

UNIVERSITY OF OTTAWA

LOW LEVEL RADIOACTIVE MATERIAL MANAGEMENT STRATEGY

2016

BACKGROUND

An exhaustive review of the regulatory framework on managing low level radioactive material; including an understanding of the regulatory definition of terms and the multiple exemption criteria was undertaken over the past year. This was necessary to adopt the appropriate management strategy for Low Level Radioactive Material (LLRM). These low levels activity currently represent a significant use of material at the University of Ottawa.

CNSC REPORTING CRITERIA

The University is required to report to CNSC via numerous routes: Annual Compliance Report, Inspections, Desktop Assessments and every five years the Nuclear Substance Radiation Device Licence Renewal, and hence a consistent approach must be adopted.

STRATEGY

To ensure that reporting accurately reflects risk, CNSC exemption criteria will be adopted in the University's radiation management program. In addition it will support the adoption of the ALARA principle (to keep the amount of exposure to radon progeny and the effective dose and equivalent dose received by and committed to persons as low as reasonably achievable, social and economic factors being taken into account) into its management of Low Level Radioactive Material.

Note:

This may be a graduate approach as the University's database and the data collection strategy evolves to be applied to this new strategy.

FUNDAMENTAL CONCEPTS THAT MUST BE UNDERSTOOD

Nuclear Substances: specifies six types of substances, but for the University its application to option (c) “a radioactive nuclide” is the most often reference.

Exemption Activity (EA): is defined as activities that can be carried out without a licence and include: issues such as possess, transfer, store, use, abandon, and a variety of other activities that are specific to the nature of the Radioactive Material (RAM) (NSRD section1)

Exempt Quantities (EQ): is a specific activity either in Bq/g or Bq for each specific radionuclide (NSRD Schedule 1)

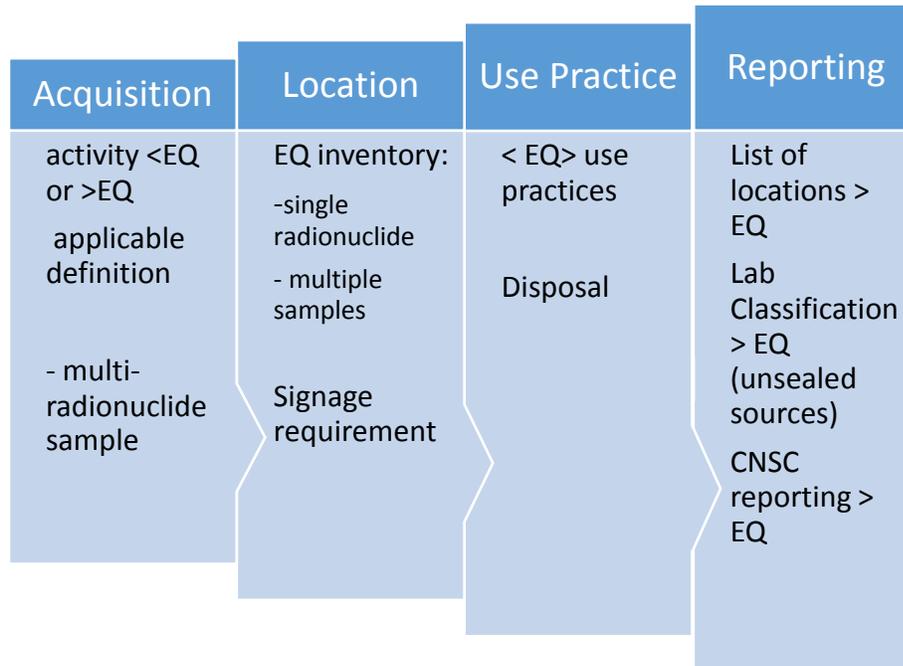
KEY AREAS OF REPORTING

Key areas which are reported on and for which EA apply are:

- *NSRD – Nuclear Substance and Radiation Device Regulation*
- *Nuclear Substance see CNSC Act definition*

Reporting Requirement	Regulatory Reference	Regulatory Exemption Activity
Sealed Source Inventory	NSRD 5.1b	Less than 1 EQ
Sealed Source in a Device Inventory	NSRD 5.1c	Less than 10 times the EQ
Unsealed Source Inventory	NSRD 5.1a	Nuclear substance (c) does not exceed 1 EQ
Depleted Uranium, Natural Uranium, or Natural Thorium Inventory	NSRD 5.1f	Not more than 10 kg in any calendar year that is not used for the radioactive properties
Respect of more than one radioactive nuclear substance	NSRD 1 (EQ definition (c))	
Locations – basic lab	NSRD 5.1a Licence 07152-1-18.10 Condition 5.	EQ definition (c), and > 1 EQ

LLRM ASSESSMENT PROCESS



Bottom Line:

To effectively managed LLRM one must be able to determine whether a specific sample of RAM is below EA values and what are the implications.

Step 1	Determine which exemption from licencing applies, and which EA criteria is applicable to the RAM (at the acquisition/transfer stage), if more than one EA is applicable determine which is the most appropriate.
Step 2	If <EA, include in <u>EA Element of the RSP</u> If > EA include in the RSP
Step 3	Determine if the addition of the RAM in the locations alter: <ul style="list-style-type: none"> • the classification of the Permit and Location (stock vs use locations(s)) • signage (100 EQ) • lab classification (applicable to locations where >EQ) • entry/reporting inventory • list of areas where >EQ exist
Step 4	Determine implications of use practices <ul style="list-style-type: none"> • stock < EQ (in locations that are either <EQ or >EQ) • aliquot <EQ but stock >EQ

	<ul style="list-style-type: none"> ex. contamination monitoring, inventory management, leak testing
Step 5	<p>Ensure CNSC reporting requirements can be met.</p> <ul style="list-style-type: none"> Locations (> EQ) # basic labs (> EQ) # of workers (>EQ)

UO Radiation Safety Program Impact

While the University adopts EA criteria, it also recognizes the importance of ensuring appropriate oversight and monitoring. It does so by an Internal Authorization Process for Radioactive Material (see appendices A and B). The following table summarizes activities:

Enrollment into uO RSP	< EA in Lab	<EQ (quotients)	> EQ	Best Practice
Inventory				
Signage				
Disposal				
Monitoring Contamination - unsealed Leak testing – sealed				

APPENDIX A

INVENTORY RATIONAL

uO RSP Impact:

Associated with the acquisition of radioactive material is the requirement to maintain an active inventory of this material in terms of both its use and its disposal/transfer. Thus the issue must be addressed as to the appropriate measures for LLRM. Factors are:

- Acquisition (purchase and transfers)
- Planned Use (initial extraction from stock, and subsequent experimental use)
- Disposal

Overall the management of sealed sources inventory in terms of exemption quantities is straight forward. But it is important to note that one must apply the exemptions based on sealed source, sealed source in a device, deuterium or a compound containing deuterium, depleted uranium or <10kg of depleted uranium. (NSRD 1 b,c,d,e,f)

Internal Authorizations:

The University internal authorization process is based on a permitting system with various classes of permits:

- Unsealed (Open Source) Radioisotope
- Sealed Source
- Sealed Source in a Device
- Exemption Quantity
- Depleted Uranium
- etc

Note: that the classes of permits will be review to align with the LLRM strategy.

These permits are tied to the inventory either directly (inventory embedded into the Permit) or indirectly (inventory is independent of the Permit, but supports the approved use outline in the Permit). To better articulate the LLRM in situations the overall use practices in the lab are less than the EA, specific Permits are issued in accordance to the nature of the EA. Therefore is excluded in reports to CNSC as their criteria.

Application:

1. Unsealed Radioactive Material

Unsealed LLRM Management – Underlying Principle

Unsealed radioactive material is assessed in terms of the unsealed EA (NSRD 1a). If strictly applied this would mean no radionuclide existing at the university would be exempt if the sum total of all sources of this radionuclide exceed the exemption quantity. This would not be in conformance with the CNSC adopted philosophy found in other exemption criteria ie) laboratory list and inspection criteria. Nor in the concept of ALARA, as significant management requirements and restrictions would need to be applied where negligible risks exist. The following scenarios are managed:

Scenario (one location)	Conclusion	Example
<i>Single radionuclide</i>		
Total inventory < EA	exempt	a
Individual acquisition <EA but total activity >EA	Not exempt	b
<i>Multiple radionuclides considered</i>		
All radionuclides < than their corresponding EA	Exempt	c
One radionuclide >EA	Not exempt	d

Examples- one location contains

(H-3 EQ= 1000 MBq) (P-32 EQ= 0.1 MBq)

- a) 100 MBq of H-3 therefore exempt (H-3 EQ is not exceeded)
- b) 11 vials of 100 MBq each of H-3 totalling 1100 MBq therefore not exempt (H-3 EQ is exceeded)
- c) 100 MBq of H-3 as well as P-32= 0.01 MBq therefore exempt (H-3 or P-32 EQs are not exceeded)
- d) 100 MBq of H-3 as well as P-32= 1MBq therefore not exempt (P-32 EQs is exceeded)

Samples containing multiple radionuclides the EQ is calculated (as per NSRD Reg. EQ definition) and if greater than 1 the sample is not exempt

2. Sealed Radioactive Material

All sealed sources are maintained in the database and are covered by the Sealed Source Permit which records the source, serial number and activity at the time the Permit was issued and/or revision (effective date). Disposal/transfers are recorded accordingly.

3. Sealed Radioactive Material in a Device

All sealed sources are maintained in the database and are covered by the Sealed Source in a Device Permit which records the source, serial number and activity at the time the Permit was issued and/or revision (effective date). Disposal/transfers are recorded accordingly.

APPENDIX B

LISTS, LOCATIONS AND SIGNAGE REQUIREMENTS

Note that at the present time, our ability to accurately list and classify labs as being exempt is somewhat limited; especially as lab use may vary during the year. When confirmation of less or equal to EQ cannot be confirmed the lab is classified as basic level lab.

Unsealed Radioactive Material

1. Laboratory List ((Licence 07152-1-18.10 Condition 2).

“a list of all areas, rooms, or enclosures where more than one EQ of a nuclear substance is used or stored”

2. Area Classification (Licence 07152-1-18.10 Condition 5).

As the term Basic Level applies to “an, area, room or enclosure where more than one EQ of an unsealed nuclear substance is used at a single time” and does exceed 5 ALI.

Where a specific location covered by the University NSRD Licence contains radioactive material < EQ the location will not be cited as being a basic level area.

3. Signage (Radiation Protection Regulations (SOR/2000-203) S.21)

“Every licensee shall post and keep posted, at the boundary of and at every point of access to an area, room or enclosure, a durable and legible sign that bears the radiation warning symbol set out in Schedule 3 and the words “RAYONNEMENT-DANGER-RADIATION”, if (a) there is a radioactive nuclear substance in a quantity greater than 100 times its exemption quantity in the area, room or enclosure;”

If the total activity found within the room contains > 100 EQ appropriate signage will be posted.

Note current practice in the lab may involve the use of the radiation warning symbol to denote radioactive use areas. This will not be in contradiction to the CNSC requirement as their definition include the wording “RAYONNEMENT-DANGER-RADIATION”;

Sealed Radioactive Material

1. Laboratory List ((Licence 07152-1-18.10 Condition 2).

“a list of all areas, rooms, or enclosures where more than one EQ of a nuclear substance is used or stored”

2. Area Classification (Licence 07152-1-18.10 Condition 5). Does not apply to sealed sources.
3. Signage(Radiation Protection Regulations (SOR/2000-203) S.21

“Every licensee shall post and keep posted, at the boundary of and at every point of access to an area, room or enclosure, a durable and legible sign that bears the radiation warning symbol set out in Schedule 3 and the words “RAYONNEMENT-DANGER-RADIATION”, if (a) there is a radioactive nuclear substance in a quantity greater than 100 times its exemption quantity in the area, room or enclosure;”

Where a specific location covered by the University NSRD Licence contains radioactive material < EQ the location will not be cited as being a basic level area as this classification does not apply to sealed sources.

4. Disposal

Sealed Radioactive Material in a Device

1. Laboratory List ((Licence 07152-1-18.10 Condition 2).

“a list of all areas, rooms, or enclosures where more than one EQ of a nuclear substance is used or stored”

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Where a specific location covered by the University NSRD Licence contains radioactive material < EQ the location will not be cited as being a basic level area as this classification does not apply to sealed sources.