Management of the ERML Under Normal and Extreme Circumstances

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Introduction

The International Atomic Energy Agency (IAEA) Department of Safeguards (SG) has numerous items of equipment rotating between its Headquarters (HQ) in Austria and the field (nuclear and other types safeguarded facilities around the world). The Agency's equipment returning from the field is checked and decontaminated (if necessary) before leaving the nuclear facilities, but is also monitored when returned to the Agency HQ in Vienna, before it can be re-integrated in the pool of SG equipment.

The Equipment Radiation Monitoring Laboratory (ERML) performs mandatory radiation monitoring of all items returned from the field, in order to ensure full compliance with the release limits for surface contamination, applicable in Austria (0.1 Bq/cm^2 for alpha-emitting nuclides and 1.0 Bq/cm^2 for beta emitters). This is essential to prevent any cross-contamination issues between facilities and states. This is why the contamination check applies not only to SG Equipment and system components but also to mechanical tools, toolboxes, transport cases and personal belongings such as reading glasses, writing pads, backpacks, etc.

The ERML measures roughly 30,000 items a year, both inventoried and non-inventoried, for surface contamination. This includes 10,000 metal passive seals (TID seals), which are measured for contamination before they are verified.

The ERML is an ISO 17025:2017 accredited laboratory (Akkreditierung Austria ID 0417) which performs direct and indirect surface contamination measurements. The laboratory interfaces directly with customers by either receiving deliveries from the field or by staff delivering the equipment to the laboratory in person. Additional services are available at the laboratory, which include from sealed-source leakage testing and environmental samples container monitoring.

All incoming items are scanned via direct, or indirect where applicable, surface contamination monitors. If the equipment does not exceed the authorized release limits, the equipment is returned to the equipment pool, or to its owner in the case of personal belongings. Should the item show contamination level, all efforts are taken to decontaminate it. All of the contamination monitoring measurements are recorded in the asset management database for SG: SEQUOIA.

During the COVID-19 lockdowns in Austria the IAEA Department of Safeguards continued to fulfill its obligations to member states. The Safeguards staff never stopped traveling to conduct verification activities and the ERML provided uninterrupted services to the Department. This was accomplished by adopting stringent measures in matter of health & safety such as disinfection, the use of proper Personal Protective Equipment (PPE), dividers, rotating schedules, and curb-site equipment pick-up.

This exceptional mode of operation also provided lessons learned for possible future similar situation should further lockdown or or long-lasting emergency occur again.

ERML Operation under Standard Operating Conditions

The ERML is located in the Vienna International Center (VIC), at the International Atomic Energy Agency main headquarters in Vienna, Austria. The ERML's primary purpose is to monitor equipment that is returned from the field by Agency inspectors or other personnel for surface contamination. When a staff member takes equipment out of a facility, the staff member is required to check these items for contamination; many facilities also measure equipment leaving the facility for contamination to ensure that they do not violate local laws regarding the release of radioactive material. Because of the potential disparity in local requirements, it is essential the Agency can guarantee a common standard for all its equipment and ensure Member states and operators that their equipment is free of contamination before entering a facility: cross contamination risks have to be eliminated. No contaminated equipment can be redistributed, so as to minimize the risk of exposure to members of the public, Operators, or SG staff.

The ERML scans and measures all items delivered from the field for contamination before the items are returned to the proper custodian, to be used in the field again. By using ISO 17025[1] and ISO 7503[2] accredited methods, the laboratory can assure both its customers and the public that equipment leaving the laboratory has been properly, effectively, and safely measured and returned. The accredited methods used are: surface area contamination using portable monitors (Figure 1) to measure most items via direct surface area contamination measurement methods put forth in ISO7503-1(2016)[2]; and indirect surface contamination measurement using area wipe samples with a Low-Level Alpha-Beta counter put forth in ISO7503-2(2016)[3]. Additionally, the ERML performs nuclide identification using gamma spectrometry with a High Purity Germanium (HPGe) detector and gross total beta/gamma counting using a Large Article Monitor (LAM). In accordance with the IAEA's safeguards mission and those set forth in ISO 17025, the ERML practices impartiality regarding all items that are delivered, regardless of facility of origin or personnel delivering.

It is important to mention that all passive seals returned to HQ are also measured for contamination at the ERML before assessment for seals integrity verification. This is important as passive seals may be in the field for many years in a various environmental condition (high radiation containment, spent fuel ponds, SF storage containers, etc.), and can easily become contaminated.

Figure 1 LB124 and LB 770 Monitors

Every year the ERML measures around 30,000 items, broken down into around 15,000 seals, 10,000 items inventoried by Safeguards individually, and 5,000 non-inventoried items; this data is represented by Figure 2.

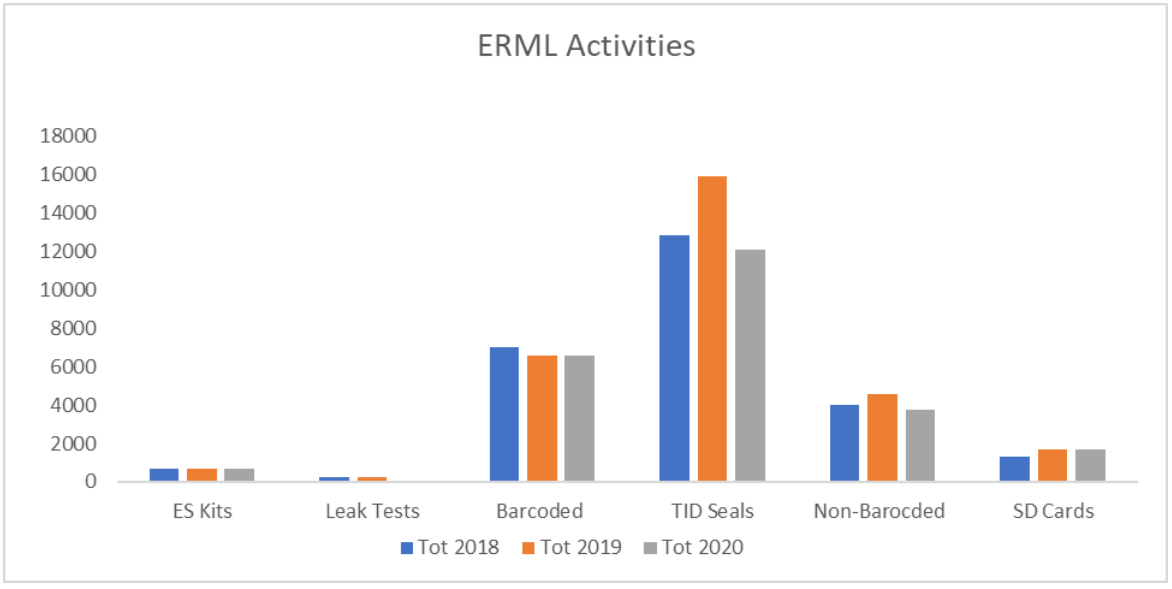

Figure 2: ERML Contamination Monitoring Activities

The ERML team also provides the practical sessions of Radiation Safety training for occupationally exposed (OEW) Department of Safeguards staff. The training includes practical instruction on the use of surface contamination monitors, environmental sample kits, and survey meters such as the RadEye and HM5 (Figure 2), as well as the regulatory limits for transporting potentially radioactive equipment or samples by hand. During the trainings, the proper use for a variety of PPE is also demonstrated. The training is mandatory for all OEW, which represents 60% of SG staff.

Figure 2 RadEyeB20 and HM5

Challenges posed by COVID-19 for an international organization

The COVID-19 pandemic posed challenges to all essential services throughout the world, with private and national bodies having to determine a way to provide services while also making sure that their the staff and counterparts would be performing these duties as safe as possible despite rapidly changing information, restrictions, and needs.

The scope of these difficulties increases by an order of magnitude when working in an international organization, with personnel travelling all throughout the world and requiring uninterrupted service. The International Atomic Energy Agency, as part of its agreement with its member states, was still required to meet the inspection needs of facilities all throughout the world. The Agency HQ, being situated in Austria, also had to adhere to local legislation and, despite certain diplomatic privileges, had to adhere to movement restrictions.

The exact scope of the agency's response is outside of the scope of this paper, but those concerning the ERML will be detailed in this paper.

During the first wave of the pandemic, the IAEA HQ at the Vienna International Centre (VIC) restricted access to all but essential personnel. Safeguards staff returning duty trips had to quarantine directly from the airport and thus could no longer drop their equipment and belongings to the ERML. Equipment was stored temporarily in airport storage area and brought to ERML twice per week.

During the first several months of the pandemic, many important transmission factors had not been clearly identified such as transmission of the virus via surfaces, plastic and metal containers, proper PPE needed to protect staff, etc. These questions and many others had to be considered in order to best protect the staff handling equipment.

The solutions to these challenging situations and several others that the ERML implemented will be presented in the rest of this paper, but it is important to emphasize that these solutions were developed and applied solely for the ERML and may not be applicable for other lab or team. The pandemic has posed a new set of challenges to all organizations, and it is important for organizations to share their lessons learned should another global event occur again.

ERML Operation during COVID-19

During the COVID-19 pandemic, the ERML remained fully operational every day. Over the course of the pandemic, the ERML was able to meet the demands of inspectors and other Safeguards personnel who still continued to perform duty travels.

At the beginning of the first wave of the pandemic, the VIC moved to a limited occupational status, with only essential personnel allowed to enter the building. During the stringent restriction measures there was always one ERML technician and one radiation protection officer present during core operational time. In order to facilitate the delivery of equipment from the field, the ERML staff met the returning SG staff at the gate of the Agency premises in order to collect the equipment. The technician would then disinfect the equipment (and their hands) before performing the standard measurement procedure. Upon completion of the monitoring activities the ERML technician could then deliver the equipment to the equipment custodians as normal, ensuring to follow proper social distancing guidelines.

As the VIC returned to limited operation from essential, several additional measures were implemented at the ERML. These included offering hand sanitizer near the delivery point and plastic dividers that allowed the ERML staff to assist with the equipment delivery while observing physical distancing guidelines (Figure 3 and Figure 5). Additionally, all staff were required to wear face masks while performing their work, at first 5-layer cloth washable masks, then surgical masks, and lately FFP2 masks according to the recommendations of the national authorities and IAEA management.

ERML management ensured a surplus of all necessary personal protective equipment was available to ERML staff at all times. During the first wave, the supply of several items was limited due to the global shortage; Safeguards used their own capacity (Safeguards Analytical Services Nuclear Chemistry Team) to produce disinfectant liquid for the laboratories and travelling staff.

Figure 3 ERML Lobby During COVID-19

Figure 5 ERML Work During COVID-19

The previously mentioned OEW practical training was also adapted in order to address the evolving pandemic-related requirements. Class sizes were lowered from 8 to 3 to ensure that all staff were able to follow social distancing requirements while the number of sections were increased to be able to still train a similar number of staff members, from 2 in a single day to up to 8 over two days. As up to date training is a requirement for OEWs, it was imperative to continue to train all staff whose training was close to expiring.

The PPE section of the course, which normally included staff fully dressing out and being fitted for respirators, moved to a primarily online presentation, with staff able to follow up for fittings or other questions. All of the non-practical sections of the trainings moved to an online only offering. With these changes, the ERML was able to meet the training requirements of the course while also ensuring both instructors and trainees were kept safe.

As the VIC returned to normal staffing levels, strict measures were kept in place in the ERML to ensure that in the event of one staff member becoming infected, the ERML would still be operational. These measures included wearing masks, increasing the distance between desks in the office area (Figure 6), ensuring that no more than two technicians were in the ERML at a time, and using the antigen and PCR-testing of COVID-19, provided by the host-country free of charge. ERML staff was strongly encouraged to perform tests twice a week and to voluntary report results. Additionally, over the course of the pandemic until the time of this paper's publishing, four new staff members were recruited and have joined the ERML team. Each of these staff members was to be trained under these new conditions, and have since been qualified to perform their duties. Part of this training included shifts including one experience technician and one new staff member, online trainings and discussions, and a new training curriculum to ensure that the new staff member would be adequately trained and confident enough to perform the tasks required of them.

Throughout the course of the pandemic, no COVID-19 workplace exposure was recorded in the ERML.

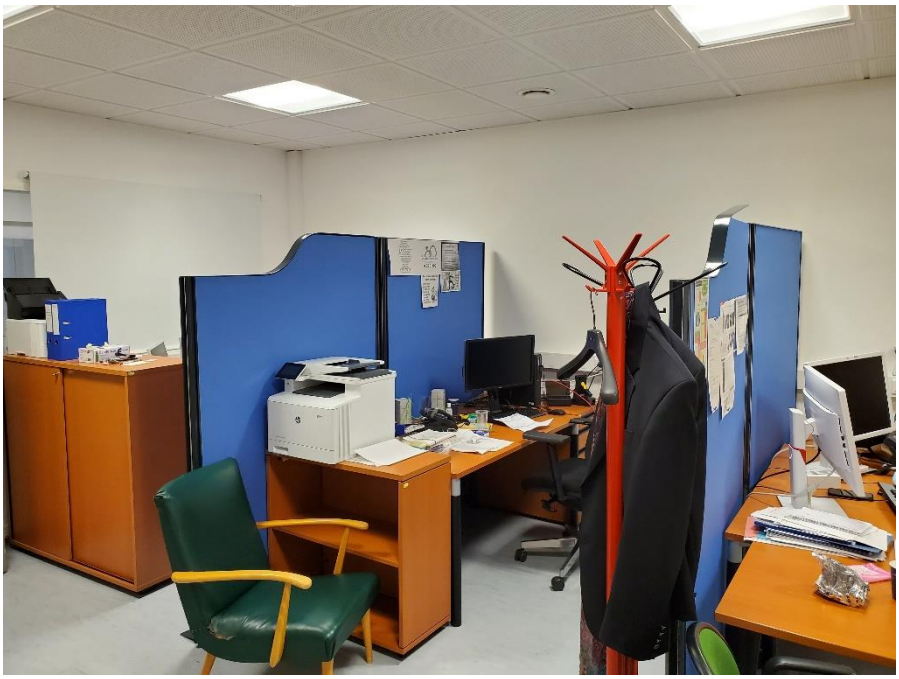

Figure 6 ERML Office Space During COVID-19

For a better dissemination of the constantly evolving information on restrictions, applicable rules, etc., a dedicated webpage was created on the Safeguards intranet. Up-to-date information, answers to frequently asked questions, links to international and national announcements, instructions and safety tips, and PPE availability for staff were uploaded to this portal regularly. This allowed staff to quickly and efficiently access trustworthy information throughout the pandemic and strengthen staff morale.

Improvements for the future

The COVID-19 pandemic has been a learning experience for the world as an uncommon type of emergency response. Many industries struggled to adapt to a situation not seen in most parts of the western world in over a century, before many of those self-same industries existed. In this respect, the pandemic and its associated restrictions can be considered as a valuable learning experience to be adapted to future similar emergencies.

The most important takeaway is the need for a great agility and flexibility at the management level (decision makers) and at the execution level to responding to a constantly changing and evolving situation. The recommendations from health officials evolved rapidly, and sometimes contradictorily, as information was discovered about the pathways of infections, preventative measures, symptoms, etc. of this particular virus. The difficulty in responding to these challenges is only compounded at an international organization, where different duty stations may have radically different federal requirements. The ability to react quickly, effectively, and safely to these changing situations is therefore a necessity. While this may be more difficult to achieve in different organizations, it is something any long-term emergency response discussion should include.

In the case of the IAEA, the staff was confronted with the need to comply with UN regulations, local Austrian restrictions and recommendations, as well as the WHO recommendations. Communication required specific effort to make sure all the provided

guidance would be shared between staff present at the HQ, travelling staff and staff working from home.

For the ERML, the main challenge from the COVID-19 pandemic has been the length of the emergency situation. Most organizational emergency response and preparedness programs assume a short timescale before a return to standard operation conditions, once the emergency has been contained or dealt with. Contamination can be cleaned, fires can be put out, services can be restored after an earthquake. In general, the root cause event of an emergency is a relatively short-lived event, with a longer tail on services repairing whatever damage has occurred. The COVID-19 pandemic has underlined the importance to have a validated long-term emergency preparedness business continuity plan, with identified resources and a definition of what the essential operational elements (parameters) are for each organization and group within the organization.

The widespread emergence of work-from-home practices is a good example of a long-term solution, though many industries initially struggled with developing the tools required to successfully implement such a scheme. While Agency travelling staff was used to working remotely, much of the staff had to adapt to WFH practices. The nature of this work may preclude certain industries or groups within an organization from being able to implement WFH for all staff, such as the ERML; the implementation of shift work can be a good alternative. It is important to ensure all safety requirements are met in the case of smaller shifts, however, such as a two-person rule for handling radioactive material. And above all, the commitment of the management to the safety and wellbeing of staff are imperative to build a strong safety culture that staff can rely on and therefore successfully overcome the challenges posed by these emergencies. Many staff members at the Agency are expats, so in addition to the difficulties posed from in these harsh conditions, many were also separated from their families or support networks by both distance and time zones. It is important for management to be able to connect and listen to staff who may be struggling in those circumstances.

Conclusions

Despite the difficulties posed by the COVID-19 pandemic, the Equipment Radiation Monitoring Laboratory at the International Atomic Energy Agency has been able to thus far continue to provide the required services to SG staff. By being adaptive and able to work through difficult situations, the ERML has been able to safely complete its mission without missing a day and without any COVID-19 workplace exposure. It should be underlined the importance of staff dedication and collaboration between laboratory management, higher management and technicians in the ERML. Support from colleagues and from management is needed for each staff member to be able to achieve high performance under extreme circumstances. The staff of the ERML hopes that by sharing the experiences of the lab and insights gained from the pandemic, other laboratories will be able to adjust future long-term emergency plans to better adapt to a similar situation in the future.

References

1. ISO/IEC 17025 (2017) - General requirements for the competence of testing and calibration laboratories

2. ISO 7503-1 (2016) Measurement of radioactivity -Measurement and evaluation of surface contamination -Part 1: General principles

3. ISO 7503-2 (2016) Measurement of radioactivity -Measurement and evaluation of surface contamination -Part 2: Test method using wipe-test samples