Management of biological, chemical and nuclear risks

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Abstract: *Universities use a wide range of products. The waste produced during lab work varies between the harmless and hazardous - including radioactive risks. In Belgium, the latter are treated as "dangerous" according to regional legislation and "radioactive" according to federal legislation. Managing this type of waste materials must therefore take into account not only its radioactive aspect but also other characteristics of the material. Therefore, the manager having to comply with the diverse legislation surrounding each type of waste present (radioactive, biological, chemical, etc.) must find a suitable method of processing each type of particular waste, this process of elimination having to take into account the specificity of each type of waste as well as the initial risks that each type of waste presents.*

Introduction

All human activity carries the notion of risk. According to the Bureau International du Travail (BIT), more than one million deaths caused by work-related accidents are recorded each year. These figures are alarming. Developing countries, not surprisingly, are most hit. Occupational deaths are four times higher in these countries than in industrialised countries, which are not without their share of accidents at work. In Belgium, for example, the Fond des Accidents du Travail, published the following figures for 1997:

- 229 184 accidents reported
- 106 495 accidents with temporary work incapacity
- 15 004 accidents with permanent work incapacity
- 219 fatal accidents

Accidents are not the only risk to which workers are exposed. Occupational illness is equally present but more difficult to measure. Many substances can affect human health both in the short and in the long term. These are defined as dangerous substances. During, their extraction, their manufacture, their transportation or their handling, such substances can either affect health directly or indirectly by impinging on the human genetic make-up or polluting the environment.

When these substances have no more practical use and need to be disposed of, they become waste. If waste contains one or more substances of a hazardous nature, it is referred to as dangerous waste. To minimise the impact of dangerous waste on workers, neighbouring populations and the environment, a system of waste management has to be set up in each organisation or industry.

The Catholic University of Louvain (UCL)

Founded in 1425 by Pope Martin V, the Catholic University of Louvain is the oldest Belgian institution and one the oldest in Europe. In 1971, for linguistics reasons, the university was split in two separate institutions, one remained in its native town (Louvain-Leuven) delivering courses in the Dutch language (Katholieke Universiteit te Leuven – KUL), and the other, French-speaking (Université Catholique de Louvain - UCL), was set up in Wallonia on a piece land that symbolically, took the name of Louvain-la-Neuve (New Louvain). The medical faculty and teaching hospital are in the Brussels region at Woluwé-St-Lambert.

The UCL educates nearly half the students in French-speaking Belgium (Wallonia and Brussels) making it the main French-speaking University in Belgium. In addition to the sites in Louvain-la-Neuve and Brussels, the UCL has sites near Namur (Cliniques Universitaires de Mont-Godinne), Bastogne (Laboratoire d'écologie des prairies de Michamps), Chimay, and Charleroi etc.

As well as being a teaching institution, the UCL is a full-blown enterprise with people employed in labs, workshops and various experimental installations. The UCL is a "large enterprise" not by the high levels of risks generated but by their diversity and the large number of people it employs. The UCL is the biggest employer in the province of Brabant Wallon. 2000-2001 statistics show:

- 1.332 academic staff,
- 1.750 research staff,
- 1.958 administration and technical staff,
- 19.843 students,
- Nearly 5.000 employed at the Cliniques Universitaires St Luc in Woluwé-St-Lambert,
- Etc…

Competent Bodies

The high number of employees working in teaching and research labs generate large quantities of waste of all kinds. Much of the waste is harmless being non-hazardous industrial waste or waste that can be treated as domestic waste.

Other residues are dangerous whether it be for employees exposed to them in the first instance or for environment and the population at large in the longer term. This is the dangerous industrial waste.

All waste, and even more so, dangerous waste must be managed. Who should be in charge? How should it be organised? How should waste be classified? What legal dispositions are available? What are the competences of waste manager?

At the UCL, the management of waste generated by the University as well as specific waste from outside companies with whom the university has a contractual agreement, is handled by the Waste Management Centre (*Centre de Gestion des Déchets*) which also has the necessary expertise in several ancillary matters.

This centralisation of competence is justified by the following observations:

- The classification of waste is fairly complex and the frontier between dangerous and not-dangerous is far from obvious thus requiring in-depth knowledge and understanding of legislation pertaining to both the protection of the environment and the " *Code du bien-être au travail"*.
- Waste produced in laboratories often presents different kinds of hazards, which require a broad range of expertise from the waste manager to assess the various risks, involved in handling as well as disposing of waste. Radioactive waste for example, demands an expertise in radiation protection and methods of measuring activity, but may also require a sound knowledge in chemistry and/or biology.
- When dealing with competent bodies (*l'Office Wallon des Déchets, l'Organisme National pour la Gestion des Déchets Radioactifs, l'Institut Bruxellois pour la Gestion de L'Environnement, la Police de l'Environnement de la Région Wallone,* etc.) it is easier to provide a unique point of contact.
- Greater efficiency may be generally expected from a centralised system.

At the UCL, radioactive waste, for example, often contains other substances, radioactive or not as the case may be, but presenting other supplementary hazards. It may be toxic (e.g., a pesticide labelled with ^{14}C); it may present a biological hazard (e.g., a blood test with a RIA kit) or be associated with a dangerous substance (e.g., a liquid scintillation counting vial of ^{3}H).

Practically, and it is especially true in the medical field, radioactive hazards are often associated with biological hazards. Therefore, this type of waste cannot be treated as only biologically dangerous or only radioactive, but combines both types of hazards with the added factor that radioactivity decreases over time. Management and disposal of this kind of combined risk waste need to consider all these characteristics.

Therefore, the waste manager has to find, in the current legal context, ways of managing dangerous waste within the waste management department of the UCL. This new organisation needs to take into account the recent Royal Decree of 27/3/98 relating to the creation of an internal department for the "Prévention et la Protection au travail (SIPP)". Other current legislation including the Royal Decree of 28 February 1963 on the protection of workers and population against ionising radiation, regional dispositions on the environment and the new legislation (June 1999) on the transportation of dangerous substances must also be taken into account.

Waste management in an organisation like the UCL that has operational units in different regions is especially delicate because in Belgium, the third phase of the reform of the state, voted by the federal Parliament on July 16, 1993, has given the regions, exclusive competence for the management of the environment. Therefore, the Région Wallone (Walloon Region) has total competence over the management of waste produced in Wallonia, similarly the Région de Bruxelles-Capitale (Brussels-Capital Region) over Brussels waste and the Région flamande (Flanders Region) over waste produced in Flanders.

As of that date, and in compliance with European directives, the Regions:

- Decide the general and sector norms in environmental policies, thus consistent with the “proximity” principle
- Control the import and export of waste
- Collaborate on the establishment and control of product norms that remain at federal level.

It should be pointed out that at the moment, the regions have no power over the radioactive waste, which has remained a competence of the federal level.

Definitions

Waste

It is not easy to give a definition of waste; it is a notion that has proved variable over time, space and authorities. Generally speaking, waste is any substance, material or residue, by-product of human activities that requires treatment before being eliminated, should recycling or re-use not be within the means of existing technology [1]. Because the UCL has two sites, one in Wallonia and one in the Brussels Region, we also need to consider two regional definitions.

Article 2.1° of the Walloon Region decree of 27 June 1996, on waste [2], gives the following definition:

- *"Toute matière ou tout objet qui relève des catégories figurant à l'annexe I dont le détenteur se défait ou dont il a l'intention ou l'obligation de se défaire"* .[1]

Article 2.1 of Brussels-Capital decree of 7 March 1991 on prevention and management of waste [3], defines waste as:

- *"Toute substance ou tout objet qui relève des catégories figurant à l'annexe I dont le détenteur se défait ou dont il a l'intention ou l'obligation de se défaire"* .[2]

Dangerous waste

Waste is labelled dangerous when it can cause harm to people whether in the short or the long or even very long term. Dangerous waste may present an immediate health hazard, or indirectly affect the human genetic makeup or the environment.

Article 2.5° of the Walloon Region decree of 27 June 1996 on waste [2], defines dangerous waste as follows:

- *"Les déchets qui représentent un danger spécifique pour l'homme ou l'environnement parce qu'ils sont composés d'un ou plusieurs constituants et qu'ils possèdent une ou plusieurs caractéristiques, énumérés par le Gouvernement, conformément aux prescriptions européennes en vigueur"*.[3]

Article 5 §3 of the same Decree refers to the list of dangerous waste laid down by the Walloon government. This has been published in the Walloon Government Order of 10 July 1997 establishing a catalogue for waste [4], the Article 3 of which states that waste is dangerous if it belongs to the list referred to in column 3 of the annex to the 10 July 1997 Order, or if it fulfils a series of conditions which are relatively difficult to interpret.

The Brussels Region in Article 2.2. of its decree of 7 March 1991, on prevention and management of waste [3], defines dangerous waste as that belonging to certain categories or types listed in a series of attachments.

Radioactive waste

Radioactive waste meets the general definition of waste with the particularity of having molecules, mineral or organic, that contain radioactive atoms. Because this kind of waste is not included in the dangerous waste classification mentioned in 2.2.2, we are left to wonder whether it is dangerous or not?

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[1] Any matter or object pertaining to the categories given in annex I, whose possessor is disposing of, or intends or must dispose of.

[2] Any substance or object pertaining to the categories given in annex I, whose possessor is disposing of, or intends or must dispose of

[3] Waste that presents hazards to man or the environment because it contains one or more of the components or characteristics listed by the Government, according to the current European directives.

Furthermore, the above definition of radioactive waste is too simplistic. It does not provide ways of saying that radioactive waste is dangerous or not, particularly as most compounds have varying concentrations of naturally occurring radio-isotopes (^{14}C, ^{40}K, ^{226}Ra,…). Waste produced from these substances is "radioactive" in so far as it contains some level of radioactivity, but is it radioactive waste?

- Royal Decree of October 16, 1991 -

The Royal Decree of October 16, 1991 amending that of March 30, 1981 setting forth the responsibilities and mode of operation of the *Organisme Public de Gestion des Déchets Radioactifs et des Matières Fissiles*[4] (ONDRAF/NIRAS) gives the following definition (Article 1):

> *"Déchets radioactifs" : toute matière pour laquelle aucune utilisation n'est prévue et qui contient des radionucléides en concentration supérieure aux valeurs que les autorités compétentes considèrent comme admissibles dans des matériaux propres à une utilisation ou au rejet sans contrôle"*.[5]

Since no concentration value has been officially determined in Belgium, we need to look at the Royal Decree of February 28 1963 on the protection of populations and employees against the danger of ionising radiation.

- Royal Decree of February 28 1963 -

Article 33 of the decree gives the following definition:

> *"Un déchet radioactif est un déchet dont le rayonnement est supérieur au fond naturel des radiations"*[6]

Natural background being defined as:

> *"l'ensemble des rayonnements ionisants, qui proviennent des sources naturelles terrestres et cosmiques, dans la mesure où l'exposition qui en résulte n'est pas augmentée de manière significative du fait de l'homme".*[7]

This official definition is nevertheless vague considering that the background level of naturally occurring radiation varies significantly between the regions:

- Altitude and soil considerably affect the level of natural radioactivity. Because of the lower altitude in Flanders and the greater concentration of ^{126}Ra in the soil in Wallonia, this definition alone could lead to the labelling of the same waste non radioactive in Wallonia while it would be radioactive in Flanders.
- Irradiation dose rate from radon emissions near slag heaps, is twice the normal value so does this make waste less radioactive when measured in Liège or Charleroi than in Louvain-la-Neuve or Arlon? Or should all slag heaps be classified as radioactive waste since people receive a man-induced significantly higher exposure to radiation in their vicinity.

Exposure or dose received by one individual is in proportion to the specific activity present in the waste (kBq. kg^{-1}). As the mean activity of the human body is 12 kBq [5], 6 kBq from ^{40}K alone, should we allow cremation of human bodies that average a specific activity in ^{40}K of 0.084 kBq.kg^{-1} [6],. Should the 6% of ashes not be considered radioactive waste since their specific activity in ^{40}K is 17 times higher, and the resulting irradiation dose, all other factors being equal, can be multiplied by the same factor?

Should incineration be banned in general because it always generates potassium concentrate, therefore ^{40}K, in the ashes? What about a patient dying after a medical radio-diagnostic or even more so a patient dying after a thyroid condition treated with ^{131}I?

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[4] Public organisation in charge of radioactive waste and fissile matters.

[5] Radioactive waste: any substance of no specific intended use that contains concentrations of radio nuclides greater than declared admissible in materials intended for use or for reject without controls by the relevant authorities.

[6] Radioactive waste is waste emitting radiation higher that the natural background.

[7] All ionising radiation from natural source, earthly or cosmic as long as exposure from such sources is not significantly increased by human activity.

It is apparent that, the current legislation does not provide a clear definition of radioactive waste. In the end, authorised experts (*Expert Agréé de Contrôle Physique*) have to decide whether they are dealing with radioactive waste or not. This system means that waste managers must either be registered experts or call upon the services of such experts. This situation invariably leads to inconsistencies in the treatment of this type of waste.

Low level radioactive waste

No official definition of a low level radioactive waste (LLRW) exists and consequently there is no official definition of very low activity (VLLRW).

A definition of low activity waste is given by J.C. Zerbib [7] as:

- Beta-gamma emitters
- Maximum alpha activity per package 370 kBq. kg^{-1}

In Belgium, *l'Organisme National pour la Gestion des Déchets Radioactifs et des Matières Fissiles (ONDRAF)* in its procedure for the collection of non-packaged waste (PR1) sets forth various requirements (8 through 12) and more specifically sets limits in specific activity (40 GBq/m^3 in beta-gamma for example).

A document that describes the treatment and packaging processes at BELGOPROCESS (industrial subsidiary of the ONDRAF), defines category A packaged waste as follows [13]:

- *Déchets bêta-gamma de faible activité volumique (quelques Ci/m^3) dont la demi-vie des radio-isotopes qu'ils contiennent ne dépasse pas 30 ans. Leur teneur en alpha et en bêta-gamma de longue demi-vie (>30 ans) est faible ou nulle*[8].

Very Low level radioactive waste

Two types of Category A radioactive waste have been defined [14], the low level radioactive waste (LLRW) and the very low level radioactive waste (VLLRW). This classification is based on the way waste is managed and eliminated at the UCL (16 –18). VLLRW is defined as follows:

- Solid, combustible or not, of medical scientific or industrial origin but excluding products of electro-nuclear origin,
- No alpha emitters (<detection limit),
- No beta-gamma emitters with half-life exceeding one year except for ^{3}H and ^{14}C,
- Beta-gamma activity no greater than 200 MBq per batch[9] containing radioisotopes of over 60-day half-life,
- Activity of the batch[9] limited to 1 GBq in ^{3}H and 500 MBq in ^{14}C.

Radioactive waste collected by the *Waste Management Centre* that meets the above criteria is treated as Very Low Level Radioactive Waste and is thus handled and eliminated by the UCL. Waste that does not meet these specifications must be treated as Low Level Radioactive Waste and sealed in 220-litre containers to be sent to ONDRAF/NIRAS for treatment.

Legislation makes provisions for the elimination of single risk waste. In fact, most waste combines several risks and with the lack of clear guidelines, the waste manager has to evaluate which is the greater risk and come up with a strategy that satisfies the different legislation as best as possible.

Dangerous radioactive/biological hazard mixed risk waste

As mentioned earlier, waste produced in university or research laboratories often present a radioactive risk mixed with biological risk. With this type of waste, we need to decide whether it is a case of radioactive waste with associated biological risk or a biological waste with associated radioactive risk.

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[8] Beta-gamma waste with low volume activity (a few Ci/m^3) whose isotope's half-life does not exceed 30 years. Long half-life (> 30 years) alpha and beta-gamma content is low or nil.

[9] A batch is a set of packages collected on a given date from a given producer.

As illustrated in figure 1, solid dangerous radioactive-biological waste is treated primarily as radioactive when collected from the producing unit. If the radionuclide has a half-life greater than a year and is not a radioisotope of ^{3}H or ^{14}C, the residue is classed as LLRW. Such residue amounts to about 2 to 3 % of the total volume of solid radioactive waste collected by the Centre and are packaged and sent to the ONDRAF. All other waste is treated as VLLRW and stored to decay until the radioactive risk becomes negligible and the waste can be eliminated.

Practical Issues in the Management of Waste at the UCL

Personnel information and training

An essential aspect of waste management is informing and training the producers of waste. Seminars on dangerous waste are organised on a regular basis in the relevant research laboratories. The prime objective of these sessions is making the laboratory personnel aware of the need to sort their waste before packaging it. Information exchanged during these sessions enable the waste manager to gather information on the type of residue produced as well as the risk potential involved, a notion best evaluated by the researchers themselves.

Each individual employed at the UCL, both in Wallonia and in Brussels, receives a six-page document adapted to the regional legislation. The document describes the different categories of residues generated by the University together with the treatment methods applicable to dangerous waste. An important chapter also deals with radioactive waste.

In a university, the staff turn over (undergraduates, research assistants, doctorate students, …) is very high. Ideally, the information and training process should be continuous. With this in mind, a plastic-coated card is displayed in the sorting and packaging areas of each laboratory. Together with the colour coded packages to be used for the different type of substances, the card also stresses that in cases of combined risks, the radioactive risk takes priority, and provides phone numbers where more information can be obtained. Furthermore, a Webb site including all operating procedure is being prepared for the UCL intranet.

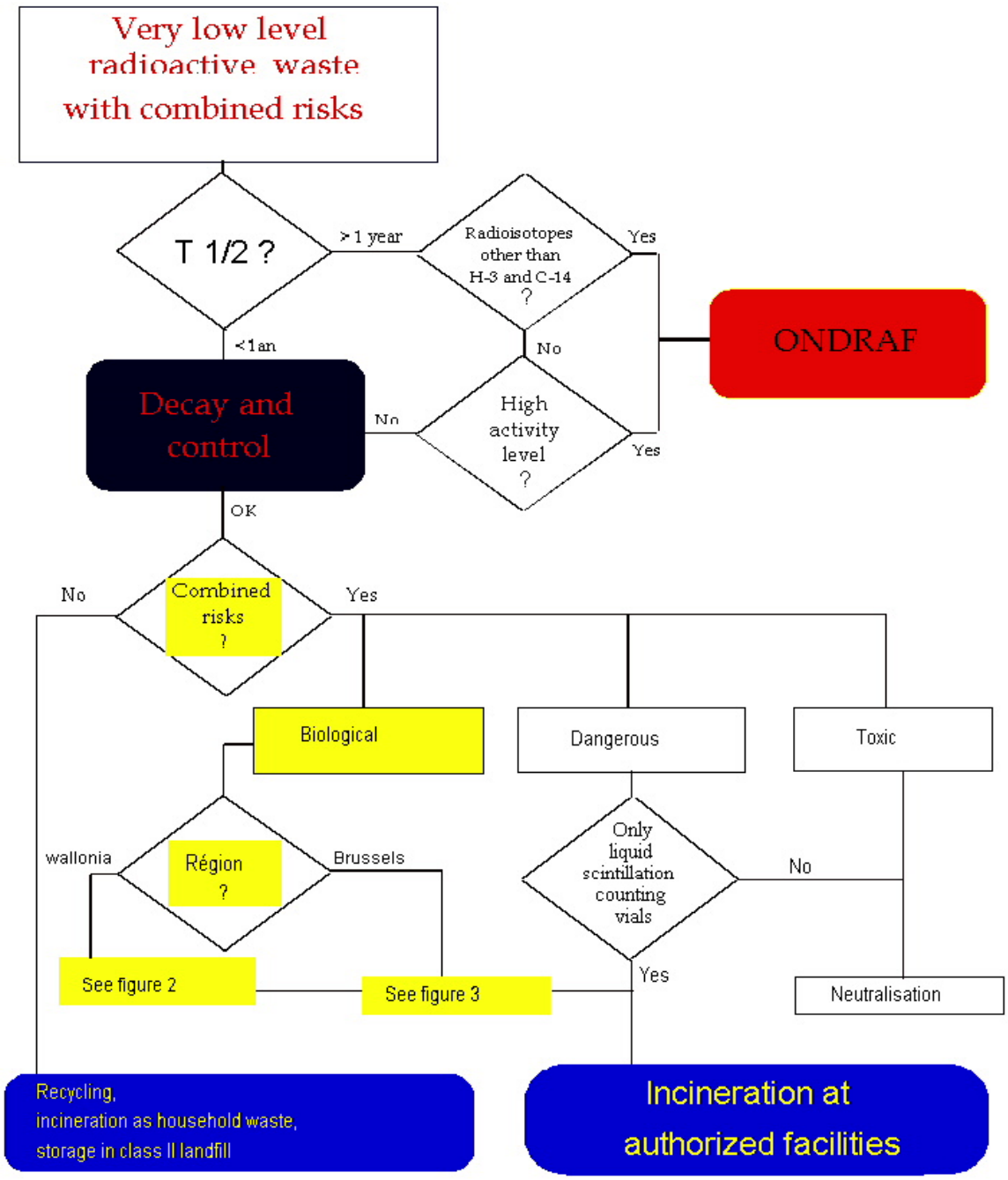

Figure 1: Flow chart for handling Category A radioactive solids with associated risks

Types and quantity of waste at the UCL

Waste produced at the UCL is sorted and identified by their producers (unit, department…) according to a procedure set up by the Waste Management Centre. Figure 1 shows for each category of waste the amount collected in a year.

Dangerous biological waste	39.000 kg/an
Radioactive waste	36.000 kg/an
Dangerous chemical waste	32.000 kg/an
TOTAL	107.000kg/an

General Procedure for Waste Management at the UCL

Because the two UCL sites are located in two different regions, two procedures must be drafted, one for waste produced at Louvain-la-Neuve, and the other for waste produced at Woluwé-St-Lambert. The basic principle is to isolate the waste in appropriate installations until a sufficient amount of radionuclide has disappeared by radioactive decay so that potential residual risk from incineration is acceptable. Incineration is the method recommended by regional legislation for disposing of waste contaminated by mutagenic, carcinogenic, teratogenic or phathogenic agents often associated with radioactive risk.

Waste is collected from a unit in batches, evaluating the activity of the batch from the movements of labelled molecules in and out of the laboratory since the last collection. Each package in the batch is identified individually to ensure full traceability up to elimination. A batch is either LLRW or VLLRW depending on its contents.

Packages of a batch of VLLRW are stored for two years in numbered movable containers, themselves stored in identified storage areas. The characteristics of each batch are entered in a database as follows:

- Batch number
- Date of entry
- Origin
- Area and container numbers
- Characteristics: isotopic nature,
  package type,
  estimated activity of each isotope.

Theoretical authorisation for removal from store after decay

At any moment, the waste manager can obtain a list of batches of VLLRW which can be removed from the store in order to be eliminated by incineration. The management software carries out the calculations using the following parameters:

- isotope activity initially encoded in the data base
- daily average volume of ash produced by the incinerator
- daily average volume of gas emitted by the incinerator
- table of radioactive half life of the radio-isotopes concerned
- derived air concentration (DAC) for gaseous release
- table of clearance levels

The outcome proposed by the system represents the theoretical percentage of the activity released compared to the legal maximum fixed values. These are established according to the nature of the radioisotope, the latter ending up in fine in gaseous effluents and/or in solid effluents.

In gaseous effluents, the maximum is defined in article 36.1 of the Royal Decree of 1963. This maximum is equal to 2.10^{-2} times the figure found in column 5 of annex II (DAC 40 hour per week) of the Royal Decree and is expressed in Bq per m^3 at the point of emission. The DAC 40 hour per week represents the derived air concentration for people exposed to ionising radiation in the course of their job.

For solid effluents, no value has been defined by the different legal texts. We have therefore used the unconditional clearance levels proposed by the International Atomic Energy Agency (IAEA) in solid residues [15]. The maximum is expressed in Bq per g of matter.

Practical control before clearance

As we have just seen, the decision of the software to clear VLLRW is based, among other things, on activity data and the radioisotopes encoded at the beginning. This information is mostly given by the producers on the collection form. The data is not entirely reliable especially as we also collect from external sources where we have no means of checking the activity of radioisotopes entering these institutions.

A system of activity control, fully automatic, allows us to verify that there is no residual contamination in each package of each batch. Up to 30 bags or boxes can be loaded onto the baskets of a conveyor system that brings each package in turn in the shielded chamber of a disused whole body counter. Each basket turns for a pre-set time in front a series of detectors (three thin NaI detector with beryllium window, 50 cm high plastic scintillation detector, one large 5X 3-inch NaI detector and a germanium detector for qualitative analysis. The

first basket contains a phantom made of a series of ^{207}Bi calibrated sources. It is used to compare the values measured by the detectors with recorded values in the same regions of interest (ROI). The operator is alerted in case of discrepancies.

Before sending the first sample basket, a comparison is made in the different regions of interest between the measured background noise and the recorded values. If the measured background is within the statistical error of the recorded values, the first sample basket is sent for counting. Then, the sample is transferred out of the counting room and a second background reading is taken. The sample measurement is only validated if both background readings give matching results.

A list of negative packages of the batch is drawn up and green stickers are affixed onto the cleared packages.

Elimination of the waste

Louvain-la Neuve is in Wallonia and it can be said that after radioactivity decay, we are handling a B2 type biological waste, the only biological type to be considered potentially dangerous. At this point because only the biological risk is involved, the waste must be eliminated according to the legislation for this type of waste. In Wallonia, there are four options for disposing of B2 type waste (figure 2).

- Contracting out to an authorised firm: it is a costly solution
- Converting to class A waste: this option is not authorised in our facilities,
- Burning in own incinerator: the university does not have an incinerator at Louvain-la-Neuve,
- Sending to a specialised facility duly authorized: this is the solution which is used actually.

Radioactive waste produced at the Woluwé-St-Lambert site are held locally during the period of decay and then transported to the activity control unit at Louvain-la-Neuve. For transport purposes, it is not treated as “special” but as radioactive waste. It is only after it has been verified, at LLN that it contains no radioactivity that it can be declared a B2 as we are in Wallonia.

If the "special waste" were to be treated in the Brussels Region, it would need to:

- Go through a disinfecting process: again this option was discarded because IBGE (Institut Bruxellois pour la Gestion de l’environnement) does not allow this option.
- Be incinerated in a specialised facility: this solution has been used until recently because the UCL had its own facility specialised in the destruction of hospital waste, near the St Luc clinics. This facility was the only one authorised in the Brussels region.

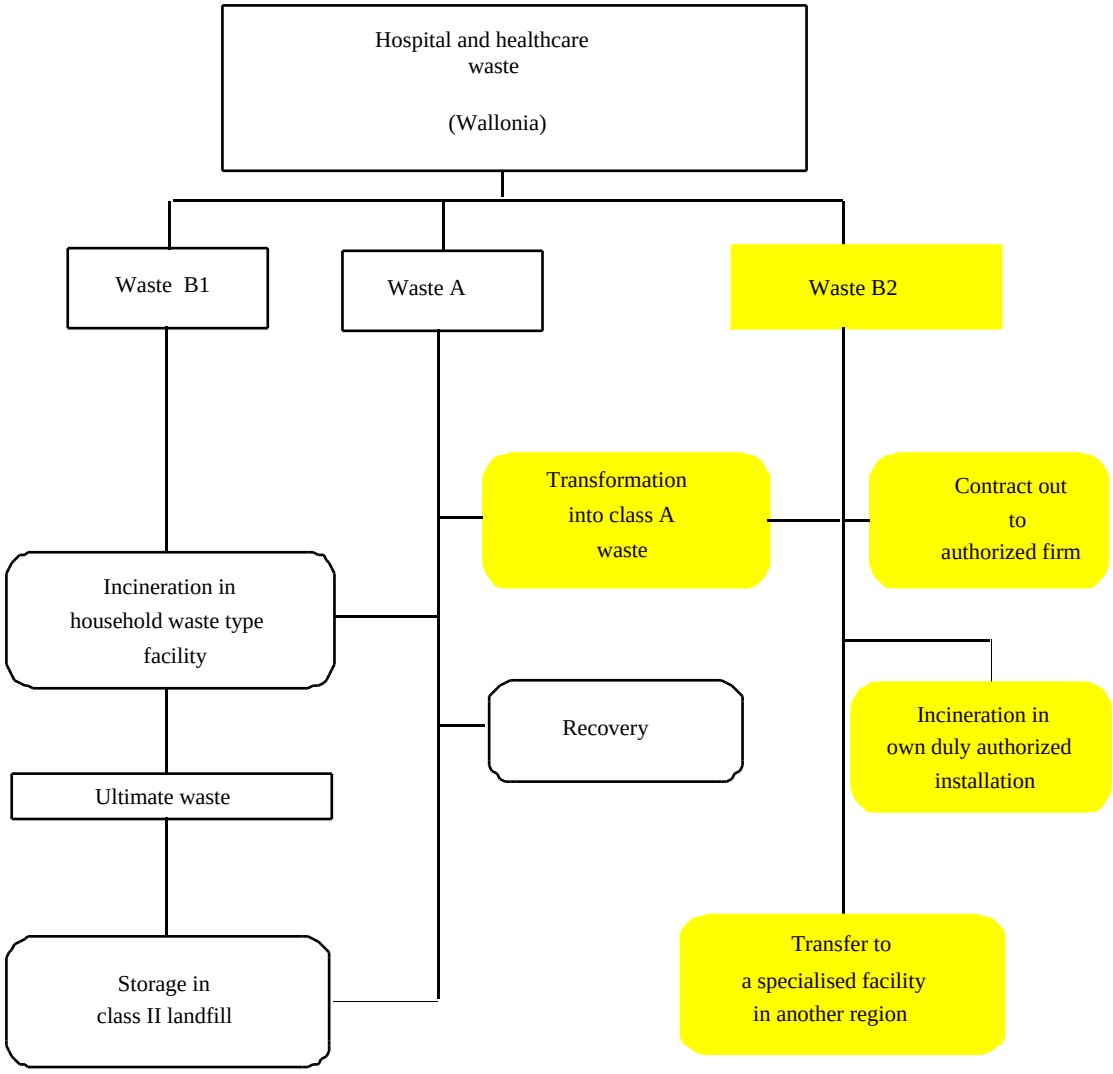

Figure 2: Elimination Process for dangerous biological waste in Wallonia

Conclusion

A university produces a large amount of waste, which can be of a hazardous nature. This is the case with radioactive waste and dangerous waste. Often theses types also present associated risks.

If the ALARA principle is to be applied to global waste management, then new horizons must be sought and the issue extended beyond radioactive risks. This opening to the non-radioactive implies however that several competences are mustered within a central organization. The waste management centre at the UCL can call upon:

- Advisors on work safety and accident prevention for all aspects relating to the protection of workers
- Chemists for the management of chemical substances.
- Biologists for the management of genetically modified organism (GMO), carcinogenic substances, …
- Certified experts on the control of ionising radiation for aspects relating to radioactivity (experts de contrôle physique des radiations ionisantes).
- Advisors on transport safety for aspects relating to loading, transportation and unloading dangerous substances (conseiller à la sécurité des transports de matières dangereuses)..

Because of the association of these multiple competences, it was possible to set up procedures of management practices, not readily available in the various legislations that tend to be applicable to very specific types of waste.

Although the UCL system of waste management is not perfect, and there must be room for improvement, the fact that it exists should be highlighted especially when waste from medical or other origins has recently been found in public landfill sites or in the ashes of incineration units.

One of the main difficulties, however, is the near impossibility of creating an organisational culture in the area of waste management. For example, how do we instil in workers operating in both Woluwé St Lambert in Brussels and in Louvain-la-Neuve in Wallonia that they should place used paper in yellow containers in Brussels and white ones in Wallonia? How do we explain that in Woluwé St Lambert, they should place household waste in grey bags and biological waste in yellow bags while Ottignies-Louvain-la-Neuve has retained a yellow bag for household waste? How do we explain that in the future they should sort and classify waste according to a catalogue description even where this not always evident and this catalogue does not even exist in the other region…?

Another important point that should be mentioned is the unenviable position of anyone managing "dangerous waste". If the waste is not listed in the catalogue, can we conclude that the waste is not dangerous? When we are confronted with VLLRW and its associated risks, the waste manager must comply simultaneously with the diverse legislation pertaining to each type of "dangerous waste", whether it is radioactive, biological, chemical or of another category. This situation often resembles the squaring of the circle! For example, how does a manager of the UCL, with its main campus in Wallonia and its Medicine Faculty in the Brussels Region, who has to drive across the Flemish Region to get from one site to another, react to radioactive and biological mixed waste when:

- Walloon legislation imposes the packaging of hospital waste or similar in plastic bags marked with the "Biologically hazardous" sign and displaying *Déchets d'activités hospitalières et de soins de santé - Classe B2* (Waste emanating from hospital activities and health care - Class B2)
- Brussels-Capital Region legislation says the waste be placed in yellow bags with the reference *Déchets spéciaux d'activités de soin -Spéciale afvalstoffen afkomstig van activiteiten inzake gezondheidszorg* (Special waste from health care activities)
- Flemish legislation names this waste: *risicohoudend medisch afval* (Hazardous medical waste).
- At the federal level, radioactive waste that can be incinerated must be packaged in transparent bags displaying the radioactive sign.

What should the manager do when regional legislation dictates that biological waste should be incinerated within 24 hours of its collection whereas federal legislation regarding radioactive waste forbids its elimination while it is still radioactive?

How should a manager clear solid VLLRW when the federal legislation does not refer to any clearance level at all.

Clearly, within the current legal framework, the position of a manager of mixed risk VLLRW is far from comfortable. The waste manager is in a very vulnerable situation indeed. Each decision could be improper in one legislative framework or another, each VLLRW clearance could lead to being criticised for discharging radioactive waste into the environment.

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