UNIROYAL CHEMICAL

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MS 16

Q-8

John R. McGrath, Senior Health Physicist
Nuclear Materials Safety Branch
Div. Of Radiation Safety & Safeguards
US NRC Region I
475 Allendale Road
King of Prussia, PA 19406-1415

Response to request for additional information by John R. McGrath for:
NRC License No. 06-00221-08
Docket No. 030-03759
Control No. 120452

Dear Mr. McGrath:

As discussed with you in a telephone conversation, Uniroyal Chemical Company would prefer to lower the scope of the license by changing the classification from a Type A broad license to a Type B license. It is my understanding that this would permit the RSO to authorize and approve new users and uses for radioisotopes in circumstances where currently the RSC must convene to make the decisions. Since the group of users (approximately 16-18 persons) and nearly all of the uses of radioisotope is in a single location at the company headquarters in Middlebury, CT, and carbon-14 in millicurie or lower amounts is the only isotope regularly used, the RSO can easily and safely oversee the entire program. This change will greatly simplify the management of the program. The program will continue to be supervised and monitored by upper management and be carried out by the RSO assisted by several aides (essentially, an unofficial radiation safety committee).

If it is deemed permissible to replace the RSC by the RSO, the wording in statements below should be changed to reflect this. That is, where RSC responsibilities are mentioned, the responsibilities will be assumed by the RSO.

In response to the request for additional information in letter of Aug. 3, 1995:

1. Currently all radioisotope-containing packages received are monitored, using a survey meter, for contamination at the package surface by the RSO or a person designated by the RSO. Since only C-14 is being received, we have never encountered any radiation at the package surface by this detection method. Naturally if there is no detectable radiation at the package surface, it was felt that there was no need to determine the radiation level at the 1 meter distance. In the unlikely event that we should order and receive any materials which could produce radiation at the 1 meter distance or materials with a "Yellow II" label, we do monitor these packages at the 1 meter distance. Since the NRC feels that it is necessary to monitor all packages regardless of isotope or quantity at 1 meter, this procedure will be added to the normal routine for monitoring incoming packages.

   All packages received currently are also wipe tested on the outer surface as well as the surfaces of each of the inner packing containers. Contaminated inner packages are discarded as radioactive waste or decontaminated, whichever is deemed most appropriate. Contamination levels are determined by liquid scintillation counting (LSC) of the wipe patches.

2. A program for annually reviewing the radiation protection program and implementation has been formulated as follows:

   a. The Radiation Safety Officer (or Radiation Safety Committee), the Chemistry Section Manager and any interested persons will meet on an annual basis to review the radiation safety program as practiced during the previous twelve month period and to discuss positive changes which could be put into place during the upcoming twelve month period. The items to be reviewed shall include but not be limited to:

      1.) All points mentioned in the materials license
      2.) Materials users, with respect to:
            a) Safety habits as practiced
            b) Attitudes regarding safety
            c) Special circumstances, if any
      3.) Receipt, storage and shipment of radioisotopes
      4.) Waste storage and disposal of radioisotopes and contaminated materials
      5.) New associates (users) training and refresher training for current associates (users)
      6.) Record keeping
      7.) Emergency procedures, including spills and/or losses
      8.) The general level of compliance with NRC regulations

   A copy of the minutes from this meeting will be sent to the Research Director of

the Crop Protection Division.

b. As part of the normal annual review of all Uniroyal associates who work with radioactive materials, their conduct and performance regarding the use and handling of such materials is included, as indicated above. This is an essential and integral part of the safety procedures in place for the entire R&D staff. The review is performed by the Senior Group Leader in charge of the individual and ultimately by the Section Manager, and is a part of the normal annual performance review required for continuing employment. A copy of the evaluation and any recommendations is given to the Research Director.

The RSO is also reviewed by the Section Manager, who is a member of the RSC and has many years of previous experience working with radioisotopes.

c. Since all stocks of radiolabeled materials except for those actively in use in a study system are maintained by the RSO, the inventory is currently in control of the RSO and the RSC. The inventory is reviewed quarterly by the RSO and the Section Manager. Monthly wipe test surveys are taken all work areas. These wipe tests are performed by an associate who is not involved in working with radioisotopes in the laboratories. The results are reported to the RSO, Section Manager and circulated to everyone actively working in the areas where radioisotopes are being used. Currently, only new user's procedures are regularly evaluated through observation and discussion at quarterly intervals with management and/or RSC meetings. This is being expanded to include evaluation of all users on at least a quarterly basis.

3. All authorized users must have as a minimum a high school diploma or equivalent. A science degree from a two year or four year college is preferred but may be complemented by additional training. Prior to working with any radioisotope, the new user receives instruction in the basics of radiation in general and radioactivity as it pertains to the material with which he/she will be working. The person is instructed in the safe and proper way to handle the radioactive materials, the need for suitable protective clothing, procedures for safe disposal of contaminated materials, methods of quantitation of radioactivity and types of calculations needed for determining levels of radioactivity as required by individual projects. In addition, the new worker receives other training in safety rules and procedures for working with hazardous materials in general, which are mandated by various other federal agencies. Once the worker has received instruction regarding radioisotopes usage and has read the various informational material distributed to him, he signs a document certifying that he has completed preliminary training. A novice worker is then assigned to work under the supervision of an experienced veteran worker until he or she has demonstrated competence in the safe and proper use and handling of the various radiolabeled materials. New users handle only

small amounts (2- 4 mCi or less) until they have demonstrated ease and competence in working with labeled materials. Once the worker has demonstrated the capability to handle the material in a safe and knowledgeable manner, he/she is permitted to take on assignments or projects involving the use of larger amounts (5-25 mCi) with minimal supervision. He/she is still required to continue to display care and skill in maintaining low levels of contamination commensurate with the task he is performing.

4. Refresher training is performed at various monthly Section Meetings, at which attendance is mandatory for all Section members, including those not working with radioisotopes. A portion 3-90 minutes) of the 5 hour meeting is dedicated to safety considerations. A record of the meeting and signed attendance sheets are maintained by the Section.

   Since the type of work being performed consists primarily of using low levels of carbon-14 radioisotope as a tag in radiotracer studies in plant, animal, soil and water matrices, refresher training consists mainly of reviewing the general procedures in safe handling of labeled chemicals, special procedures for such things as receipt and disposal, and updating of changes made due to new state or federal regulations, company policy or Section policy. On occasion an outside consultant may be brought in for a seminar. Videos, when appropriate, are rented for viewing.

   When problems or unsafe occurrences are encountered, they are discussed in the forum of the monthly meeting and a consensus is reached on how to resolve the problem or avoid it in the future.

   Much of the pertinent training involved in the safe handling of 14C labeled materials is the same as for handling dangerous and toxic chemicals. Therefore the general laboratory safety training carried out at each monthly Section Meeting also supplements the regulation for refresher training.

   In order to keep abreast of the field, the RSO attends various seminars and workshops sponsored by independent agents, the state and the NRC, as available. Any pertinent information is conveyed back to the users at the monthly Safety meeting and/or by issuance of special memos.

   The training program is currently undergoing expansion and improvement. A copy of the general outline is included with this submission along with copies of several of the Figures and Documents used as teaching aids. These are modified and upgraded at regular intervals as required.

5. This item was included in the license application at the suggestion of a guest speaker from the NRC at a meeting of the Connecticut LLRW generators forum.

It was intended to cover the possibly receipt of transuranics commingled with ordinary radioactive waste in the ash material returned from combustion of radioactive waste returned to the generator for storage until a disposal site in the Region is opened. However, with the reopening of the Barnwell, SC disposal site, and the steam reforming process of waste combustion in which each generator can be assured of receiving only his own waste back, this item is no longer necessary. I would like to withdraw it from the application.

6. In order to release facilities or equipment for unrestricted use, the area or equipment is decontaminated by thorough cleaning until contaminated areas or equipment checks show levels of residual radiation below the levels shown in Table 1 of Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material, April 1993. A calibrated survey meter will be used to determine fixed contamination on surfaces. Removable contamination will be determined by wipe tests using either dry filter paper wipe tests pads specifically designed and sold for that purpose. The radioactivity on the pads will be determined by LSC and corrected for background and counter efficiency. Hoods and ductwork will be checked at the intake and outlet areas, and if contaminated above acceptable levels, will be either cleaned if possible or scrapped as radioactive waste. Reusable equipment such as refrigerators will not be released for food uses, only for chemical storage.

Any surfaces not able to be cleaned to below the acceptable levels will be removed and disposed of as radioactive waste. The Radiation Safety Officer or in his/her absence, a member of the Radiation Safety Committee, will review and approve the survey prior to releasing any contaminated equipment or area for unrestricted usage.

Sincerely,

William H. Harned

William H. Harned, Ph.D.
Radiation Safety Officer
Crop Protection Chemistry Sect.
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RADIATION SAFETY TRAINING

- Each person is responsible for completing the radiation safety training forms.

- What is radiation?
  - Photons - u.v. or γ
  - α - Helium Nucleus
  - β - Nuclear Electron
  - Neutrons
  - Protons

- What is exposure?

- What are T, D, and S?

- What is A.L.R.A.?

- How do you measure radiation?
  - G-M Tubes
  - Gas Flow Counters
  - Liquid Scintillation Counting (LSC)
  - Film Badges
  - Personal Dosimeters

- Who is in charge here?

PROPERTIES OF THE MOST COMMON TYPES OF RADIATION PARTICLES PRODUCED BY RADIOACTIVE DECAY

Particle	alpha	beta*	gamma
Composition	protons (2), neutrons (2)	electron (1)	photon
Mass (amu)	4	0.00054	-
Charge	+2	-1 (+1)	0
Max. distance in air	a few cm's	1000 inches	very far
Quality factor (damage to tissue rating)	20	1	1

* A few isotopes produce a positron, the positively charged counterpart of the electron.

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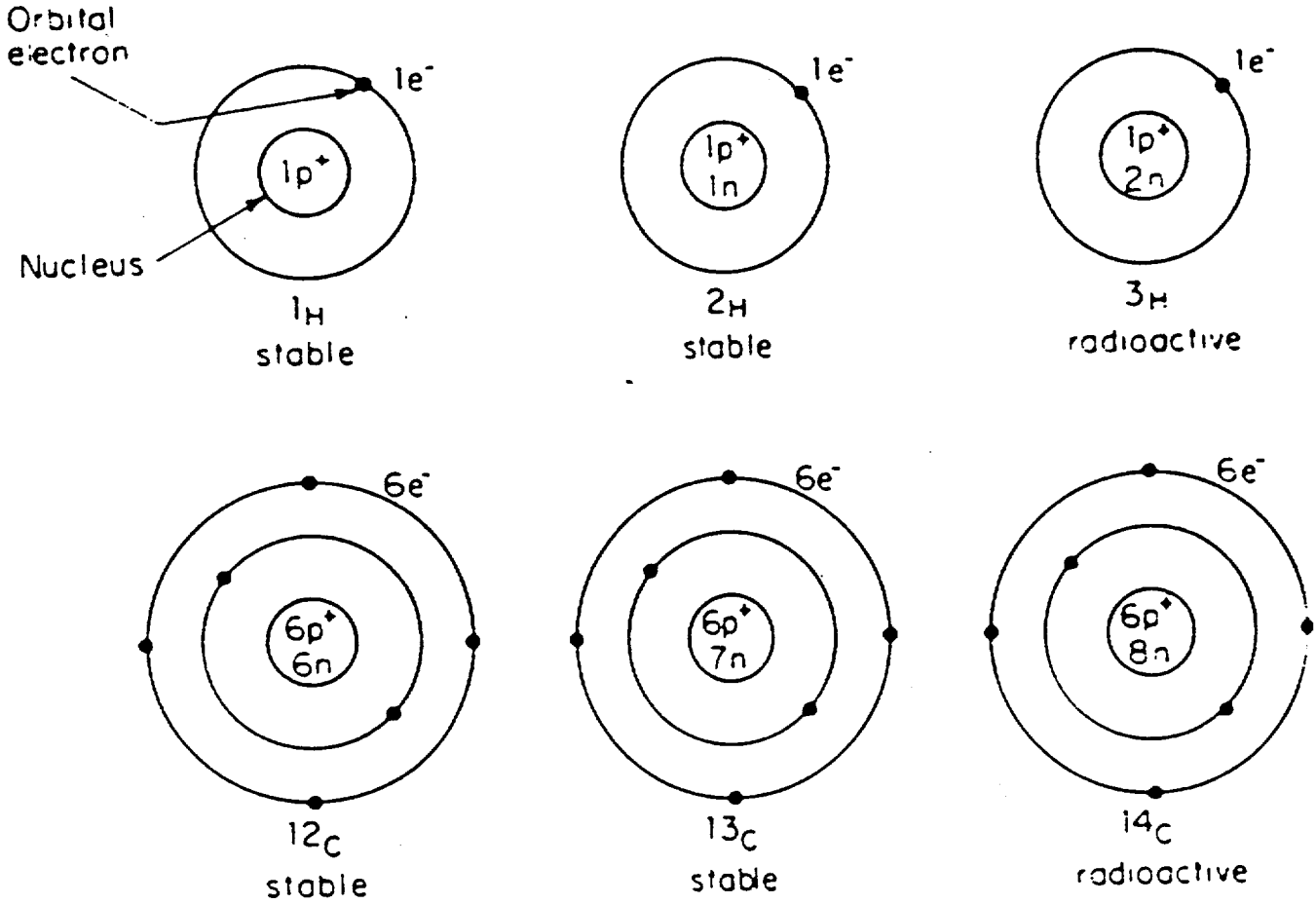
THE THREE ISOTOPES OF CARBON AND HYDROGEN



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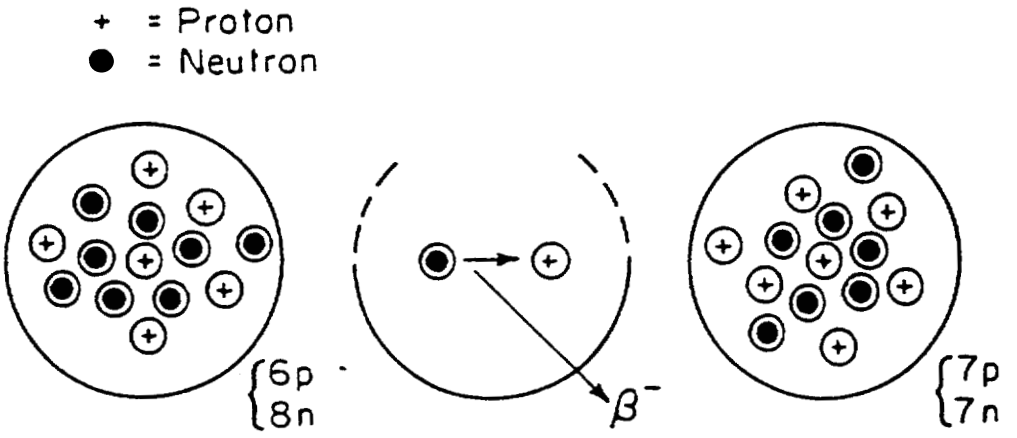
DECAY OF THE CARBON-14 NUCLEUS



The carbon-14 nucleus contains 6 protons and 8 neutrons.

It is not stable. The ratio of neutrons to protons is too high.

The ratio is changed by the spontaneous transformation of one of the neutrons into a proton and the emission of an energetic beta particle (negative) from the nucleus.

The average lifetime of the nucleus is 8250 years.

The resultant nitrogen-14 nucleus (7 protons, 7 neutrons) is stable.

ISOTOPES COMMONLY USED IN BIOLOGICAL RESEARCH

	^{3}H	^{14}C	^{32}P
Half-life	12.3 yr	5,730 yr	14.3 dy
Max. beta energy (MeV)	0.018	0.154	1.71
Avg. beta energy (MeV)	0.006	0.050	0.70
Range in air (ft)	0.02	1	20
Range in density 1.0 material (cm)	0.00052	0.029	0.8
Dose rate from 100 beta particles/cm2/sec (mrad/hr)	-	64	12
Fraction transmitted through dead skin layer (0.007 cm)	-	0.11	0.95

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DEFINITIONS FOR AMOUNTS OF RADIOACTIVITY

- CPM = counts per minute
- DPM = disintegrations per minute
  = CPM x 1/efficiency of measurement
- CPS = counts per second
- dps = disintegretions per second
- 1 millcurie (mCi) = 2,220,000,000 DPM
  (2.22×10^9 DPM)
- 1 microcurie (μCi) = 2,220,000 DPM
  (2.22×10^6 DPM)
- 1 becqueral (Bq) = 1 disintegration per second (dsp)
- 1 mCi = 37 Mbq (37 megabecquerals)
- SA = Specific Activity = Radioactivity per unit mass or unit volume

  eg. mCi/mmole, DPM/μg, μCi/mL, etc.

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DEFINITIONS OF RADIATION DOSE

- RAD = unit of absorbed dose
- 1 RAD = the quantity of any ionizing radiation imparting 100 ergs/g to matter
- REM = unit measuring the damage done to the body
- REM = RAD x QF

  where QF is the "quality factor" of the type of radiation. The "quality factor" indicates the damage potential of the particular type of radiation.

RADIATION TYPE	QF
gamma ray, X-ray	1
beta particle, positron	1
proton, neutron	10
alpha particle	20

HANDOUTS

- What is Radiation?
- Carbon-14 facts sheet / radiation dose units
- α, β, and γ particles / comparison of ^{3}H (tritium), ^{14}C, and ^{32}P
- US Nuclear Regulatory Guide 8.13 -- Prenatal Radiation Exposure
- US Nuclear Regulatory Guide 8.29 -- Risks from Occupational Radiation Exposure
- National Low-Level Waste Management of Carbon-14
- Uniroyal Chemical Laboratory and Field Safety Rules for Working with Radioisotopes