VOID SHEET

TO: License Fee Management Branch

FROM: RIII - CHARLES E. GILL

SUBJECT: VOIDED APPLICATION

Control Number: 301848

Applicant: University of Wisconsin - Madison

License Number: 48-09843-18

Docket Number: 030-03465

Date Voided: May 8, 1998

Reason for Void: No licensing action was required.
(The licensee's regulatory question was responded to by letter).

Charles E. Gill May 8, 1998
Signature Date

Attachment:
Official Record Copy of
Voided Action

FOR LFMB USE ONLY

___ Refund Authorized and processed

___ No Refund Due

✓ Fee Exempt or Fee Not Required

Comments: _____ Log completed ✓

_____ Processed by: SAC 6/10/98

_____

9806110161 980508
PDR ADOCK 03003465
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ML 30
BT

BETWEEN:

License Fee Management Branch, ARM
and
Regional Licensing Sections

(FOR LFMS USE)
INFORMATION FROM LTS

Program Code: 02110
Status Code: 2
Fee Category: 7B EX 2C 2B 1D
Exp. Date: 19940331
Fee Comments: 170.11(A)(4)
Decom Fin Assur Reqd: Y

R6

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
   Applicant/Licensee: WISCONSIN-MADISON, UNIVERSITY OF
   Received Date: 960919
   Docket No: 3003465
   Control No.: 301848
   License No.: 48-09843-18
   Action Type: Amendment

2. FEE ATTACHED
   Amount: 0
   Check No.: 0

3. COMMENTS

Signed Maria Gibson
Date 9/25/96

B. LICENSE FEE MANAGEMENT BRANCH (Check when milestone 03 is entered /)

1. Fee Category and Amount: 7B EX 2C 2B 1D

2. Correct Fee Paid / Application may be processed for:
   Amendment /
   Renewal
   License

3. OTHER

Signed AC
Date 9/25/96

1996 SEP 25 AM 10 50

Log Sep 10 III
Remitter
Check No. 170.11A(4)
Amount
Fee Category 7B EX 2C 2B 1D
Typed Fee AMD
Date Check Rec'd
Date Completed 9/25/96
By: AC

FEE EXEMPT

OCT 02 1996

UNIVERSITY OF WISCONSIN MADISON

September 13, 1996

U.S. Nuclear Regulatory Commission, Region III
Nuclear Materials Licensing Section
ATTN: Patricia Pelke
801 Warrenville Road
Lisle, Illinois 60532-4351

RE: Additional Information -- Request for Disposal of Organic Liquid Wastes Under the Provisions of 10 CFR 20.2002, Control # 98903 / Docket # 030-03465

Dear Ms Pelke:

Reference your request for additional information dated 13 August, 1996 which stated:

> We have also reviewed the additional information you provided for authorization to dispose of organic liquid wastes under 10 CFR Part 20, Section 20.2002. Based on the information you provided in your December 23, 1995 letter, the purpose of your request is to extend the exemption specified in 10 CFR Part 20, Section 20.2005(a)(1) for liquid scintillation counting medium to other organic liquids. Your submittal references both Sections 20.2002 and 20.2005 of 10 CFR Part 20, and it appears that the specific wastes that are generated would meet the criteria in 20.2005(a)(1) if they were not subsequently mixed with other organic solvents.
>
> The information submitted indicates that you propose to incinerate these "organic liquids" as "non-radioactive" at any EPA permitted/licensed commercial hazardous waste incinerator and you submitted an assessment of the dose along with your assumptions. In your evaluation, you assume 100% combustion of the hydrogen-3 and carbon-14 and release as effluent from the incinerator, but you did not submit sufficient information to validate your assumption of 100% combustion for these radionuclides. In addition, you did not address the fraction of these radionuclides that may be retained in the incinerator ash that will subsequently be sent to a landfill, and the dose to the general public that will result. Your evaluation also needs to account for (or at least address) reconcentration and migration of the carbon-14 to potable water supplies at the landfill. In order to further consider your request, it will be necessary for you to submit the additional information discussed above. You should also review the requirements of 10 CFR Part 51 (copy enclosed) and be aware that an Environmental Impact Statement may be required to support the disposal request unless you can demonstrate that you meet the criteria for a Categorical Exclusion (10 CFR Part 51, Section 51.22).

Your first assumption is correct. We are placing this request under provisions of 10 CFR 20.2002 ***Method for obtaining approval of proposed disposal procedures*** and in our previous letters dated 28 July 1995 and 23 December 1995 we provided information relevant to 20.2002 (a) - (d). Our contention is that these ^{3}H and ^{14}C organic wastes would meet the criteria specified in 20.2005(a)(1) if there were not additional organic components.

Our letter of 23 December 1995 demonstrated that "the total dose to the maximally exposed individual for a 1 time incineration of our accumulated mixed waste would be approximately 0.0344 mrem" and that "the continuing dose would be approximately 0.0007 mrem from ^{3}H and 0.0046 mrem from ^{14}C for a total of 0.0053 mrem."

pm: 9-17-96
170.11(a)(4)
FEE EXEMPT
Continuation of 98903

RECEIVED
SEP 19 1996
REGION III

30148
OCT 02 1996
SEP 19 1996

Safety Department
University of Wisconsin–Madison 30 North Murray Street Madison, Wisconsin 53715-2609
608/262-8769 FAX: 608/262-6767

To obtain answers to the questions you posed, we contacted Dennis Warshall in the Thermal Operations Group of AETS at the Trade Waste facility (618/271-2804). We assumed 100% combustion but we asked the following two questions about the products of combustion and are indicating the response:

1. In an EPA approved Chemical / Organic incinerator, what is the efficiency of the system (e.g., how efficient is it in breaking down the organic molecules)?

   The destruction required efficiency (DRE) is 99.99% The lowest he's ever actually seen it is 99.999% for carbon tetrachloride

2. What are the byproducts, that is, what happens to Hydrogen and Carbon molecules in the burn (i.e., do they become CO2 and H20?) and with what general efficiency?

   Yes, CO_2 & H_2O, > 99% combustion efficiency as measured by a carbon monoxide (CO) meter.

Thus there is essentially no solid waste and we were informed as follows:

3. What happens to the effluent? If this goes through an x-stage hepa filter, what percent goes up the stack, what is trapped in the filter?

   No HEPA. TWI has a dry scrubber and baghouse. The scrubber injects a solution ($Ca(OH)_2$) to react with the acid flue gases. The reacted solids are caught by the baghouse. Their permitted maximum particulate release level is 0.08 g/dscf although they typically emit ~ 0.003 g/dscf

4. What happens to the solid waste, what does it consist of (i.e., are there hydrocarbon remains and if so how much)?

   Solid waste, that is, the baghouse filter cake, is stabilized (e.g., concrete) and buried at a hazardous waste landfill (Adams Center, Fort Wayne, Indiana). No leachable waste is allowed into the landfill which is double lined and has leachate collection systems.

Thus, 100% combustion is a valid assumption. However, assuming some residue in the bag house or other solid waste stream, the EPA and state natural resources / pollution regulations require wastes from chemical incineration to be buried in a hazardous waste landfill. The requirements for such a landfill is that it be double lined with a leachate collection system. Thus, the risk of contamination of the potable water is nonexistent.

As we stated initially, these wastes are essentially liquid scintillation cocktails (LSC), and the route of disposal for organic LSC with concentrations < 0.05 μCi/gm is destruction via EPA licensed incineration. When the NRC adopted 20.2005(a)(1), the doses to the population from such disposal were evaluated and considered acceptable.

Therefore, request permission to be allowed to consider approximately 95 mCi of ^{3}H and 11.7 mCi of ^{14}C as non-NRC regulated organic solvent waste and (annually) to consider an annual average of 10 mCi of ^{3}H and 2 mCi of ^{14}C as non-NRC regulated organic solvent wastes. The average concentration of these wastes will be less than the 20.2005 levels of 0.05 μCi/gm for LSC wastes which are regarded "as if it were not radioactive."

If you have any questions pertaining to this item, please call me at (608) 262-9178 or FAX me at (608) 262-6767.

Sincerely,

Ronald R. Bresell

Ronald R. Bresell
Radiation Safety Officer

MAY 1 9 1998

Ronald Bresell
Radiation Safety Officer
University of Wisconsin - Madison
Safety Department
30 North Murray Street
Madison, WI 53715

Dear Mr. Bresell:

SUBJECT: REQUEST BY THE UNIVERSITY OF WISCONSIN (LICENSE NO. 48-09843-18) TO DISPOSE OF ORGANIC SOLVENTS CONTAINING ^{14}C AND ^{3}H (CONTROL NO. 301848)

This is in response to your request, letters dated July 28, 1995, December 23, 1995 and September 13, 1996, to dispose of radioactive waste pursuant to the Nuclear Regulatory Commission's (NRC) regulations at 10 CFR 20.2002 as if it were "not radioactive." We have completed our review of your request. For your convenience, we have restated your request, our regulatory review and our conclusion below.

LICENSEE REQUEST:

In its request, the licensee stated the following concerning the waste:

1. The radioactive waste consists of liquid scintillation cocktails (LSC) and other organic solvents containing Carbon-14 (^{14}C) and Tritium (^{3}H);

2. As of December 1995, it is storing approximately 1100 gallons of this waste with an average concentration of 0.023 microcuries per gram (μCi/gm) of ^{3}H and 0.0028 μCi/g of ^{14}C;

3. This waste contains approximately 95 millicuries (mCi) of ^{3}H and 11.7 mCi of ^{14}C; and annually.

4. The licensee generates waste containing about 10 mCi of ^{3}H and 2 mCi of ^{14}C annually.

The licensee is requesting authorization to dispose of the waste in storage, as well as the waste that is generated each year, as if they are not radioactive because the radionuclide concentrations in the waste are less than the levels described in NRC's regulations in 10 CFR 20.2005 and their disposal by incineration would not result in significant increases in exposure to workers or the public. The licensee also indicated that while incineration capacity for the waste is currently available, the cost differential between incineration as a non-radioactive waste verses incineration as radioactive waste is significant.

301848

REGULATORY REVIEW:

Regarding the first rationale used by the licensee for making its request, NRC regulations at 10 CFR 20.2005 state "(a) A licensee may dispose of the following waste as if it were not radioactive:

> (1) 0.05 microcurie (1.85kBq), or less, of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting"

In the Statement of Considerations (SOCs) for this regulation, the NRC staff indicated that the principal reason that the regulation was promulgated was to reduce the large volume of liquid scintillation fluid that would be sent to a licensed low-level waste disposal facility for burial. The SOCs also indicated that, in order to expand this regulation to other media, the staff would need to "examine the specific waste streams which contribute a large volume to the burial grounds as candidates for alternative regulatory approaches." Therefore, it is clear that the intent of the regulation is to reduce the amount of waste being buried in a low-level waste disposal facility and instead promote alternative disposal methodologies, such as incineration . Since this is a relatively small volume waste stream (compared to the 200,000 to 400,00 gallons of LSC discussed in the SOCs) and an incineration option already appears to exist for this material, the rationale used in the original rulemaking is not applicable in this case.

The licensee also stated that disposal of this waste as if it were "not radioactive" would not result in significant increases in radiation exposure to workers or the public and provided dose estimates to support this assertion. While the licensee's dose estimates may be valid (the staff did not validate the dose estimates), the staff has concluded that authorizing disposal of this material under 10 CFR 20.2002 as if it were "not radioactive" based on the potential doses to workers or the public, would be inconsistent with past NRC decisions regarding the release from regulatory control pursuant to the cited regulation. 10 CFR 20.2002 provides for the disposal of radioactive waste in a manner not otherwise authorized in the regulations. Therefore, regardless of the potential doses to the public or workers, the waste described in the licensee's request would still be considered radioactive waste by the NRC staff.

NRC CONCLUSION:

It is not clear from the information provided by the licensee if the radionuclides in the waste were originally contained in the LSC component of the waste or if the radionuclides were contained in both the LSC, as well as the other organic solvents. If the radionucldies in the waste were all originally in the LSC at the 10 CFR 20.2005 levels, the licensee could dispose of the waste as if it were not radioactive, as the LSC would meet the conditions described in 10 CFR 20.2005 prior to being commingled with the organic solvents. However, if the radionuclides were present in the LSC at concentrations in excess of the 10 CFR 20.2005 levels, or if the radionuclides were originally present in the other organic solvents, the licensee would need to dispose of the material as radioactive waste.

If you have any questions or require clarification on any of the information stated above, you may contact us at (630) 829-9887.

Sincerely,

Original Signed By
Charles F. Gill
Materials Licensing Branch

Docket No. 030-03465
License No. 48-09843-18

DOCUMENT NAME: M:\03003465.RSP
To receive a copy of this document, indicate in the box:"C" = Copy without enclosure "E"= Copy with enclosure"N"= No copy

OFFICE	RIII	C					
NAME	CGILL:jaw						
DATE	05/16/98						

OFFICIAL RECORD COPY

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

97-08

March 17, 1998

MEMORANDUM TO: B.J. Holt, Chief
Nuclear Materials Licensing Section
Division of Nuclear Material Safety
Region III

FROM: John W.N. Hickey, Chief
Low-Level Waste and Decommissioning
Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

SUBJECT: REQUEST BY THE UNIVERSITY OF WISCONSIN TO DISPOSE OF ORGANIC SOLVENTS CONTAINING 14C AND 3H (CONTROL NO. 301848)

This is in response to your request for technical assistance, dated March 14, 1997, concerning a request by the University of Wisconsin (License No. 48-09843-18) to dispose of radioactive waste pursuant to the Nuclear Regulatory Commission's regulations at 10 CFR 2002 as if it were "not radioactive." In its request, the licensee states the following concerning the waste:

1. The radioactive waste consists of liquid scintillation cocktails (LSC) and other organic solvents containing Carbon-14 (^{14}C) and Tritium (^{3}H);

2. As of December 1995, it is storing approximately 1100 gallons of this waste with an average concentration of 0.023 microcuries per gram (μCi/gm) of ^{3}H and 0.0028μCi/g of ^{14}C;

3. This waste contains approximately 95 millicuries (mCi) of ^{3}H and 11.7 mCi of ^{14}C; and

4. The licensee generates waste containing about 10 mCi of ^{3}H and 2 mCi of ^{14}C annually.

The licensee is requesting authorization to dispose of the waste in storage, as well as the waste that is generated each year, as if they are not radioactive because the radionuclide concentrations in the waste are less than the levels described in NRC's regulations at 10 CFR 20.2005 and their disposal by incineration would not result in significant increases in exposure to workers or the public. The licensee also indicated that while incineration capacity for the waste is currently available, the cost differential between incineration as a non-radioactive waste verses incineration as radioactive waste is significant.

Contact: Nick Orlando, DWM/NMSS
(301) 415-6749

Regarding the first rationale used by the licensee for making its request, NRC regulations at 10 CFR 20.2005 state "(a) A licensee may dispose of the following waste as if it were not radioactive:

(1) 0.05 microcurie (1.85kBq), or less of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting"

In the Statement of Considerations (SOCs) for this regulation, the NRC staff indicated that the principal reason that the regulation was promulgated was to reduce the large volume of liquid scintillation fluid that would be sent to a licensed low-level waste disposal facility for burial. The SOCs also indicated that, in order to expand this regulation to other media, the staff would need to "examine the specific waste streams which contribute a large volume to the burial grounds as candidates for alternative regulatory approaches." Therefore, it is clear that the intent of the regulation is to reduce the amount of waste being buried in a low-level waste disposal facility and instead promote alternative disposal methodologies, such as incineration. Since this is a relatively small volume waste stream (compared to the 200,000 to 400,000 gallons of LSC discussed in the SOCs) and an incineration option already appears to exist for this material, the rationale used in the original rulemaking is not applicable in this case.

The licensee also stated that disposal of this waste as if it were "not radioactive" would not result in significant increases in radiation exposure to workers or the public and provided dose estimates to support this assertion. While the licensee's dose estimates may be valid (the staff did not validate the dose estimates), the staff has concluded that authorizing disposal of this material under 10 CFR 20.2002 as if it were "not radioactive" based on the potential doses to workers or the public, would be inconsistent with past NRC decisions regarding the release from regulatory control pursuant to the cited regulation. 10 CFR 20.2002 provides for the disposal of radioactive waste in a manner not otherwise authorized in the regulations. Therefore, regardless of the potential doses to the public or workers, the waste described in the licensee's request would still be considered radioactive waste by the NRC staff.

It is not clear from the information provided by the licensee if the radionuclides in the waste were originally contained in the LSC component of the waste or if the radionuclides were contained in both the LSC, as well as the other organic solvents. If the radionuclides in the waste were all originally in the LSC at the 10 CFR 20.2005 levels, the licensee could dispose of the waste as if it were not radioactive, as the LSC would meet the conditions described in 10 CFR 20.2005 prior to being commingled with the organic solvents. However, if the radionuclides were present in the LSC at concentrations in excess of the 10 CFR 20.2005 levels, or if the radionuclides were originally present in the other organic solvents the licensee would need to dispose of the material as radioactive waste.

MAR 19 1997

97-08

REGIONAL TECHNICAL ASSISTANCE REQUEST FORM

Date: March 14, 1997

Mail to: *Don Cool (DAC), Mail Stop: 8F5 TWFN*

E-Mail to: *IMNSMAIL*
If E-mail, cc:CLE ,Division of Industrial and Medical Nuclear Safety, NMSS

From: B.J. Holt (BJH), Region III
Chief, Nuclear Materials Licensing Section

Licensee: University of Wisconsin
License No. 48-09843-18

☐ *Control No. 301848*

☐ *Letter dated: September 13, 1996*

☐ *Suggested change in licensing procedure (enclosed):*
N/A

☐ *Problem/Issue: In accordance with 10 CFR 20, Section 20.2002, the licensee is requesting authorization for a proposed disposal procedure that is not granted in 10 CFR Part 20. Specifically, the licensee claims that certain H-3 and C-14 organic wastes meet the criteria of Section 20.2005 (a)(1). They contend that if not for the organic components, these specific waste products are essentially liquid scintillation cocktails, which per 20.2005 (a) (1) can be treated as non-radioactive provided the concentration of C-14 and H-3 does not exceed 0.05 uci/gram.*

In support of their request and in answer to questions our licensing section initially posed in an August 13, 1996 letter, the licensee contacted Dennis Warshall of the Trade Waste Facility and posed a number of questions concerning EPA approved incinerators and their efficiency. Based on his comments, they plan on assuming 100 percent combustion of both H-3 and C-14, leaving no H-3 or C-14 residues.

☐ *Action Required: Please review and determine if the licensee's proposed method meets the criteria in 20.2002*

☐ *Recommended Action (with revisions):* ☐ *Approve or* ☐ *Reject*
The licensee's request appears reasonable, however at this time we have not conducted enough research to recommend approval or rejection of their proposal.

MAR 19 1997

Remarks: Attached you will find documents from the licensee dated July 28, 1995, December 23, 1995, and September 13, 1996. These documents provide further information relative to the licensee's request. In addition, we have included a copy of our cover letter dated August 13, 1996, which discusses additional information the licensee should submit on this matter.

Headquarters Reviewer:
Regional Reviewer: Kevin Null
Reviewer Code: R2
Reviewer Phone No.: (630)829-9854 *FAX No.: (630) 515-1259*
Request Needed by: *Form TAR-10 8/93*

cc: Roy Caniano

REF 1
265-43

July 28, 1995

TO: U.S. Nuclear Regulatory Commission, Region III
Nuclear Materials Licensing Section
801 Warrenville Road
Lisle, Illinois 60532-4351

FROM: Ronald R. Bresell
Radiation Safety Officer

RE: Request for Disposal of Organic Liquid Wastes Under the Provisions of 10 CFR 20.2002, BML 48-09843-18

This is a request to be allowed to dispose of specific low concentration (< 0.05 µCi per gram of $^{3}H/^{14}C$ -- less than the 20.2005 "not radioactive" levels) organic liquid wastes under the provisions of 10 CFR 20.2002.

1. This liquid waste consists of 55-gallon drums of organic solvent wastes contaminated with low levels of ^{3}H and ^{14}C. Much of the solvents are actually commercial LSC fluids (e.g., PicoFlow, Aquasol, BioSafe II, OptiFluor, FloScint, etc.) and fall under the provisions of 20.2005(a)(1). However, these fluids had been mixed with other organic solvents (e.g., methanol, acetonitrile, acetone, chloroform, etc.) in the individual lab prior to collection by Safety.

2. These wastes consist only of $^{3}H/^{14}C$ contaminated solvents which, except for other organic chemicals, are identical to LSC cocktail. The average concentration of the waste we have on-hand is 0.023 µCi/gm of ^{3}H and 0.0028 µCi/gm of ^{14}C. These levels are less than that specified in 20.2005 for disposal of LSC wastes "as if it were not radioactive." The total activity which we have on-hand is about 95 mCi of ^{3}H and 11.7 mCi of ^{14}C. The UW generates no more than 10 mCi of ^{3}H and 2 mCi of ^{14}C organic solvent wastes annually.

3. Based on item 2, it is our intention to dispose of these wastes as Resource Conservation and Recovery Act (RCRA) chemical solvent wastes as if they were not radioactive. One scenario for disposal involves using our contract with Chemical Waste Management. They periodically collect chemical wastes from our EPA approved hazardous waste facility and take it to an approved RCRA waste facility for incineration in an incinerator with the capability to process the organic compounds present in the waste.

Approval of this proposal to consider these $^{3}H/^{14}C$ organic liquid wastes "not radioactive" would not change the waste's ultimate safe disposal mechanism. This request meets the letter and intent of both the NRC and EPA to insure safe (i.e., 20.2002(d)) disposal of regulated waste streams. Additionally, because there is a significant difference in incineration costs between organic and radioactive organic wastes, approval of this request would make their disposal immediately achievable. Regardless of the label placed on this waste stream, it would be treated in essentially the same manner: incineration in an EPA approved chemical incinerator.

If you have any questions pertaining to this item, please call me at (608) 262-9178 or FAX me at (608) 262-6767.

Sincerely,

Ronald R. Bresell
Radiation Safety Officer

UNIVERSITY OF
WISCONSIN
MADISON

A
030-03465

December 23, 1995

U.S. Nuclear Regulatory Commission, Region III
Nuclear Materials Licensing Section
ATTN: Patricia Pelke
801 Warrenville Road
Lisle, Illinois 60532-4351

RE: Additional Information – Request for Disposal of Organic Liquid Wastes Under the Provisions of 10 CFR 20.2002, Control # 98903

Dear Ms Pelke:

48-09843-18

Reference (enclosed as numbered tabs)

1. Our letter dated 28 July, 95
2. Your request for additional information dated 9 November, 95
3. Table 2, Column 1, Appendix B, 10 CFR 20
4. NUREG-0656, Study of Alternative Methods for the Management of LSC Wastes
5. Item 11, Waste Management, included in our BML 48-09843-18 renewal application

Background

The purpose of this request is to extend the exemption now provided to the radioactive content of low-level scintillation cocktail to other organic liquids. The public is protected from the chemical variability of the organic liquids by explicitly limiting disposal of the liquids to EPA-licensed hazardous waste incinerators.

We requested (ref. 1) that the UW-Madison initially (i.e., one time only) be allowed to consider 95 mCi of ^{3}H and 11.7 mCi of ^{14}C as non-NRC regulated organic solvent waste and (annually, on a routine basis) to be allowed to consider an annual average of 10 mCi of ^{3}H and 2 mCi of ^{14}C as non-NRC regulated organic solvent wastes. We noted that the average concentration of these wastes will be less than the 20.2005 levels of 0.05 μCi/gm for LSC wastes which are regarded "as if it were not radioactive."

Your letter (ref. 2) indicated 4 items of information required.

1. *A description of the waste containing licensed material to be disposed of, including the physical and chemical properties necessary to adequately evaluate the associated risk and the proposed manner and conditions of waste disposal.*

RECEIVED
DEC 28 1995
REGION III

As noted in paragraph # 1 of our original letter, this is EPA regulated organic solvent wastes contaminated with low levels of ^{3}H and ^{14}C. The averag

Safety Department

University of Wisconsin–Madison 103 North Lake Street Madison, Wisconsin 53715-1212
608/262-8769 FAX: 608/262-6767

399729

concentration for the approximately 1100 gallons of solvent is 0.023 μCi/gm of ^{3}H and 0.0028 μCi/gm of ^{14}C. Historically, the University had been licensed (by the NRC) and permitted (by the State of Wisconsin Division of Natural Resources) to incinerate non-hazardous, flammable wastes at our Arlington Farms incinerator. The University was not permitted to incinerate certain hazardous wastes (e.g., chloroform, acetonitrile, etc.) which resulted from various researches (e.g., HPLC, cell washing, etc.). Some of these organic solvent wastes were the result of analyzing EPA listed hazardous chemicals in liquid scintillation systems, contaminating the media with a hazardous component so the waste could not be disposed of "as if it were not radioactive." We had this waste analyzed in December 1991. Table 1 provides a partial listing of some of the chemicals identified. From the list you can see why we stated:

This liquid waste consists of 55-gallon drums of organic solvent wastes contaminated with low levels of ^{3}H and ^{14}C. Much of the solvents are actually commercial LSC fluids (e.g., PicoFlow, Aquasol, BioSafe II, OptiFluor, FloScint, etc.) and fall under the provisions of 20.2005(a)(1). However, these fluids had been mixed with other organic solvents (e.g., methanol, acetonitrile, acetone, chloroform, etc.) in the individual lab prior to collection by Safety.

In summary:

a. The radioactive concentrations of ^{3}H and ^{14}C are less than the levels permitted for purely scintillation cocktail.
b. The chemical properties are within the EPA definition of regulated hazardous waste.
c. Materials come from the same sources and have the same range of physical and chemical properties as materials handled by our hazardous waste management program. The only difference is the low radioactive content.

2. *An analysis and evaluation of pertinent information on the nature of the environment.*

Our goal is to regulate as RCRA waste **only** this specific waste and similar organic solvent wastes with concentrations less than those specified in 10 CFR 20.2005. Safety of the public is assured because:

a. Handling is and will be by staff that operate under EPA regulations with respect to chemical content and NRC regulations with respect to radioactive content.
b. The facility possesses an EPA generator license and a NRC Broadscope license. This means that all handling, analysis and decision-making is done by trained waste management personnel.
c. Transportation will be in accordance with DOT rules and regulations.
d. Disposal will be in an EPA-licensed commercial hazardous waste incinerator.

3. *The nature and location of other potentially affected licensed and unlicensed facilities.*

While our goal is to not treat this specific waste stream as radioactive (and the dose calculated below justifies this stratagem), we are mandated to treat this waste according to it's EPA hazard by only utilizing contractors which have EPA licensed hazardous waste incinerators.

4. *An evaluation of the dose(s) and procedures to ensure that doses are maintained ALARA and within the dose limits specified in 10 CFR Part 20.*

It is our belief that the determination of radiation doses below demonstrates that this proposal is both safe and efficacious and disposing of this waste according to it's EPA regulated component is viable.

Our contention will be that disposing of these wastes in a non-NRC regulated fashion as if they were only EPA regulated organic solvent wastes, would not contribute a significant dose to maximally exposed members of the general public. We will assume that incineration will result in 100% combustion, consequently all ^{3}H and ^{14}C will be released to the atmosphere.

Dosimetry - UW Effluent Based

Reference 3 states, "The concentration values given in Columns 1 and 2 of Table 2 are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (50 millirem or 0.5 millisieverts)."

On pg. Item 11-5 of our BML application (ref. 5) we stated we would use Sutton's Model of Diffusion for an elevated source of airborne radioactivity. This is:

$$C = \frac{2 \cdot f_v \cdot Q}{e \cdot \pi \cdot \mu \cdot t \cdot h^2}$$

where:

C = The maximum concentration of a radionuclide in air (μCi/ml), averaged over a specified period of time, at any point of human occupancy which would result from incinerating the quantity Q of the radionuclide on a given day.

f_v = Volatile fraction for each radionuclide incinerated (assume 100% of all radioactivity incinerated is released to the atmosphere, i.e., $f_v = 1$).

μ = 3 mph. this is a conservative estimate of the mean uniform wind speed at the incinerator site (from meteorological data).

t = the time period over which the radionuclide air concentration is averaged. This is 24 hours for a daily average, 30 days for a monthly average, and 365 days for a yearly average.

h = the vertical distance between the point of effluent discharge (stack nozzle) and the

nearest point of human occupancy. Assuming individuals entering unrestricted areas near the incinerators are ≤ 2 meters tall and the height of the incinerator stack is 10 meters, then h = 8 m.

Using these and conversion factors, we calculated Daily and Monthly incineration limits to insure that the annual concentration would not exceed 20% of the air concentration (ref. 3) or would not exceed 10 mrem. For ^{3}H and ^{14}C, those monthly limits are 900 mCi and 18 mCi, respectively. The gist of Table 1, ref. 5 is that if we incinerated 10,800 mCi of ^{3}H and 216 mCi of ^{14}C, we would only provide doses of 0.474 mrem (50 mrem x 0.00948) and 0.3165 mrem (50 mrem x 0.00633).

Consider our history of incineration. We have added to ref. 5 yearly summaries so it includes the isotope, activity (mCi) of solid (or dry) LLRW, and percent of the air concentration (ref. 3) incinerated at our Herrick Drive incinerator during the past 5 years as a representative example of our use (for 1995 we have included 11 months data normalized to 12 months). We have **not** adjusted the percent of the air concentration prior to 1 January 1994 to take into account the change in values for the new 10 CFR Part 20, these percents are the value for the air concentration in effect at the time. For your convenience we have listed in Table 2, below the values for ^{3}H and ^{14}C as well as the sum of all of the fractions for all nuclides incinerated.

Table 2. Activities Incinerated, 1991 - 1995

Year	^{3}H			^{14}C			Total Fraction
	Act (mCi)	Air Conc[1]	Fraction	Act (mCi)	Air Conc	Fraction	
1995	509.67	44.10	0.044	141.31	12.227	0.408	1.687[2]
1994	241.6	20.90	0.0209	80.96	7.005	0.2335	1.505
1993	796.84	68.94	0.0345	109.12	9.442	0.0094	1.341
1992	426.7	36.92	0.01846	85.35	7.385	0.00738	2.189
1991	552.98	47.85	0.024	68.63	5.94	0.006	2.977

[1]Air Concentration given in units of x 10^{-12} μCi/ml
[2]Considers all nuclides through 12/1 and $^{3}H/^{14}C$ extrapolated for 1995

Thus, while our license requires the UW to maintain effluents to 20% of Table 2, Column 1 levels, we strive to maintain these effluents ALARA and in most instances we are able to keep these (i.e., the Total Fraction) below 3% of Table 2, Column 1 values. The result of this it that our exposure to the maximally exposed individual should remain below 1.5 mrem (2% x 50 mrem = 1 mrem).

What impact would incinerating an additional 95 mCi of ^{3}H and 11.7 mCi of ^{14}C have on these exposures? Adding these activities into the current, 1995, estimates increases the ^{3}H

fraction to 0.052, the ^{14}C fraction to 0.441, and the total fraction to 1.729. Thus, it would increase the total fraction by 0.042% (i.e., 1.729 - 1.687) with a projected dose of below 2 mrem (2% of 50 mrem) for all airborne effluents incinerated. That being the case, the dosimetric impact of incinerating an additional average of 10 mCi of ^{3}H and 2 mCi of ^{14}C every year would be statistically insignificant.

Dosimetry - NUREG-0656 Based

While we have shown that, considered with the UW's effluent, these additional effluents would be minuscule, our goal is to treat this material as if it were not radioactive so it can be disposed of according to it's EPA regulated hazard classification. How then to estimate the dose to the maximally exposed individual given that we only wish to be tied to using an EPA-licensed commercial hazardous waste incinerator? Appendix B, ref. 4 provides a radiation dose assessment based on the following assumptions:

1. The activity is diluted by an atmospheric dilution factor of 10^{-3} sec/m^3
2. The incinerator operates for 2000 hours per year.
3. Target person is then an incinerator operator performing light work. From the Radiological Health Handbook (p. 216) the respiratory rate would be 9600 liters per 8-hours. This would be 9.6 m^3 per workday. If we assume a 2000 hour work year, then the worker works 250 days. Calculating the total volume of air per year is then (250 days)(9.6 m^3/day) = 2400 m^3/yr.
4. Using Table 2, Column 1 values (i.e., 1 x 10^{-7} μCi/ml for ^{3}H and 3 x 10^{-9} μCi/ml for ^{14}C), assuming a respiratory rate during the 8-hour day, 250-day workyear of 2.4 x 10^{9} ml (2400 m^3), and that the air concentration if breathed continuously would contribute a dose of 50 mrem, the dose conversion factors of 2.08 x 10^{-7} mrem/pCi for ^{3}H and 6.94 x 10^{-6} mrem/pCi for ^{14}C can be calculated.

Based upon a 1 curie source, the concentration of radioactive effluents at the location of interest is calculated to be 1.39 x 10^{-10} Ci/m^3 (or 139 pCi/m^3). If the respiratory rate of an adult male doing light work for 8 hrs is 9.6 m^3, then in a 250 (8-hr day) year the person would respire 2400 m^3/yr. To calculate the dose to such a worker where these materials will be incinerated:

$$H\text{-}3: \quad \frac{0.095\ Ci}{1\ Ci} \cdot 139\ \frac{pCi}{m^3} \cdot 2400\ \frac{m^3}{yr} \cdot 2.08 \times 10^{-7}\ \frac{mrem}{pCi} = 0.0066\ \frac{mrem}{yr}$$

$$C\text{-}14: \quad \frac{0.012\ Ci}{1\ Ci} \cdot 139\ \frac{pCi}{m^3} \cdot 2400\ \frac{m^3}{yr} \cdot 6.94 \times 10^{-6}\ \frac{mrem}{pCi} = 0.0278\ \frac{mrem}{yr}$$

Hence, the total dose to the maximally exposed individual for a 1 time incineration of our accumulated mixed waste would be approximately 0.0344 mrem.

If we were allowed to thereafter dispose of approximately 10 mCi of ^{3}H and 2 mCi of ^{14}C per year of EPA regulated organic solvent wastes as unregulated, the continuing dose would

be approximately 0.0007 mrem from ^{3}H and 0.0046 mrem from ^{14}C for a total of 0.0053 mrem. These doses for the year are significantly less than the daily background dose.

Summary

Thus, regardless of the environment where they are received, radiation doses would be indistinguishable from and significantly less than background levels. That being the case, from a radiological view, the disposal environment and facilities should be irrelevant. We believe that wastes handled as EPA regulated organic solvent wastes in EPA permitted activities will be accorded such safeguards as to prevent contamination of the environment by those liquid wastes. In fact, when reviewing risks, we believe it is very likely that the risks inherent with treating these wastes as mixed wastes with the possible time delays for disposal through the only EPA permitted and NRC licensed facility, are significantly greater than treating this waste stream as EPA regulated wastes only and disposing of them during the coming year.

For that reason, request permission to be allowed to consider 95 mCi of ^{3}H and 11.7 mCi of ^{14}C as non-NRC regulated organic solvent waste and (annually) to consider an annual average of 10 mCi of ^{3}H and 2 mCi of ^{14}C as non-NRC regulated organic solvent wastes. The average concentration of these wastes will be less than the 20.2005 levels of 0.05 μCi/gm for LSC wastes which are regarded "as if it were not radioactive."

If you have any questions pertaining to this item, please call me at (608) 262-9178 or FAX me at (608) 262-6767.

Sincerely,

Ronald R. Bresell

Ronald R. Bresell
Radiation Safety Officer

Table 1. Some of the Compounds Identified in Solvent Drums

Methylene chloride	Pyridine
Chloroform	Dimethyl sulfoxide
1, 2-dichloroethane	Ethyl benzene
Benzene	Phosphoric acid, tributyl ester
Toluene	1,2,3-trimethyl-4-propenylnaphalene
Xylenes	C6 cyclic hydrocarbons
Phenol	Dichlorobenzene
Tetrahydronaphthalene	2,3-dihydro-3,3,5,7-tetramethyl-1H-inden-1-one
Naphthalene	Tetrahydrofuran
Dihydrodimethyl-1H-indene	Acetic acid
Tetrahydromethylnaphthalene	1-methoxy-2-propanol
Methylnaphthalene	1,3,6-trioxocane
Tetrahydrodimethylnaphthalene	3-methyl-1-butanol
Tetrahydroethelnaphthalene	1-(2-methoxy-1-methyl ethoxy)-2-propanol
Ethylnaphthalene	2-ethoxypropoxy-2-propanol
Dimethylnaphthalene	Tetrahydrotetramethylfuran
1-(2-propenyl)naphthalene	1-butanol,3-methyl-,acetate
Methylbiphenyl	Diphenylhydrazine
Methylethylnaphthalene	9-methyl-9-silafluorene
Trimethylnaphthalene	Methyldibenzothiophene
C13, C14, and C15 PHA	1,3,6-trioxocane
Dimethylbiphenyl	Ethanol, 2-methoxy-,acetate
Diphenylhydrazine	Acetic acid, phentylester
Methyl-(methylethyl)-naphthalene	C9-C19 aromatic hydrocarbons
9,9-dimethyl-9-silafluorene	C10-C16 cyclic hydrocarbons
Dibenzothiophene	C6-C24 aliphatic hydrocarbons
Dimethyldibenzothiophene	Octanoic acid, 1,2,3-propane triyl ester
Diphenyloxazole	Decanedioic acid, dibutyl ester
	Unidentified organic compounds

UNIVERSITY OF
WISCONSIN
MADISON

September 13, 1996

A
030-03465

RL

48-09843-1

U.S. Nuclear Regulatory Commission, Region III
Nuclear Materials Licensing Section
ATTN: Patricia Pelke
801 Warrenville Road
Lisle, Illinois 60532-4351

RE: Additional Information – Request for Disposal of Organic Liquid Wastes Under the Provisions of 10 CFR 20.2002, Control # 98903 / Docket # 030-03465

Dear Ms Pelke:

Reference your request for additional information dated 13 August, 1996 which stated:

> We have also reviewed the additional information you provided for authorization to dispose of organic liquid wastes under 10 CFR Part 20, Section 20.2002. Based on the information you provided in your December 23, 1995 letter, the purpose of your request is to extend the exemption specified in 10 CFR Part 20, Section 20.2005(a)(1) for liquid scintillation counting medium to other organic liquids. Your submittal references both Sections 20.2002 and 20.2005 of 10 CFR Part 20, and it appears that the specific wastes that are generated would meet the criteria in 20.2005(a)(1) if they were not subsequently mixed with other organic solvents.
>
> The information submitted indicates that you propose to incinerate these "organic liquids" as "non-radioactive" at any EPA permitted/licensed commercial hazardous waste incinerator and you submitted an assessment of the dose along with your assumptions. In your evaluation, you assume 100% combustion of the hydrogen-3 and carbon-14 and release as effluent from the incinerator, but you did not submit sufficient information to validate your assumption of 100% combustion for these radionuclides. In addition, you did not address the fraction of these radionuclides that may be retained in the incinerator ash that will subsequently be sent to a landfill, and the dose to the general public that will result. Your evaluation also needs to account for (or at least address) reconcentration and migration of the carbon-14 to potable water supplies at the landfill. In order to further consider you request, it will be necessary for you to submit the additional information discussed above. You should also review the requirements of 10 CFR Part 51 (copy enclosed) and be aware that an Environmental Impact Statement may be required to support the disposal request unless you can demonstrate that you meet the criteria for a Categorical Exclusion (10 CFR Part 51, Section 51.22).

Your first assumption is correct. We are placing this request under provisions of 10 CFR 20.2002 *Method for obtaining approval of proposed disposal procedures* and in our previous letters dated 28 July 1995 and 23 December 1995 we provided information relevant to 20.2002 (a) - (d). Our contention is that these ^{3}H and ^{14}C organic wastes would meet the criteria specified in 20.2005(a)(1) if there were not additional organic components.

Our letter of 23 December 1995 demonstrated that "the total dose to the maximally exposed individual for a 1 time incineration of our accumulated mixed waste would be approximately 0.0344 mrem" and that "the continuing dose would be approximately 0.0007 mrem from ^{3}H and 0.0046 mrem from ^{14}C for a total of 0.0053 mrem."

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Safety Department

University of Wisconsin–Madison 30 North Murray Street Madison, Wisconsin 53715-2609
608/262-8769 FAX: 608/262-6767

To obtain answers to the questions you posed, we contacted Dennis Warshall in the Thermal Operations Group of AETS at the Trade Waste facility (618/271-2804). We assumed 100% combustion but we asked the following two questions about the products of combustion and are indicating the response:

1. In an EPA approved Chemical / Organic incinerator, what is the efficiency of the system (e.g., how efficient is it in breaking down the organic molecules)?

   The destruction required efficiency (DRE) is 99.99% The lowest he's ever actually seen it is 99.999% for carbon tetrachloride

2. What are the byproducts, that is, what happens to Hydrogen and Carbon molecules in the burn (i.e., do they become CO2 and H20?) and with what general efficiency?

   Yes, CO_2 & H_2O, > 99% combustion efficiency as measured by a carbon monoxide (CO) meter.

Thus there is essentially no solid waste and we were informed as follows:

3. What happens to the effluent? If this goes through an x-stage hepa filter, what percent goes up the stack, what is trapped in the filter?

   No HEPA. TWI has a dry scrubber and baghouse. The scrubber injects a solution ($Ca(OH)_2$) to react with the acid flue gases. The reacted solids are caught by the baghouse. Their permitted maximum particulate release level is 0.08 g/dscf although they typically emit ~ 0.003 g/dscf

4. What happens to the solid waste, what does it consist of (i.e., are there hydrocarbon remains and if so how much)?

   Solid waste, that is, the baghouse filter cake, is stabilized (e.g., concrete) and buried at a hazardous waste landfill (Adams Center, Fort Wayne, Indiana). No leachable waste is allowed into the landfill which is double lined and has leachate collection systems.

Thus, 100% combustion is a valid assumption. However, assuming some residue in the bag house or other solid waste stream, the EPA and state natural resources / pollution regulations require wastes from chemical incineration to be buried in a hazardous waste landfill. The requirements for such a landfill is that it be double lined with a leachate collection system. Thus, the risk of contamination of the potable water is nonexistent.

As we stated initially, these wastes are essentially liquid scintillation cocktails (LSC), and the route of disposal for organic LSC with concentrations < 0.05 μCi/gm is destruction via EPA licensed incineration. When the NRC adopted 20.2005(a)(1), the doses to the population from such disposal were evaluated and considered acceptable.

Therefore, request permission to be allowed to consider approximately 95 mCi of ^{3}H and 11.7 mCi of ^{14}C as non-NRC regulated organic solvent waste and (annually) to consider an annual average of 10 mCi of ^{3}H and 2 mCi of ^{14}C as non-NRC regulated organic solvent wastes. The average concentration of these wastes will be less than the 20.2005 levels of 0.05 μCi/gm for LSC wastes which are regarded "as if it were not radioactive."

If you have any questions pertaining to this item, please call me at (608) 262-9178 or FAX me at (608) 262-6767.

Sincerely,

Ronald R Bresell

Ronald R. Bresell
Radiation Safety Officer

AUG 13 1996

Ronald Bresell
Radiation Safety Officer
University of Wisconsin
Safety Department
30 North Murray Street
Madison, WI 53715

Dear Mr. Bresell:

Enclosed are the following Amendments to your NRC Licenses as a result of your new mailing address:

License No.	Amendment No.
48-09843-18	94
48-09843-28	18
48-09843-32	20
48-09843-34	15

Also note that the expiration date (Item 4 of the license) for License Nos. 48-09843-32 and 48-09843-34 have been extended five years. The extension is the result of an amendment to 10 CFR Part 30, Section 30.36 (Federal Register Notice dated January 16, 1996, copy enclosed) which included provisions for a one-time, five year license renewal extension for licenses that met specific criteria outlined in the regulation.

Based on the information provided in your April 12, 1996 letter, we have not authorized your request to use byproduct material at laboratory facilities located at the University of Wisconsin-Greenbay (UW-Greenbay). This institution has an NRC license (48-13818-01) for the possession and use of byproduct material at their institution. The University of Wisconsin-Madison cannot authorize locations of use, uses, and users at other NRC licensed facilities under their broad scope license. In order to consider this request, UW-Greenbay needs to amend their license to include the material, type of research, and user under their license.

We have also reviewed the additional information you provided for authorization to dispose of organic liquid wastes under 10 CFR Part 20, Section 20.2002. Based on the information you provided in your December 23, 1995 letter, the purpose of your request is to extend the exemption specified in 10 CFR Part 20, Section 20.2005(a)(1) for liquid scintillation counting medium to other organic liquids. Your submittal references both Sections 20.2002 and 20.2005 of 10 CFR Part 20, and it appears that the specific wastes that are generated would meet the criteria in 20.2005(a)(1) if they were not subsequently mixed with other organic solvents.

The information submitted indicates that you propose to incinerate these "organic liquids" as "non-radioactive" at any EPA permitted/licensed commercial hazardous waste incinerator and you submitted an assessment of the dose along with your assumptions. In your evaluation, you assume 100% combustion of the hydrogen-3 and carbon-14 and release as effluent from the incinerator, but you did not submit sufficient information to validate your assumption of 100% combustion for these radionuclides. In addition, you did not address the fraction of these radionuclides that may be retained in the incinerator ash that will subsequently be sent to a landfill, and the dose to the general public that will result. Your evaluation also needs to account for (or at least address) reconcentration and migration of the carbon-14 to potable water supplies at the landfill. In order to further consider you request, it will be necessary for you to submit the additional information discussed above. You should also review the requirements of 10 CFR Part 51 (copy enclosed) and be aware that an Environmental Impact Statement may be required to support the disposal request unless you can demonstrate that you meet the criteria for a Categorical Exclusion (10 CFR Part 51, Section 51.22).

In addition, it appears that the disposal request you submitted may have broader implications for the regulated community at large. Therefore, you may want to consider petitioning the Commission for rulemaking regarding this issue in accordance with 10 CFR Part 2, Subpart H.

Please review your license amendments carefully to ensure that you understand all the terms and conditions. If you have any questions, please contact me at (630) 829-9868.

Sincerely,

Original Signed By
Patricia J. Pelke
Nuclear Materials Licensing Branch

License No. 48-09843-18
Docket No. 030-03465

Enclosure: As stated

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NAME	PJPelke:brt						
DATE	08/13/96						

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
801 WARRENVILLE ROAD
LISLE, ILLINOIS 60532-4351

September 20, 1996

Ronald R. Bresell
Radiation Safety Officer
University of Wisconsin-Madison
Safety Department
30 North Murray Street
Madison, WI 53715

SUBJECT: ACKNOWLEDGEMENT OF CORRESPONDENCE
(Letter Dated September 13, 1996)

Dear Licensee:

In response to your request, we have completed the initial processing, which is an administrative review of your application for a(n):

__ New License ✓ Amendment __ Renewal
__ Termination __ Auth User (Amendment not required) __ Other____

No administrative deficiencies were identified during this initial review. However, it should be noted that a technical review may identify omissions in the submitted information.

It appears that your request is routine (see 1-3 below, as applicable).

1. New and amendment actions are normally processed within 90 days, unless we find major deficiencies, or policy issues requiring central program office assistance.

2. Renewal actions are normally processed within 180 days, however, under timely filing (before expiration), you may continue to operate under your existing license.

3. Termination actions are normally processed within 90 days, unless confirmatory surveys following decontamination/decommissioning activities are involved.

A copy of your correspondence has been forwarded to our Licensing Fee and Debt Collection Branch (301/415-6097) for approval of the fee category and amount, if required.

If you have a compelling safety or business-related reason for requesting expedited review, please contact the Materials Licensing Branch at (630) 829-9887. We will try to complete your request as soon as practicable. Any correspondence about this request should reference the control number.

Nuclear Materials Support Branch

Mail Control No. 301848
License No. 48-09843-18

UNIVERSITY OF WISCONSIN MADISON

A 030-03465

December 23, 1995

U.S. Nuclear Regulatory Commission, Region III
Nuclear Materials Licensing Section
ATTN: Patricia Pelke
801 Warrenville Road
Lisle, Illinois 60532-4351

RL Addl. INFO.

RE: Additional Information – Request for Disposal of Organic Liquid Wastes Under the Provisions of 10 CFR 20.2002, Control # 98903

48-09843-18

Dear Ms Pelke:

Reference (enclosed as numbered tabs)

1. Our letter dated 28 July, 95
2. Your request for additional information dated 9 November, 95
3. Table 2, Column 1, Appendix B, 10 CFR 20
4. NUREG-0656, Study of Alternative Methods for the Management of LSC Wastes
5. Item 11, Waste Management, included in our BML 48-09843-18 renewal application

Background

The purpose of this request is to extend the exemption now provided to the radioactive content of low-level scintillation cocktail to other organic liquids. The public is protected from the chemical variability of the organic liquids by explicitly limiting disposal of the liquids to EPA-licensed hazardous waste incinerators.

We requested (ref. 1) that the UW-Madison initially (i.e., one time only) be allowed to consider 95 mCi of ^{3}H and 11.7 mCi of ^{14}C as non-NRC regulated organic solvent waste and (annually, on a routine basis) to be allowed to consider an annual average of 10 mCi of ^{3}H and 2 mCi of ^{14}C as non-NRC regulated organic solvent wastes. We noted that the average concentration of these wastes will be less than the 20.2005 levels of 0.05 μCi/gm for LSC wastes which are regarded "as if it were not radioactive."

Your letter (ref. 2) indicated 4 items of information required.

1. *A description of the waste containing licensed material to be disposed of, including the physical and chemical properties necessary to adequately evaluate the associated risk and the proposed manner and conditions of waste disposal.*

   As noted in paragraph # 1 of our original letter, this is EPA regulated organic solvent wastes contaminated with low levels of ^{3}H and ^{14}C. The averag

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University of Wisconsin–Madison 103 North Lake Street Madison, Wisconsin 53715-1212
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concentration for the approximately 1100 gallons of solvent is 0.023 μCi/gm of ^{3}H and 0.0028 μCi/gm of ^{14}C. Historically, the University had been licensed (by the NRC) and permitted (by the State of Wisconsin Division of Natural Resources) to incinerate non-hazardous, flammable wastes at our Arlington Farms incinerator. The University was not permitted to incinerate certain hazardous wastes (e.g., chloroform, acetonitrile, etc.) which resulted from various researches (e.g., HPLC, cell washing, etc.). Some of these organic solvent wastes were the result of analyzing EPA listed hazardous chemicals in liquid scintillation systems, contaminating the media with a hazardous component so the waste could not be disposed of "as if it were not radioactive." We had this waste analyzed in December 1991. Table 1 provides a partial listing of some of the chemicals identified. From the list you can see why we stated:

This liquid waste consists of 55-gallon drums of organic solvent wastes contaminated with low levels of ^{3}H and ^{14}C. Much of the solvents are actually commercial LSC fluids (e.g., PicoFlow, Aquasol, BioSafe II, OptiFluor, FloScint, etc.) and fall under the provisions of 20.2005(a)(1). However, these fluids had been mixed with other organic solvents (e.g., methanol, acetonitrile, acetone, chloroform, etc.) in the individual lab prior to collection by Safety.

In summary:

a. The radioactive concentrations of ^{3}H and ^{14}C are less than the levels permitted for purely scintillation cocktail.
b. The chemical properties are within the EPA definition of regulated hazardous waste.
c. Materials come from the same sources and have the same range of physical and chemical properties as materials handled by our hazardous waste management program. The only difference is the low radioactive content.

2. *An analysis and evaluation of pertinent information on the nature of the environment.*

Our goal is to regulate as RCRA waste only this specific waste and similar organic solvent wastes with concentrations less than those specified in 10 CFR 20.2005. Safety of the public is assured because:

a. Handling is and will be by staff that operate under EPA regulations with respect to chemical content and NRC regulations with respect to radioactive content.
b. The facility possesses an EPA generator license and a NRC Broadscope license. This means that all handling, analysis and decision-making is done by trained waste management personnel.
c. Transportation will be in accordance with DOT rules and regulations.
d. Disposal will be in an EPA-licensed commercial hazardous waste incinerator.

3. *The nature and location of other potentially affected licensed and unlicensed facilities.*

While our goal is to **not** treat this specific waste stream as radioactive (and the dose calculated below justifies this stratagem), we are mandated to treat this waste according to it's EPA hazard by only utilizing contractors which have EPA licensed hazardous waste incinerators.

4. *An evaluation of the dose(s) and procedures to ensure that doses are maintained ALARA and within the dose limits specified in 10 CFR Part 20.*

It is our belief that the determination of radiation doses below demonstrates that this proposal is both safe and efficacious and disposing of this waste according to it's EPA regulated component is viable.

Our contention will be that disposing of these wastes in a non-NRC regulated fashion as if they were only EPA regulated organic solvent wastes, would not contribute a significant dose to maximally exposed members of the general public. We will assume that incineration will result in 100% combustion, consequently all ^{3}H and ^{14}C will be released to the atmosphere.

Dosimetry - UW Effluent Based

Reference 3 states, "The concentration values given in Columns 1 and 2 of Table 2 are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (50 millirem or 0.5 millisieverts)."

On pg. Item 11-5 of our BML application (ref. 5) we stated we would use Sutton's Model of Diffusion for an elevated source of airborne radioactivity. This is:

$$C = \frac{2 \cdot f_v \cdot Q}{e \cdot \pi \cdot \mu \cdot t \cdot h^2}$$

where:

C = The maximum concentration of a radionuclide in air (μCi/ml), averaged over a specified period of time, at any point of human occupancy which would result from incinerating the quantity Q of the radionuclide on a given day.

f_v = Volatile fraction for each radionuclide incinerated (assume 100% of all radioactivity incinerated is released to the atmosphere, i.e., $f_v = 1$).

μ = 3 mph. this is a conservative estimate of the mean uniform wind speed at the incinerator site (from meteorological data).

t = the time period over which the radionuclide air concentration is averaged. This is 24 hours for a daily average, 30 days for a monthly average, and 365 days for a yearly average.

h = the vertical distance between the point of effluent discharge (stack nozzle) and the

nearest point of human occupancy. Assuming individuals entering unrestricted areas near the incinerators are ≤ 2 meters tall and the height of the incinerator stack is 10 meters, then h = 8 m.

Using these and conversion factors, we calculated Daily and Monthly incineration limits to insure that the annual concentration would not exceed 20% of the air concentration (ref. 3) or would not exceed 10 mrem. For ^{3}H and ^{14}C, those monthly limits are 900 mCi and 18 mCi, respectively. The gist of Table 1, ref. 5 is that if we incinerated 10,800 mCi of ^{3}H and 216 mCi of ^{14}C, we would only provide doses of 0.474 mrem (50 mrem x 0.00948) and 0.3165 mrem (50 mrem x 0.00633).

Consider our history of incineration. We have added to ref. 5 yearly summaries so it includes the isotope, activity (mCi) of solid (or dry) LLRW, and percent of the air concentration (ref. 3) incinerated at our Herrick Drive incinerator during the past 5 years as a representative example of our use (for 1995 we have included 11 months data normalized to 12 months). We have **not** adjusted the percent of the air concentration prior to 1 January 1994 to take into account the change in values for the new 10 CFR Part 20, these percents are the value for the air concentration in effect at the time. For your convenience we have listed in Table 2, below the values for ^{3}H and ^{14}C as well as the sum of all of the fractions for all nuclides incinerated.

Table 2. Activities Incinerated, 1991 - 1995

Year	^{3}H			^{14}C			Total Fraction
	Act (mCi)	Air Conc[1]	Fraction	Act (mCi)	Air Conc	Fraction	
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1993	796.84	68.94	0.0345	109.12	9.442	0.0094	1.341
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1991	552.98	47.85	0.024	68.63	5.94	0.006	2.977

[1]Air Concentration given in units of x 10^{-12} μCi/ml
[2]Considers all nuclides through 12/1 and $^{3}H/^{14}C$ extrapolated for 1995

Thus, while our license requires the UW to maintain effluents to 20% of Table 2, Column 1 levels, we strive to maintain these effluents ALARA and in most instances we are able to keep these (i.e., the Total Fraction) below 3% of Table 2, Column 1 values. The result of this it that our exposure to the maximally exposed individual should remain below 1.5 mrem (2% x 50 mrem = 1 mrem).

What impact would incinerating an additional 95 mCi of ^{3}H and 11.7 mCi of ^{14}C have on these exposures? Adding these activities into the current, 1995, estimates increases the ^{3}H

fraction to 0.052, the ^{14}C fraction to 0.441, and the total fraction to 1.729. Thus, it would increase the total fraction by 0.042% (i.e., 1.729 - 1.687) with a projected dose of below 2 mrem (2% of 50 mrem) for all airborne effluents incinerated. That being the case, the dosimetric impact of incinerating an additional average of 10 mCi of ^{3}H and 2 mCi of ^{14}C every year would be statistically insignificant.

Dosimetry - NUREG-0656 Based

While we have shown that, considered with the UW's effluent, these additional effluents would be minuscule, our goal is to treat this material as if it were not radioactive so it can be disposed of according to it's EPA regulated hazard classification. How then to estimate the dose to the maximally exposed individual given that we only wish to be tied to using an EPA-licensed commercial hazardous waste incinerator? Appendix B, ref. 4 provides a radiation dose assessment based on the following assumptions:

1. The activity is diluted by an atmospheric dilution factor of 10^{-3} sec/m^3
2. The incinerator operates for 2000 hours per year.
3. Target person is then an incinerator operator performing light work. From the Radiological Health Handbook (p. 216) the respiratory rate would be 9600 liters per 8-hours. This would be 9.6 m^3 per workday. If we assume a 2000 hour work year, then the worker works 250 days. Calculating the total volume of air per year is then (250 days)(9.6 m^3/day) = 2400 m^3/yr.
4. Using Table 2, Column 1 values (i.e., 1 x 10^{-7} μCi/ml for ^{3}H and 3 x 10^{-9} μCi/ml for ^{14}C), assuming a respiratory rate during the 8-hour day, 250-day workyear of 2.4 x 10^{9} ml (2400 m^3), and that the air concentration if breathed continuously would contribute a dose of 50 mrem, the dose conversion factors of 2.08 x 10^{-7} mrem/pCi for ^{3}H and 6.94 x 10^{-6} mrem/pCi for ^{14}C can be calculated.

Based upon a 1 curie source, the concentration of radioactive effluents at the location of interest is calculated to be 1.39 x 10^{-10} Ci/m^3 (or 139 pCi/m^3). If the respiratory rate of an adult male doing light work for 8 hrs is 9.6 m^3, then in a 250 (8-hr day) year the person would respire 2400 m^3/yr. To calculate the dose to such a worker where these materials will be incinerated:

$$H\text{-}3: \quad \frac{0.095\ Ci}{1\ Ci} \cdot 139\ \frac{pCi}{m^3} \cdot 2400\ \frac{m^3}{yr} \cdot 2.08 \times 10^{-7}\ \frac{mrem}{pCi} = 0.0066\ \frac{mrem}{yr}$$

$$C\text{-}14: \quad \frac{0.012\ Ci}{1\ Ci} \cdot 139\ \frac{pCi}{m^3} \cdot 2400\ \frac{m^3}{yr} \cdot 6.94 \times 10^{-6}\ \frac{mrem}{pCi} = 0.0278\ \frac{mrem}{yr}$$

Hence, the total dose to the maximally exposed individual for a 1 time incineration of our accumulated mixed waste would be approximately 0.0344 mrem.

If we were allowed to thereafter dispose of approximately 10 mCi of ^{3}H and 2 mCi of ^{14}C per year of EPA regulated organic solvent wastes as unregulated, the continuing dose would

be approximately 0.0007 mrem from ^{3}H and 0.0046 mrem from ^{14}C for a total of 0.0053 mrem. These doses for the year are significantly less than the daily background dose.

Summary

Thus, regardless of the environment where they are received, radiation doses would be indistinguishable from and significantly less than background levels. That being the case, from a radiological view, the disposal environment and facilities should be irrelevant. We believe that wastes handled as EPA regulated organic solvent wastes in EPA permitted activities will be accorded such safeguards as to prevent contamination of the environment by those liquid wastes. In fact, when reviewing risks, we believe it is very likely that the risks inherent with treating these wastes as mixed wastes with the possible time delays for disposal through the only EPA permitted and NRC licensed facility, are significantly greater than treating this waste stream as EPA regulated wastes only and disposing of them during the coming year.

For that reason, request permission to be allowed to consider 95 mCi of ^{3}H and 11.7 mCi of ^{14}C as non-NRC regulated organic solvent waste and (annually) to consider an annual average of 10 mCi of ^{3}H and 2 mCi of ^{14}C as non-NRC regulated organic solvent wastes. The average concentration of these wastes will be less than the 20.2005 levels of 0.05 μCi/gm for LSC wastes which are regarded "as if it were not radioactive."

If you have any questions pertaining to this item, please call me at (608) 262-9178 or FAX me at (608) 262-6767.

Sincerely,

Ronald R. Bresell

Ronald R. Bresell
Radiation Safety Officer

Table 1. Some of the Compounds Identified in Solvent Drums

Methylene chloride	Pyridine
Chloroform	Dimethyl sulfoxide
1, 2-dichloroethane	Ethyl benzene
Benzene	Phosphoric acid, tributyl ester
Toluene	1,2,3-trimethyl-4-propenylnaphalene
Xylenes	C6 cyclic hydrocarbons
Phenol	Dichlorobenzene
Tetrahydronaphthalene	2,3-dihydro-3,3,5,7-tetramethyl-1H-inden-1-one
Naphthalene	Tetrahydrofuran
Dihydrodimethyl-1H-indene	Acetic acid
Tetrahydromethylnaphthalene	1-methoxy-2-propanol
Methylnaphthalene	1,3,6-trioxocane
Tetrahydrodimethylnaphthalene	3-methyl-1-butanol
Tetrahydroethelnaphthalene	1-(2-methoxy-1-methyl ethoxy)-2-propanol
Ethylnaphthalene	2-ethoxypropoxy-2-propanol
Dimethylnaphthalene	Tetrahydrotetramethylfuran
1-(2-propenyl)naphthalene	1-butanol,3-methyl-,acetate
Methylbiphenyl	Diphenylhydrazine
Methylethylnaphthalene	9-methyl-9-silafluorene
Trimethylnaphthalene	Methyldibenzothiophene
C13, C14, and C15 PHA	1,3,6-trioxocane
Dimethylbiphenyl	Ethanol, 2-methoxy-,acetate
Diphenylhydrazine	Acetic acid, phentylester
Methyl-(methylethyl)-naphthalene	C9-C19 aromatic hydrocarbons
9,9-dimethyl-9-silafluorene	C10-C16 cyclic hydrocarbons
Dibenzothiophene	C6-C24 aliphatic hydrocarbons
Dimethyldibenzothiophene	Octanoic acid, 1,2,3-propane triyl ester
Diphenyloxazole	Decanedioic acid, dibutyl ester
	Unidentified organic compounds