

Exemption guidance

Guidance for NORM industrial activities on how to comply with the radioactive substances exemption regime

**February 2013
Version 1**

**Radioactive Substances Act 1993
The Environmental Permitting (England and Wales) (Amendment)
Regulations 2011**

Who is the guidance for?

This guidance is for businesses and individuals who have to handle naturally occurring radioactive substances.

This guidance is not intended for anyone who is using naturally occurring radioactive materials for its radioactive, fertile or fissile properties. Different arrangements apply to such uses.

This guidance is not aimed at anyone remediating contaminated land. Separate guidance is available on this topic.

This guidance is intended to provide a general overview of the regulatory regime. If this guidance does not answer your particular query you should contact a suitable radioactive waste advisor or the relevant environment agency for further advice.

My business handles NORM how does the radioactive substances regulatory regime apply to me?

The radioactive substances regulatory regime only applies to naturally occurring radioactive substances that meet two criteria:

1. They must arise from industrial activities that are specified in the legislation (NORM Industrial Activities), and
2. They must contain concentrations of naturally occurring radionuclides above specified values (NORM “out of scope” values).

This document provides guidance on both of these criteria. If a substance does not satisfy both of these criteria then it is not subject to the radioactive substances legislation. If it does satisfy the criteria, then it is subject to the legislation and will require permitting unless it is exempt. Guidance below will help you determine if you are exempt.

Criteria 1: NORM Industrial Activities

This list of industrial activities is reproduced below. If your industrial activity is not on this list then the radioactive substance legislation does not apply to you. For example, a company manufacturing granite building materials would not be captured by the RS legislation, no matter how much natural radioactivity the granite contained.

NORM Industrial Activities

Part 1

- *Production and use of thorium, or thorium compounds, and the production of products where thorium is deliberately added*
- *Production and use of uranium or uranium compounds, and the production of products where uranium is deliberately added*

Part 2

- *Extraction, production and use of rare earth elements and rare earth element alloys*
- *Mining and processing of ores other than uranium ore*
- *Production of oil and gas*

- *Removal and management of radioactive scales and precipitates from equipment associated with industrial activities*
- *Any industrial activity utilising phosphate ore*
- *Manufacture of titanium dioxide pigments*
- *The extraction and refining of zircon and manufacture of zirconium compounds*
- *Production of tin, copper, aluminium, zinc, lead and iron and steel*
- *Activities related to coal mine de-watering plants*
- *Water treatment associated with provision of drinking water and the remediation of contamination from other NORM industrial activities*
- *China clay extraction*

The list of industrial activities is subdivided into two parts. The difference between the parts is as follows:

Both materials and wastes arising from or used in activities listed in part 1 are in scope of the legislation and may need regulating as radioactive material or radioactive waste.

Example 1: A company manufactures thorium compounds for laboratory use. Any raw materials that contain thorium are considered to be radioactive material. The thorium compounds (products) are considered to be radioactive material. Any thorium containing waste arising from the production of the compounds is considered to be radioactive waste and the thorium compounds themselves will become radioactive waste after they have been used or have no further use.

Only wastes arising from activities listed in part 2 are in scope of the legislation; the products (materials) produced by these activities (e.g. titanium dioxide pigments or oil and natural gas) are not regulated as radioactive material or radioactive waste. There is an exception to this general case in that useful equipment that is contaminated with NORM waste is considered to be radioactive material and is therefore subject to regulation. However, regulation of such contaminated items is only required when they are moved off the premises where they were contaminated.

Example 2a: A pump is used in oil and gas production and becomes contaminated with NORM scale. Whilst the pump is in use and is on the production premises it is not classed as radioactive material or radioactive waste.

Example 2b: The contaminated pump is moved from the production premises to be used elsewhere. The pump is in good working order. In this case the pump would be considered to be radioactive material when it leaves the premises where it was contaminated.

Example 2c: The pump has stopped working properly and a decision has been made to send it away to have the contaminating scale removed. Once the pump has been cleaned it will be returned to use. In this case the pump is considered to be radioactive material, it is not waste as there is an intention to continue to use it for its original purpose. Once cleaned the pump ceases to be classed as radioactive, whilst the NORM scale which has been removed is classed as radioactive waste.

Example 2d: The contaminated pump is no longer required and a decision has been made to send it away to have the contaminating scale removed following which the pump will be scrapped. In this case the pump is

considered to be radioactive waste. Once cleaned the scrap material ceases to be classed as radioactive, whilst the NORM scale which has been removed is classed as radioactive waste.

In relation to examples 2c and 2d, the environment agencies recognise that there is little practical difference between how a decontamination facility treats a contaminated item which is considered to be waste and one which is considered to be material. In both cases it is essential that the treatment facility is permitted and has appropriate measures in place to account for the contaminated items and store them safely in order to prevent the spread of contamination. Additionally they must be permitted to dispose of the waste that is generated as a result of cleaning.

With this in mind and to minimise regulatory burden the environment agencies take a flexible approach to the transfer of contaminated items which are being sent for cleaning. Such items may be consigned as either material or waste providing the recipient cleaning facility is appropriately permitted. As a minimum the recipient facility must be permitted to accumulate and dispose of radioactive waste and they shall classify all contaminated items that they receive for treatment as radioactive waste.

Criteria 2: NORM “out of scope” values

The legislation only applies if the concentration of the naturally occurring radioactive substances exceeds specified values. The most commonly used values are reproduced in Table 1; these are the radionuclides at the top of each of the three natural decay series, radium-226, radium-228, lead-210 and polonium-210.

Table 1 – Out of scope values for selected radionuclides in secular equilibrium¹

Radionuclide	Solid or relevant liquid concentration in becquerels per gram (Bq/g)	Any other liquid concentration in becquerels per litre (Bq/l)	Gaseous concentration in becquerels per cubic metre (Bq/m ³)
U-238sec	0.5	0.1	0.001
Th-232sec	0.5	0.1	0.001
U-235sec	1	0.1	0.0001
Ra-228+	1	0.1	0.01
Ra-226+	0.5	1	0.01
Pb-210+	5	0.1	0.01
Po-210	5	0.1	0.01
U-238sec incl. U-235 sec	0.5	0.1	0.001

What is a relevant liquid?

A relevant liquid is either a non-aqueous liquid or an aqueous liquid which has certain other toxic and hazardous properties (specified in the legislation) that would prevent it from being discharged to the water environment. Some examples of what are and are not relevant liquids are given below. Further detail is available in our separate document “*Exemption Guidance: Relevant Liquids*”.

Relevant Liquid

Oil

Concentrated mineral acids

¹ The values are extracted from the radioactive waste legislation. Other values can be found in that Table 2.2 of the Government Guidance on the exemption regime.

Not Relevant liquid

Produced water arising from oil and gas extraction

How to deal with equilibrium and non-equilibrium

The values presented in table 1 were calculated assuming that all daughter radionuclides are present in secular equilibrium. This means that if there is no reason to suspect that a process has occurred that has removed this equilibrium then it is sufficient to compare against this single value for the decay series in question.

If the substance has subject to a process that means the top radionuclides are only in equilibrium with the short lived radionuclides rather than the full chain, then different, less restrictive, values are available in the legislation (reproduced in Table 2.2 of the Government Guidance).

In the case where daughter radionuclides are present at higher activities than their parent radionuclides, a summation calculation is required using the relevant values presented in the legislation (reproduced in Table 2.2 of the Government Guidance).

Multiple decay series present

The majority of naturally occurring radioactive substances will contain multiple natural decay series, i.e. U-238, U-235 and Th-232. In this case it is not simply a case of being less than each value for each decay series specified in Table 1. A summation rule needs to be used to determine whether the values are complied with or not.

U-238 and U-235 are usually found in a fixed natural ratio a special value therefore it is possible to calculate an out of scope value for natural uranium, i.e. *U-238sec incl.U-235sec* (provided in table 1). This value is the same as that U-238sec; this means that there is no need to take explicit account of U-235 in natural substances.

The natural ratio of U to Th is variable so it is not possible to present a single figure for these radionuclides. Where both are present their activity needs to be determined and the following calculation carried out. If the answer is less than 1 the substance is not subject to the radioactive substances legislation

$$\frac{\text{Activity concentration of U - 238}}{0.5} + \frac{\text{Activity concentration of Th - 232}}{0.5}$$

My substance is subject to the legislation, is it exempt?

If your substance contains metallic uranium or thorium or contains prepared compounds of uranium or thorium then there are specific exemptions that may apply to you. A separate guidance document is available for these exemptions. (*Exemption Guidance: Uranium and Thorium*)

If your substance is “*NORM waste*” it may be exempt. *NORM waste* is a specific term used in the legislation, it includes wastes from the industrial activities listed above and also includes *NORM wastes* from the remediation of *NORM contaminated land* providing it wasn't contaminated as a result of activities related to the nuclear fuel cycle. A separate guidance document is available in relation remediation of contaminated land. (*Exemption Guidance: Remediation of NORM contaminated land*)

Whether or not *NORM waste* is exempt depends on the *NORM waste concentration*. There is an exemption for the accumulation of some *NORM waste* and there are exemptions related to the disposal of *NORM waste*.

What is the “NORM waste concentration” and how is it calculated?

The legislation defines the “NORM waste concentration” as:

*“the sum of the concentrations of the single radionuclide with the highest concentration in each of the natural decay chains beginning with -
U-238
U-235 and
Th-232”*

This means that when determining if *NORM waste* is exempt, the radionuclides that are present in each of the three natural decay series specified must be taken into account. However, providing that U-235 (and its daughters) is not enhanced above the natural uranium ratio it will not make a significant contribution to the overall impact so can be omitted from consideration.

There is no requirement to determine the concentration of every radionuclide that is present in the *NORM waste*, only that which is present at the highest concentration for each decay chain.

Example 3: A waste contains uranium and thorium. There is no reason to believe that any daughter radionuclide is present at a higher concentration than the parents.

In this case it is only necessary to measure the U-238 and Th-232 concentrations.

In this example the U-238 activity was determined to be 2.5 Bq/g and the Th-232 activity was 2.0 Bq/g.

Therefore the NORM waste concentration is given by

U-238 + Th-232

$2.5 + 2.0 = 4.6 \text{ Bq/g}$

Example 4: NORM scale from the oil and gas industry has been removed from some production equipment and the operator needs to determine if it is exempt.

The operator should consider each of the natural decay series in turn to determine what is the appropriate value to input into the NORM waste concentration calculation.

U-238 decay chain: Ra-226 is the topmost radionuclide from the U-238 chain that is present in the waste. From historical measurements the operator knows that the radionuclides Po-210 and Pb-210 are present at concentration less than Ra-226.

U-235 decay chain: There is no reason to believe that U-235 or its daughters have been enhanced above the natural ratio therefore they can be ignored.

Th-232 decay chain: Ra-228 is the topmost radionuclide from the Th-232 chain that is present in the waste. From historical measurements the operator knows that there are no radionuclides further down the decay chain that are present at a greater activity than Ra-228.

In this example the NORM waste concentration is given by Ra-226 + Ra-228

Accumulation of NORM waste

Am I exempt from the requirement to have a permit to accumulate my NORM waste?

If you do not have a permit for the accumulation of NORM waste then you may accumulate NORM waste providing its concentration is less than 10 Bq/g. There is no limit on the total quantity of NORM waste that you may accumulate but you must dispose of the waste as soon as practicable to prevent unnecessary accumulation.

If you do have a permit for the accumulation of NORM waste then you may only use the exemption to accumulate waste with a NORM concentration up to 5 Bq/g. There is no limit on the total quantity of NORM waste that you may accumulate but you must dispose of the waste as soon as practicable to prevent unnecessary accumulation.

Are there any special conditions that I need to comply with when I accumulate NORM waste?

Yes, the exemption has a number of conditions that must be complied with. These are set out below:

Keep adequate records

Adequate records would contain the following information:

- Location of waste on the premises
- The NORM concentration of the waste along with supporting evidence
- The date that waste was generated or brought onto the premises
- The date that waste was disposed of from the premises

Label as radioactive where practicable

Allow access to records / premises

You must allow environment agency inspectors access to your records and premises so they can check compliance with this exemption.

Prevent accidental removal, loss or theft

Normal arrangements to prevent theft of any goods or equipment.

Dispose of waste as soon as practicable

You must dispose of waste as soon as practicable. The records required above will indicate how long waste has been accumulated on site. The environmental regulators may ask you to justify the length of time that particular waste has remained on site.

The fact that disposal costs are expensive will not be accepted as adequate justification as to why radioactive waste has not been disposed of.

Disposal of NORM waste

Am I exempt from the requirement to have a permit to dispose of my NORM waste?

Some NORM wastes are exempt providing they contain concentrations of NORM less than specified values and providing that particular disposal route are used. These exemptions are explained below and are also illustrated in Figure 1.

My NORM waste has a NORM concentration less than 5 Bq/g what disposal route can I use?

There are several exempt disposal routes for the disposal of such waste:

1. Landfill, up to a maximum of 50 GBq per year
2. Incinerator², up to maximum of 100 MBq per year
3. Waste permitted person (a person who has a valid permit that allows them to receive such waste)
4. Landfill where the total activity quantity exceeds 50 GBq per year

If you elect to use any of these routes then you need to ensure that you are compliant with all other waste legislation. The exemption described here only relates to the requirement to be permitted under the radioactive substances legislation.

Waste does not have to be disposed of directly to a landfill or incinerator; disposals to facilities that prepare the waste for landfill or incineration are also exempt.

If you are disposing of more than 50 GBq it must be sent to an assessed landfill. An assessed landfill is explained below.

If you are sending waste to a disposal facility which has a permit to dispose of NORM waste you should inform them prior to sending your waste as they will need to dispose of your wastes in accordance with their permit.

My NORM waste has a NORM concentration between 5 and 10 Bq/g what disposal route can I use?

There are two disposal routes that you can make use of:

1. To an assessed landfill
2. To a waste permitted person (a person who has a valid permit that allows them to receive such waste)

An assessed landfill is one where the disposer has provided a robust radiological assessment to the relevant environment agency which demonstrates that radiation doses are not expected to exceed:

- 1 mSv per year to workers at the place of disposal, and
- 300 µSv per year to the public

A template assessment in support of an application for an exemption for the landfill disposal of NORM waste is available on request from the environment agencies.

Are there any special conditions that I need to comply when I dispose of the waste?

Yes, you must keep adequate records of the waste which you dispose of from your premises. The purpose of this condition is to ensure that you only dispose of exempt waste and that you can demonstrate this to the environmental regulator.

² The Radioactive Substances Exemption (Scotland) Order 2011 could be interpreted as meaning that the NORM waste concentration must be less than 5 Bq/g following incineration. This is incorrect, it is the waste that is sent for incineration that must comply with the 5 Bq/g limit

Where waste is sent to a facility that does not have a permit to dispose of NORM waste where it is practicable to do so you must also remove labelling that indicates that the waste is radioactive if you are sending it to landfill or an incinerator.

I operate a landfill or an incinerator which does not have a radioactive substance permit what must I do with exempt NORM wastes I receive?

There are no conditions that you must comply with.

I operate a landfill or an incinerator which has a radioactive substance permit for NORM waste. What must I do with exempt NORM wastes I receive?

If you have a permit to dispose of NORM waste with a NORM waste concentration exceeding 10 Bq/g then you must manage any NORM waste that has been sent to you using the exemption provisions in accordance with your permit.

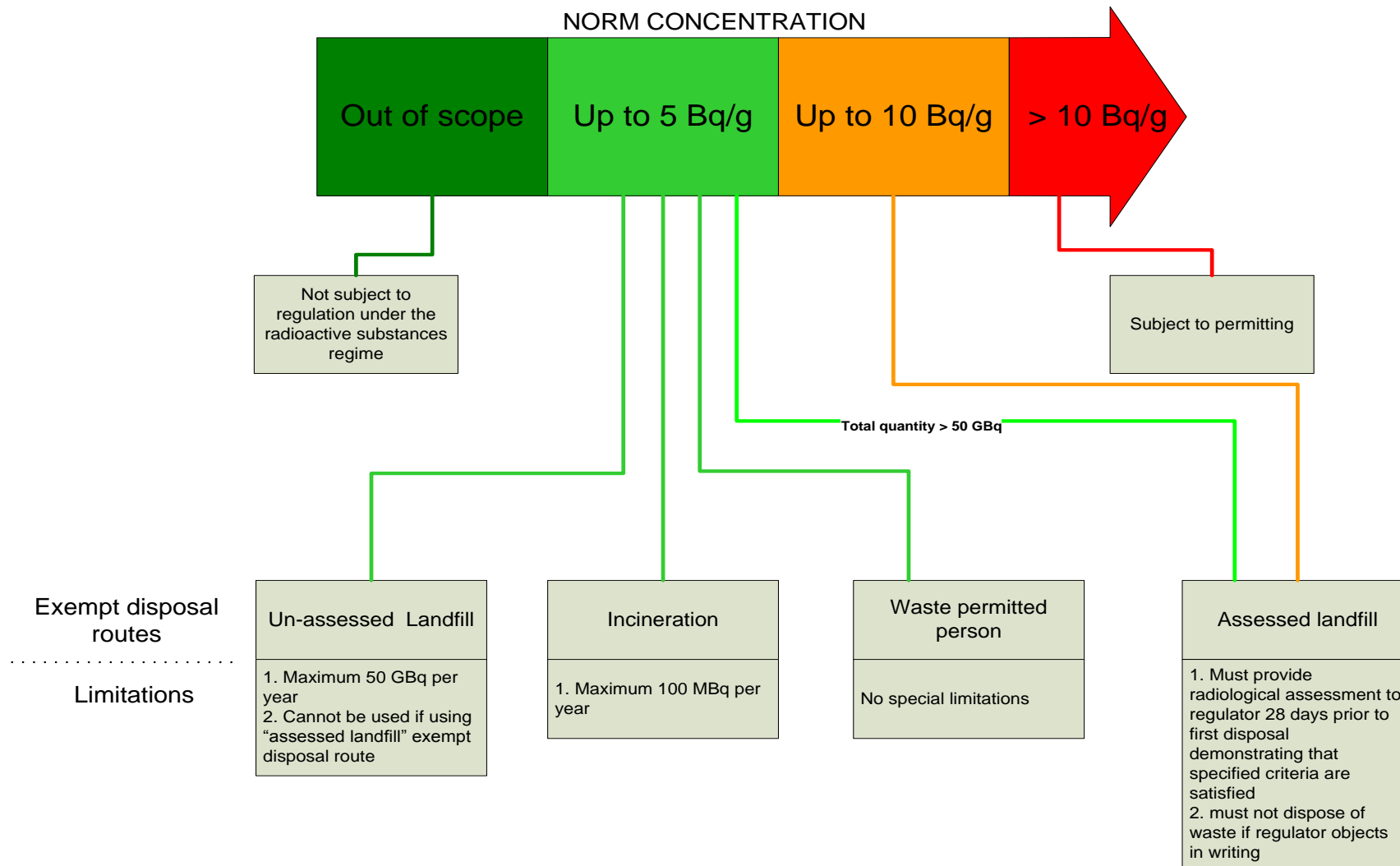


Figure 1 Schematic illustrating the NORM waste exemption