; the introduction of the use of on-line meetings, etc.	Vietnam
4.2.4 Management of Organizational Change	Succession planning is being introduced which is good practice.	Malaysia
	The organization established the Quality Management Division to accelerate the management activities for the institutes/facilities. Quality Management Division of BAEC is preparing central documents now. It is expected that after completion of the central documents, they will work for different Institutes and reactor for enhancing integrated quality management system. The establishment of the Quality Management Division was identified as a Good practice which will support the development of an integrated management system. QMD focus should include greater support to the Reactor.	Bangladesh
	The regulatory body is separated from Bangladesh Atomic Energy Commission to strengthen safety related activities of the nuclear facility and for future Nuclear Power Programme.	Bangladesh

Items	Good Practices	Country
	The establishment of an independent regulatory body is recognised as a good practice.	

5 PERFORMANCE OF SPECIFIC PROCESSES

Items	Good Practices	Country
5.1 Operation and Maintenance 5.1.1 Planning	There is good meeting planning.	Indonesia
	All functions plus Safety Division are under one Director which promotes good planning.	Indonesia
	There is good operations and maintenance planning and good communication between these groups : Maintenance schedule is sent to operation group for review at the end of each cycle operation. Both groups hold a meeting with user group on activities before starting up the reactor every operation cycle. All groups could share all the information about reactor. All maintenance works are carried out as per issued work request form and should get SRO's permission beforehand.	Korea
	BTRR has periodic maintenance and surveillance inspection programme. The periodic maintenance programme includes monthly, quarterly, semiannually and annually. BTRR operating procedures include its own inspection and testing procedures, which are periodic inspection procedure, surveillance inspection procedure, special testing procedure and IAEA guidelines. Plant surveillance (e.g. plant monitoring) and incorporation into PMP schedule is a good initiative.	Bangladesh
5.1.2 Management of Reactor Operation and Maintenance	The planning process for operation and maintenance of reactor technological systems is very robust and subject to appropriate its review and modification.	Vietnam
5.1.3 Monitoring, Measurement	Analysis of maintenance records once a month.	Indonesia

Items	Good Practices	Country
and Analysis of Data		
5.1.4 Feedback to the Planning	There is a Reactor Forum of the three reactors every 3-6 months.	Indonesia
5.2 Radiation Protection 5.2.1 Planning	There are good processes for setting and monitoring radiation doses for workers and for jobs. : The radiation protection plan in the safety analysis report (SAR) is submitted to the government to get an authorization for use of radioactive materials and operation of radiation facilities in KAERI. A program necessary for radiation protection such as the personal monitoring, the workplace monitoring, the environmental radiation monitoring, the calibration of radiation measuring devices and the radiation worker education and training etc. is explicitly described in the SAR. It is a mandatory program by the Law, and also annually reviewed and supervised by the regulatory body. KAERI has a program for radiation protection and a proper constraint of dose to workers which is lower than a dose limit and practices for ALARA programs.	Korea
5.2.2 ALARA	The use of mock ups to plan big jobs is good. : Mock up or exercise of radiation work planned.	Korea
	SSDL is serving efficiently to calibrate the survey meters, X-ray mechanics and other radiation measuring equipments of different users throughout the country. WBM facility is newly installed at AERE for monitoring internal radiation of the radiation workers. The SSDL and WBM facilities were considered to be of high quality.	Bangladesh
5.2.3 Management of Radiation	The use of electronic portable dosimeters and recording of doses electronically is good. : When the workers enter the reactor hall, they have to bring their TLD and EPD (electric pocket dosimeter). When they go out of reactor hall, their dose records in the EPD will be sent the radiation	Korea

Items	Good Practices	Country
Protection	protection team.	
5.2.4 Handling of Radioactive Waste	HEPA filter and charcoal filter nuclear grade are well managed.	Indonesia
	The practice of limiting the materials into the Reactor Hall is a good idea to minimize waste. : When some instrument or materials will be entered the reactor hall, workers remove the packing materials such as wooden box, paper box, vinyl cover.	Korea
5.2.5 Monitoring, Measurement, and Analysis of Data	Continual improvement using PDCA cycle is effectively used in the area of radiation protection.	Vietnam
5.2.6 Feedback to the Planning	Radiation surveys are updated based on experience.	Malaysia
5.3 Emergency Preparedness 5.3.1 Planning	Good emergency practices are in place.	Indonesia
	There are yearly exercises, drills e.g. on accident, terrorist activity and senior staff have attended overseas training.	Indonesia
	There is a good security fence and security system.	Indonesia
	There is a good hierarchical system of response.	Indonesia
	Basic fire fighting training is given to all staff.	Malaysia
	There is an on-site paramedic response unit involved in the emergency response.	Malaysia
	There is a backup alternate emergency centre and this is tested.	Malaysia
	The use of mobile phone text messages following emergencies should provide very quick communication.	Korea

Items	Good Practices	Country
	: Emergency situation is informed by siren and broadcasting system to the on-site personnel and by the text message of mobile phone to the on and off – site emergency workers.	
	There is good planning of emergency exercises. : The emergency plan was developed by assuming the maximum credible accident in HANARO reactor and the plan is maintained by the Nuclear Emergency Preparedness Team under Nuclear safety management Division. Every year internal and external contacts are checked, revised and published as an emergency pocket book.	Korea
5.3.2 Emergency Exercises and Drills	Both simple evacuation drills and more complex emergency exercises are conducted.	Malaysia
5.3.3 Monitoring and Measurement	Non	
5.3.4 Feedback	Continual improvement using PDCA cycle is effectively used in the area of emergency preparedness.	Vietnam
	The gathering of learning opportunities from emergency exercises and implementation into the emergency plans and procedures is considered a good practice.	Thailand
5.4 Other Key Safety Issues 5.4.1 Criticality and Shielding	There has been a workshop recently on shielding calculations.	Malaysia
5.4.2 Operating	Comprehensive reports are prepared following important events e.g. trips.	Korea

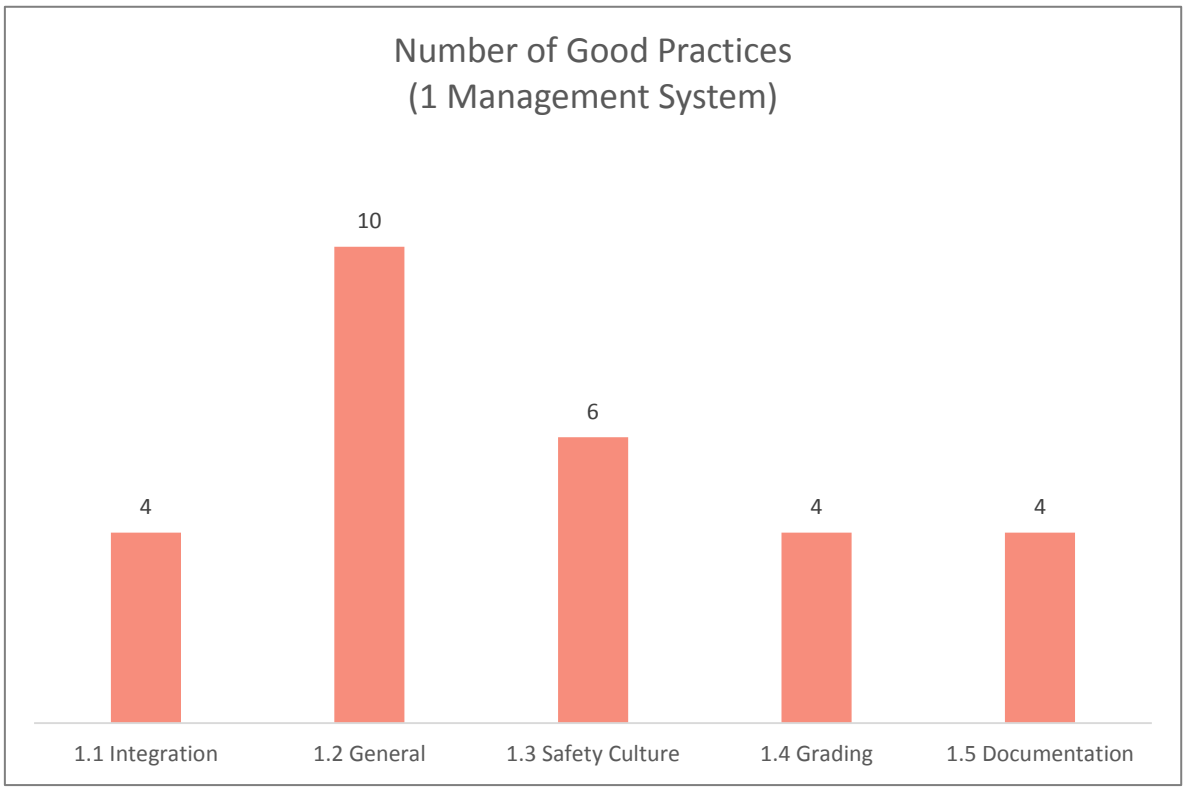
Items	Good Practices	Country
Experience Feedback	: For any abnormal events, an event report is written and reported to the operation group manager and the division director. These are educated to all staffs according to the Experience Feedback Procedure.	
	Including time in operator refresher training for learning about events in other reactors is good. : When there is a visitor from other reactors or staff come back from a business trip to other facilities, he/she is usually asked to make a seminar on their facility or on what he/she has seen and heard. A half day from the refresher training for operators is reserved for studying events in other reactors. Sometimes, operation shifts visit other power plants and have a chance to see what is going on in other power plants.	Korea
5.4.3 Aging Management	There is a Masters student who is investigating the seismic capability of the reactor.	Malaysia
	The facility is getting information from other reactors.	Malaysia
	The BTRR has been operating for about 30 years. To increase lifetime of the reactor aging management programme is undertaken and some testing related aging management was performed. Several ADP and IAEA TC projects have been successfully completed to minimize aging effects. The example of the identification of the root cause for the radial beam tube leakage of the reactor and its subsequent rectification was evidence of a strong internal capability. There are plans to increasing aging management activities by implementing inspection activities of reactor tank, leakage beam tube using Ultrasonic Testing Equipment (UTE). A plan has to be established and implemented systematic ageing management programme based on IAEA safety standards. The establishment of an aging management programme was identified as a good practice.	Bangladesh
	The initiation of an IAEA TC relating to ageing management and remaining life studies is commended.	Thailand

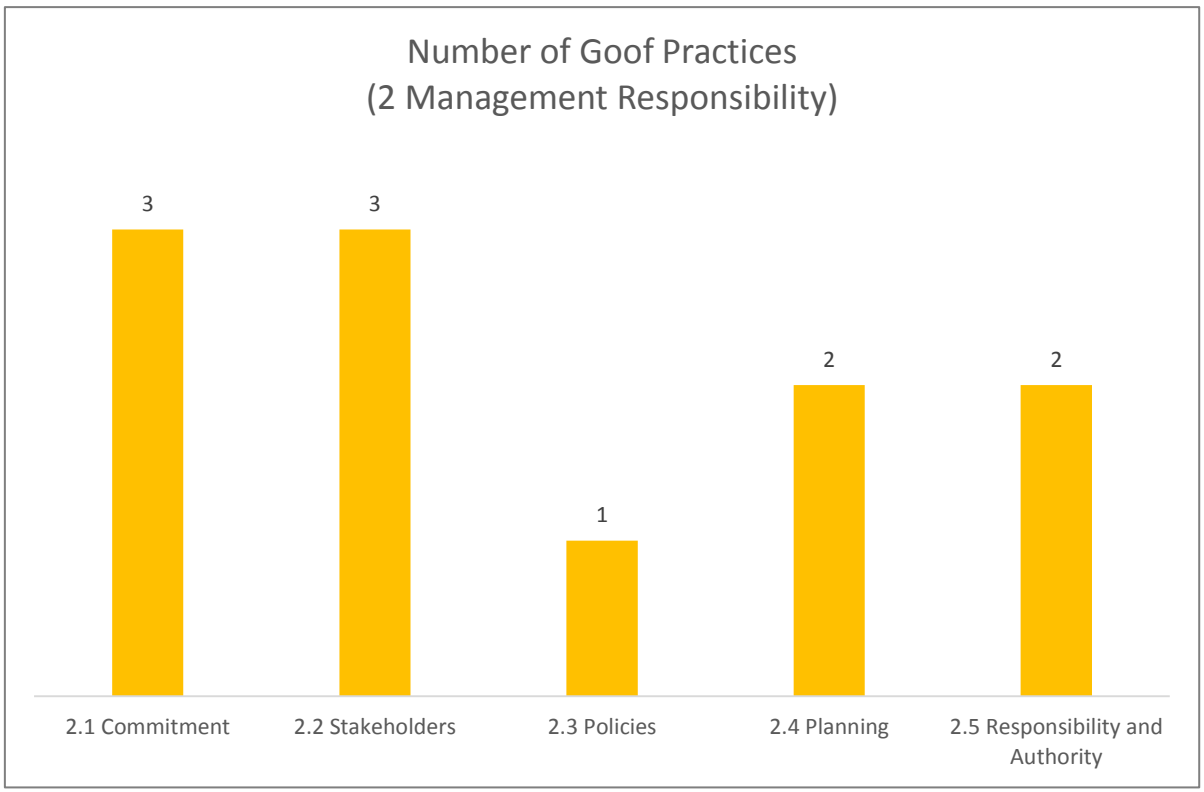
6 MEASUREMENT, ASSESSMENT, AND IMPROVEMENT

Items	Good Practices	Country
6.1 General	The Internal Safety Review Committees are a good way of improving safety.	Malaysia
	The group brainstorming sessions are good for morale and team building which will improve performance over time. : More than 2 times a year, all staffs have a group brainstorming. They send collecting ideas to the reactor manager.	Korea
	The Nuclear Training Centre of the Reactor Organization which also now has a Simulator is excellent in helping learning and improvement. : Simulators are used for refresher training for operators and for training new reactor operators.	Korea
6.2 Monitoring	The set of Key Performance Indicators (KPIs) for the reactor are very practical and useful. : 12 Safety performance indicators (SPI) are collected, and informed at the KAERI's Homepage.	Korea
6.3 Self Assessment	The Reactor has done this self assessment .	Indonesia
	The Reactor will tell staff of the results of the self assessment and peer review.	Indonesia
	The Reactor also do a self assessment on safety culture.	Indonesia
	There are inter-division safety competitions to promote safety.	Malaysia
	There are good processes for assessment. : There is a weekly group manager meeting in HANARO Division and the Division General meeting. The safety analysis group performs survey and assessment of the safety culture attitude for all staffs every two year.	Korea
6.4 Independent Assessment	There have been a number of missions to the reactor.	Indonesia
	This FNCA-SMS peer review is an independent assessment.	Indonesia
	There are a number of IAEA missions to the facility.	Malaysia

Items	Good Practices	Country
	Information ofthis FNCA SMS peer review is utilized to find a good means of independent review.	Malaysia
	There is an audit subcommittee of the main Internal Safety Review Committees.	Malaysia
6.5 SMS Review	Non	
6.6 Non-conformance, Corrective and Preventive Actions	It is apparent through discussions that the Reactor Organization are committed to and have achieved a No-Blame culture.	Bangladesh
6.7 Improvement	Non	

Attachment: Graphs


Number of Good Practices
(1 Management System)
4
10
6
4
4
1.1 Integration
1.2 General
1.3 Safety Culture
1.4 Grading
1.5 Documentation


Number of Goof Practices
(2 Management Responsibility)
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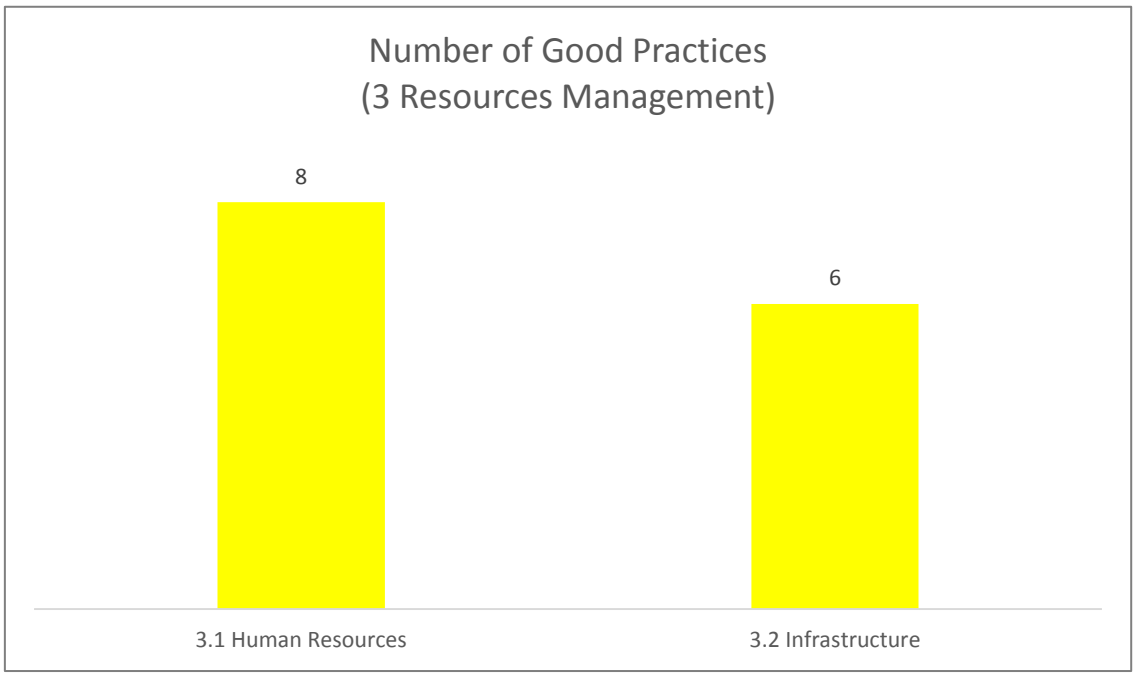
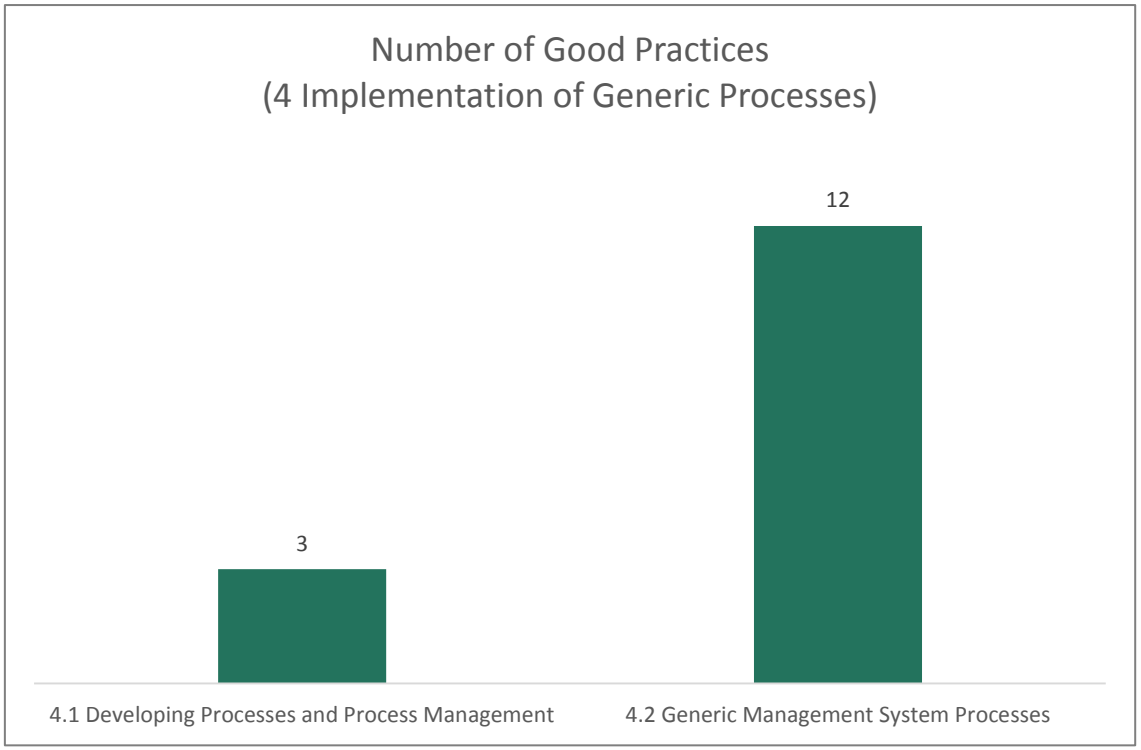
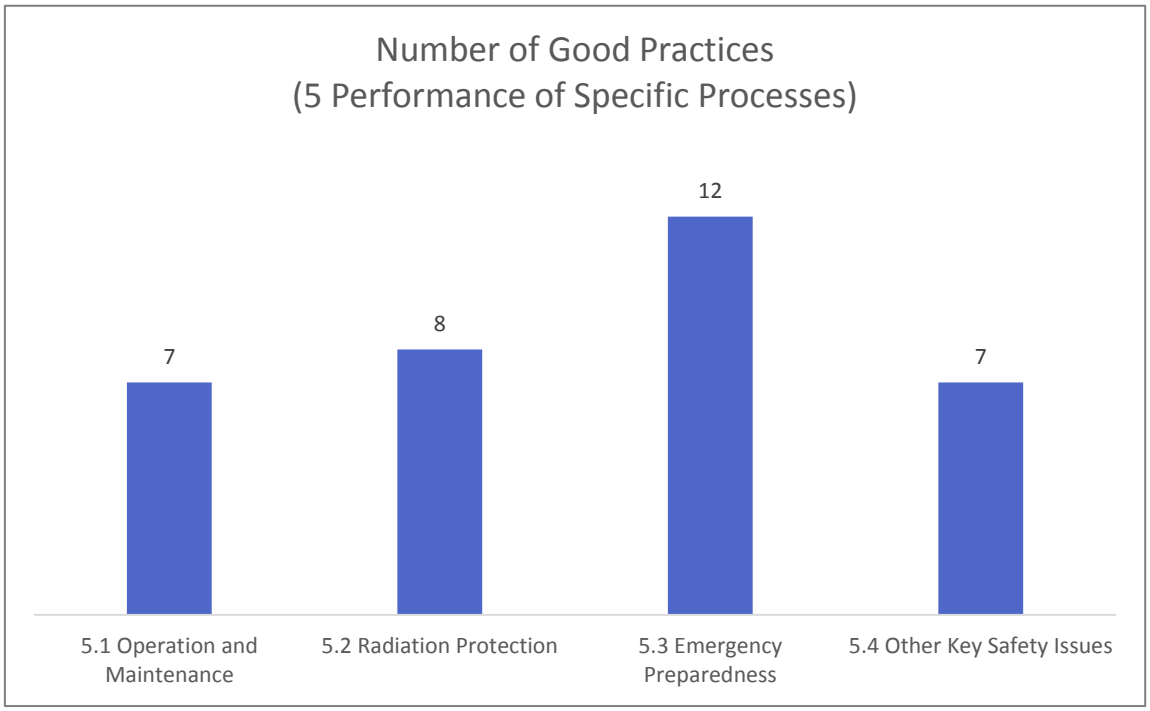
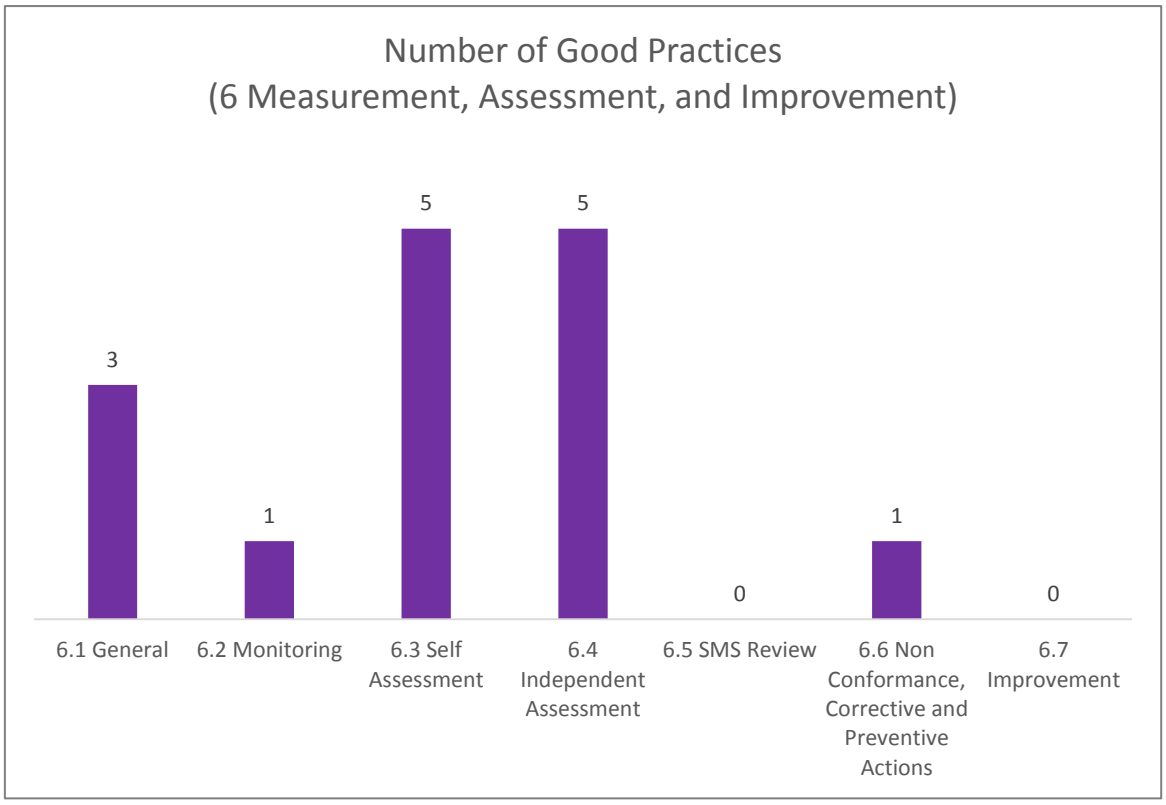
3
1
2
2
2.1 Commitment
2.2 Stakeholders
2.3 Policies
2.4 Planning
2.5 Responsibility and Authority


Number of Good Practices
(3 Resources Management)
8
6
3.1 Human Resources
3.2 Infrastructure


Number of Good Practices
(4 Implementation of Generic Processes)
12
3
4.1 Developing Processes and Process Management
4.2 Generic Management System Processes


Number of Good Practices
(5 Performance of Specific Processes)
7
8
12
7
5.1 Operation and Maintenance
5.2 Radiation Protection
5.3 Emergency Preparedness
5.4 Other Key Safety Issues


Number of Good Practices
(6 Measurement, Assessment, and Improvement)
3
1
5
5
0
1
0
6.1 General
6.2 Monitoring
6.3 Self Assessment
6.4 Independent Assessment
6.5 SMS Review
6.6 Non Conformance, Corrective and Preventive Actions
6.7 Improvement